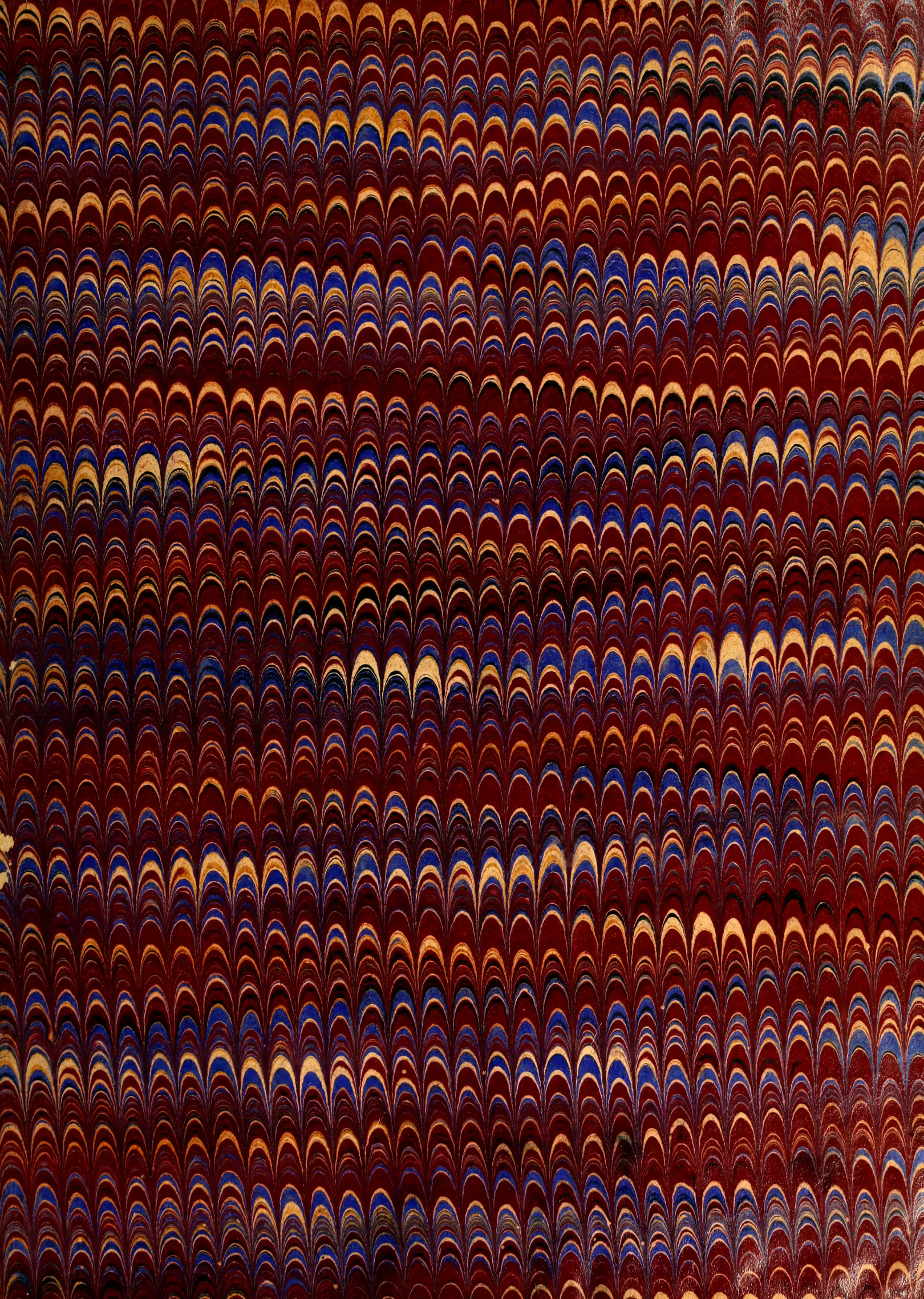
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INDEX TO VOLUME X.

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INDEX TO VOLUME X.



ARTICLES MARKED * ARE ILLUSTRATED.

Accident, A Peculiar 195
Accident, Flywheel, at Pittsburgh, Pa *437
Accidents, Best Method of Treating (Dyer) 695
Accidents, Legal Responsibility for 795
Acme Cable Grip, The 593
"Acme" Car Jack (Lewis & Fowler) *328
Air Brake, The Genett Improved *319
Air Brake, The Hunt *468
Air Brakes on the Third Avenue Railway, New York *516
Air Pump and Jet Condenser, An Independent (Davidson) *127
Ajax Line Section Switch (Van Nuis) *327
Albany Railway, Albany, N. Y., The Repair Shops and Car House of the *151
All Steel T Rail Track Construction in Terre Haute *729
Allentown, Pa., Large Consolidation at *257
Altoona & Logan Valley Electric Railway *156
Aluminum Bronze for Overhead Railway Material 470
"Aluminum" Stationary Register, The (International Register Co.) *52
Ambulance, Electric Railway 634
Ambulances, Electric Emergency 377
American Car Co., Anti-Concussion Motor Truck *325
American Car Co., Recent Work of the 585
American Engine Co., Works of the *654
American Institute of Electrical Engineers, Annual Meeting of the 396
American Institute of Electrical Engineers, Removal Notice 772
American Society of Mechanical Engineers, Annual Meeting of the 433
"American Street Railway Investments," More Comments on Our New Publication, ... 601
American Street Railway Association, Next Annual Meeting of the 582
American Street Railway Association, Proceedings of the Thirteenth Annual Convention of the *703
First Day 703
Address of the President 703
Report of the Executive Committee 704
Second Day 708
Third Day 708
American Street Railway Association, Thirteenth Annual Convention of the 673
Report of the Committee on "A Standard Form of Street Railway Accounts" 673
Report of the Committee on "City and Suburban Electric Railways" 677
Report of the Committee on "Transfers on Street Railways" 680
Report of the Committee on "Can the T Rail Be Satisfactorily Used on Paved Streets" 681
Special Paper on "Power Brakes *vs.* Hand Brakes" 683
Report of the Committee on "Mail, Express and Freight Service on Street Railway Cars" 687
Special Paper on "Brake Shoes" *689
Report of the Committee on "The Best Method of Treating Accidents" 695
Report of the Committee on "The T Rail Track Construction of the Terre Haute Electric Railway" 696
Special Paper on "Destructive Arcing of 500 Volt Fuses" *699
Special Paper on "The Use of the Booster on Electric Railway Circuits" *700
Ames Portable and Stationary Register *198
Ammonia Motor, The Railway *267
Anti-Oscillating Device, A New *124
Application of Three-Phase Electric Transmission of Power to Electric Railroad and Mill Operation *280
Armature Star, A Large *461
Arnold System of Electric Power Station Construction *392
Ashland, Wis., The Electric Road at *81
Atlanta Convention, Committees to Report at the 289
Atlanta Convention, Exhibits at the 382
Atlanta, Ga *120
Atlanta, The Coming Convention at *648

Ball Engine Co., Recent Shipments of the 602
Ball Engine Co., Vertical Engine of the *655
Ball Engine Co.'s Direct Connected Engine *191
Ball Vertical Compound Engine, A New Type of *322
Ball & Wood Vertical 600 H. P. Engine 220
Baltimore Belt Line Tunnel, Electric Locomotive for 803
Baltimore & Washington Railway, Contracts Let for the 195
Baltimore City Passenger Railway, The New Electric Equipment of the *542
Baltimore, Electric Railroad Construction in 297
Baltimore, Reference Map of the City & Suburban Railway *288
Baltimore, Rumors of Consolidation in 126
Baltimore, The Transformation of *90, *160
Barney & Smith Car and Truck *5
Barney & Smith Car Co., The Works of the *125
Barney & Smith Co., Work at the Factory of the. 263
Bass Foundry & Machine Works, Corliss Engine for Street Railway Work *587
Battie Automatic Switch *659
Battling the Snow in St. Paul 223
Bayard Street Station of the Third Avenue Railway Co., of New York *448
Belting, Grooved Raw Hide (Shultz Belting Co.). *466
Belting, What is Short Lap? 74
Bemis Standard Cable Truck *585
Berry Boiler, The *653
Best Street Car Motor, $50,000 for the 57
Boiler Accident at Indianapolis 610
Boiler Plant of the Southern Station of the Brooklyn City Railroad *383
Boiler, The Berry *653
Boiler, The Hazelton or Porcupine 470
Bonding Caps, Steel (Ohio Brass Co.) *255
Bonds, Rail Joints and (Price) *658
Booster on Electric Railway Circuits, Use of the (Vail and Wynkoop) *700
Bordeaux-Bouscat-Vigeau Electric Road 125
Boston Trolley Parties *728
Boy Conductors 647
Bracket, Combination Pole (Wood) *260
Bracket, Flexible and Adjustable, for Poles (Wrought Iron Bridge Co.) *657
Brady Metal Co 800
Bragg Fender, The *747
Brake, An Electric (Skinner) *251
Brake, An Improved Safety Clutch (Safety Clutch Brake Co) *193
Brake and Fender Combined (Moore) *131
Brake, Floating Center Equalizing (Anger) *327
Brake Shoes (Evans) *689
Brake Shoes, Wooden Faced (Wm. Wharton, Jr., & Co.) *393
Brakes, Electric, in Philadelphia *581
Brakes, The Necessity of Good 515
Bremen, Germany, Trolley Cars in *149
Bridge Company, Works of a Large Wrought Iron *388
Bridgeport, Conn., Street Railway System *730
Bridgeport, The Street Railway Strike at 136
Bridgeport Traction Co.'s Electric Road, Opening of the 582
Brill, The J. G., Co.'s Exhibit *745
Broadway Cable Co., New York, New Work of the. 33
Broadway Cable Railway, New York, Changes in the 50th Street Power House of the 285
Broadway Cable Road, New York, Completion of the *106
Broadway Railway, New York, Recent Improvements in Cable Traction 621
Brooklyn City Railroad, Boiler Plant of the Southern Station of the *383
Brooklyn City Railroad Co., Changes in the 202
Brooklyn City Railroad, Coal Handling Apparatus at the Southern Station of the *277
Brooklyn Heights Railway Co., Issue of Trust Notes by the 671
Brooklyn, Intramural Motors in *580
Brooklyn Bridge Cable Cars, Electric Lighting of 803
Brooklyn, N. Y., Carrying the Mails in *517
Brooklyn, N. Y., Electric Welding in *460
Brooklyn, N. Y., Electrolysis of Underground Pipes in 109
Brooklyn, N. Y., Extensive New Electric Railway System in 238
Brooklyn Railway Supply Co., An Improved Electric Snow Sweeper 521
Brooklyn Railway Supply Co., Electric Railway Sweeper *590
Brooklyn's Postal Car, First Trip of 580
"Brothers in Law" *287
Brownlee Injector, The 385
Brush Electric and Short Electric Railway Cos., Annual Meeting of the 326
Brussels, Electric Railways for 315
Brussels Tramways Co., The Electrical Equipment of the 430
Buda-Pesth Electric Conduit System 279
Buffalo Forge Co., Special Steel Plate Steam Fan With Double Upright Enclosed Engine *197
Burnham & Duggan's Adjustable Trolley Wire Brackets *257
Business of the General Electric Co 68
Business of the Johnson Co 68
Business of the Providence Steam Engine Co 68
Business of the Westinghouse Electric & Manufacturing Co 67

C. & C. Electric Co 72
C. & C. Electric Co., Works of the 58
Cable Cars on Third Avenue, New York, Starting the *38
Cable Construction on the Columbia Railway, Washington 557
Cable Decision 89
Cable Grip, The Acme 593
Cable Power Station, The Lexington Avenue, of the Metropolitan Traction Co., New York *490
Cable Railway on Columbus Avenue, New York, The *790
Cable Record, An Excellent *99
Cable Records in New Zealand, Good 732
Cable Roads, Electric Signaling System for (Pearce) 263
Cable Sheaves, San Francisco *383
Cable Signaling Device, Automatic (Sachs) 60
Cable Truck, Bemis Standard *585
Calendar and Clock Combined *327
California Wire Works, The *130
Capital Railway of Frankfort, Ky *376
Car and Truck, A New (Barney & Smith) *15
Car Cleaning, Compressed Air for 584
Car, Convertible, New Style of (Convertible Car Mfg. Co.) *469
Car Fender, A New (Routh) *590
Car for Bangor, Pa *125
Car Heater, "Columbia" (McGuire Mfg. Co.) *465
Car Heater, New Type of (Safety Car Heating & Lighting Co.) *798
Car Heaters, Decision On 594
Car Heating, Electric (Hadaway) 464
Car House, A Model *185
Car House, A Modern *215

Car House Design Competition, Award of Prizes in..... 557
Car House Design Competition, The Chicago General Street Railway Co.'s..... 589
Car House, Flush Transfer Tables at the Union Railway, New York..... *321
Car House, High Insurance Rate on a..... 525
Car House, New, of the Metropolitan Street Railway, New York..... *731
Car Jack, The "Acme" (Lewis & Fowler)..... *328
Car Manufacturing..... 223
Car Mile Receipts and Expenses..... 297
Car Pusher, An Easy (Woodman Mfg. Supply Co.)..... *326
Car Sign, Illuminated (Stanley)..... *250
Car Springs, Graduated (Vose)..... *129
Car Tickets, Lithographed..... 14
Car Trimmings..... *394
Car Works of James A. Trimble..... *328
Card Case, A Neat..... *474
Card Electric Motor & Dynamo Co, The Works of the..... *472
Card Electric Street Railway Motor..... *380
Care of Street Car Motors..... 115
Cars for New Orleans..... *544
Cars for the Dartmouth & Westport Street Railway, Handsome (Jackson & Sharp)..... *584
Cars for the Electric Traction Co., of Philadelphia *289
Cars, Handsome, for Boston Trolley Parties..... *728
Cars, Handsome (New Castle Car Manufacturing Co)..... *51
Cars, Handsome Vestibuled..... 586
Cars, New, for the Philadelphia Electric Lines *123
Cars Put in Operation by the People's Traction Co., Philadelphia..... 517
Casualties, Street Railway..... 793
Cement, Portland..... 802
Central Electric Co., Removal of the..... 334
Change of Officers in a New York Road..... 135
Changes in the Brooklyn City Railroad Co..... 202
Chicago City Railway Co., Annual Report of the 133
Chicago City Railway, Coal Consumption on the *497
Chicago City Railway Co., New Switching Facilities of the..... *577
Chicago City Railway Co., The System of Cable Handling in Use by (Fitch)..... *496
Chicago, Changing Grade in..... 290
Chicago General Street Railway Co.'s Car House Design Competition..... 589
Chicago, Electric Railway Construction in..... 527
Chicago, New Tunnel at..... 290
Chicago's Street Railway Traffic in 1893..... 115
Chimney, The Tallest in Canada..... 517
Cincinnati and Its Street Railroads..... *413
Cincinnati, Newport & Covington Railway..... *345
Citizens' Street Railway Co., Indianapolis, Ind., The Park of the..... *551
City and Suburban Electric Railways (Foster) 677
Clambake, An Electrical..... 582
Clamp, New Trolley (Central Electric Co.)..... *796
Clark, William J..... *368
Cleveland Electric Club, Annual Meeting of the 756
Climbing Grades at Easton, Pa..... *492
Clip, Mechanical, The Van Buren..... *800
Clipping of Horses in Germany and Austria-Hungary..... 579
Clutch Brake, Improved (Safety Clutch Brake Co.)..... *198
Coal Consumption on the Chicago City Railway. 497
Coal Handling Apparatus at the Southern Station of the Brooklyn City Railway..... *277
Coal Handling Machinery (C. W. Hunt Co.)..... 801
Columbia & Donegal Railway, The..... *223
"Columbia" Magazine Cast Iron Street Car Heater (McGuire Mfg. Co.)..... *465
Columbia Railway, Washington, Cable Construction on the..... 557
Columbia Telephone, The..... *520
Columbus Avenue Cable Railway, New York, The Progress of the..... *545
Columbus Avenue, New York, Cable Railway *790
Combination of Electric Railways in Pennsylvania..... 793
Combination Pole Bracket (Wood)..... *260
Combined Brake and Fender (Moore)..... *131
Combined Calendar and Clock..... *327
Comfort for Passengers..... 74
Comments on English Track Construction (Hodges)..... 17
Comments on our Financial Supplement, Some.. 534
Committees to Report at the Atlanta Convention..... 289
Commonweal Movement in Spokane..... *447
Comparison of Mileage and Cars for Two Years. 33
Compound, Duplex, Double Plunger Pump for Boston (Deane)..... *390
Compressed Air for Car Cleaning..... 584
Compressed Air for Cleaning Generators..... 647
Compressed Air System, The Conti, in Paris.... 643
Concrete Paving at Washington, Cost of..... 12
Condenser, An Independent Air Pump and Jet (Davidson)..... *127
Condensers, Wheeler Surface..... *261
Conduit System, A Double Compartment (Petersen)..... *189
Connecticut Street Railway Association, Annual Meeting of the..... 763
Connecticut Street Railway Association, Organization of a..... 315
Consolidation at Grand Rapids..... 289
Consolidation at Yonkers..... 601
Conti Compressed Air System in Paris..... 643
Contracts Let for the Baltimore & Washington Railway..... 195
Convention at Atlanta, The Coming..... *648
Exhibitors at the Atlanta Convention..... 650
Exhibits at the Atlanta Convention..... *650
Convention, Ladies in Attendance at the..... 714
Convention, Newspaper Men at the..... 746
Convention, Social Side of the..... 712
Convention, Some Important Exhibits at the... *733
Convention, Street Railway Men at the..... 715
Convention, The Coming..... 119
Corliss Engine for Street Railway Work (Bass Foundry & Machine Works)..... *587

CORRESPONDENCE.

Better System at Convention Exhibitions... 250
Bursting Fly wheels..... 501
Eighth Annual Meeting of the International Street Railway Association..... 619
Electric Arcing and Wheel Wear..... *785
English Cable Records..... 249
Fire at the Works of the New Castle Car Manufacturing Co., The..... 37
Influence of Soil on Wheels..... 785
Letter from Mrs. Reckenzaun..... 37
McGuire Manufacturing Co..... 365
Montreal Track Construction..... *37
Riotous Proceedings at St. Joseph, Mich.... 569
Standard System of Accounts..... 250
Steel Tired Wheels, Wrought Iron Centers 786
Wheels..... 631
Correspondence School of Technology..... 72
Corrosion of Iron Pipes by the Action of Electric Railway Currents (Jackson)..... 566
Cost of Indicated Horse Power (May)..... 437
Cost of Producing Electricity..... 264
Crawford Fenders..... 399
Crawford New Automatic Fender..... *798
Crosby, Oscar T..... *300
Crossing, An Elaborate..... *576
Curtains for Street Cars (Davis Car Shade Co.).. *257
Curtis Electric Manufacturing Co., Works of the *336
Curves and Turnouts for Electric Railways (Bryan)..... *26
Cushioned Car Wheels..... 321

Danger Signals for Electric Roads..... 383
Darrach Automatic Duplex Car Fender..... 746
Dartmouth & Westport Street Railway, Handsome Cars for (Jackson & Sharp)..... *584
Davidson Independent Air Pump and Jet Condenser..... *127
Dayton, O., Some of the Principal Industries of. *518
Death of William Richardson..... *57
Decision on a Feeder Patent..... 630
Decision on Car Heaters..... 594
Decision Reversed in the Case of the Detroit Railway Co..... 725
Decision Sustaining the Trolley System in Cambridge, Mass., Important Legal..... 794
Demand for Emergency Wagons..... 592
Deserved Testimonial, A..... 461
Detective Service, A Well Known..... 400
Detroit, Franchise Decision in..... 795
Detroit Railway Decision Reversed..... 725
Detroit, Sale of the Street Railway Lines in..... 486
Detroit Street Railway System, A Change of Ownership of the..... 616
Development of Electric and Cable Railways in London (McCallum)..... *153
Device for Reducing Jolting, Ingenious (Wright) *556
Direct Connected "Ideal" Engines..... *256
Direct Coupled Russell Engine and G. E. Dynamos..... *471
Discussions on Street Railway Practice..... 265
Dissected G. E. 800 Motor..... *258
Double Chain Screw Hoists..... *126
Drawn Steel Trolley Pole (U. S. Projectile Co.) 594
Duplex Trolley Co., New Trolley..... *195

Early Pioneers of the Electric Railway..... *111
Earnings of Street Railroads..... 384
Easton, Pa., Climbing Grades at..... *492
Easy Car Pusher, An (Woodman Mfg. & Supply Co.)..... *326
Easy Exit Car, A New (Sutton)..... *252
Economy in Power Stations, Notes on (Davis).. 788
Economy of Power House Operation (Craven).. 627
"Economy" Trolley Wheel, The..... *329
Edson Pressure Recording Gauge..... *474

EDITORIAL CORRESPONDENCE.

Atlanta, Ga..... *120, *182
Augusta, Ga..... *176
Buffalo, N. Y..... 515
Charleston, S. C..... *173
Chattanooga, Tenn..... *178
Chicago, Ill..... *510
Dallas, Tex..... *371
Dayton, O..... *505
Fort Worth, Tex..... *369
Galveston, Tex..... *310
Hot Springs, Ark..... *441
Houston, Tex..... *312
Indianapolis, Ind..... 508
Memphis, Tenn..... *443
Mobile, Ala..... *241
Montgomery, Ala..... *239
New Orleans, La..... *245, *301
Savannah, Ga..... *175
Washington, D. C..... *757

EDITORIALS.

American Street Railway Association..... 778
"American Street Railway Investments," A Supplement of the STREET RAILWAY JOURNAL..... 34
Appreciation of Our Supplement "Street Railway Investments"..... 116
Arrest of Street Railway Employes After Accidents..... 438
Atlanta Convention, The..... 632, 718
Atlanta Convention, The Prospective Attendance at the..... 502
Benefits Derived from State Associations... 570
Boulevards, Neutral Grounds and Reservations..... 236
Broad and Liberal Policy, A..... 35
Car Service on Street Railways..... 439
City Engineers and Local Street Railway Managers..... 632
Comparison in Mileage and Cars for Two Years..... 33
Concrete Foundation for Street Railway Tracks..... 34
Conductorless Cars..... 439
Convertibility as a Factor in the Value of Securities..... 236
Death of William Richardson..... 116
Desirability of Comparing Practices in Different Cities..... 237
Destruction of Water Pipes by Street Railway Electric Currents..... 570
Directors of Street Railway Companies..... 237
Double *vs.* Single Trolley Roads..... 438
Editorial Correspondence..... 438
Electrolysis and the Best Method of Bonding..... 236
Electrolysis of Gas and Water Pipes..... 298
Employes on Southern Street Railway Lines 170
Exorbitant Insurance Premiums..... 632
Faulty Discipline..... 171
Fifty Thousand Dollar Prize of the Metropolitan Traction Co..... 170
Financial Supplement, Our..... 298, 778
Franchise Valuations..... 503
Function of the Street Railway Association 367
Future Prospects of the Electric Railway Business..... 366
Great Railroad Strike, The..... 502
How Southern Managers may Increase Patronage..... 116
How to Deal With Applicants for Work..... 170
Hurry, the Bane of Street Railway Operations..... 366
Important Questions for Street Railway Men..... 571
Improvement of the Business Situation..... 633
Injury Wrought by Irresponsible Street Railway Promoters..... 366
Instructive and Interesting Report, An..... 35
Insurance of Electric Power Stations..... 502
Internal Transportation Facilities of the Greater New York..... 779
Interurban Electric Railway Traffic..... 779
Leakage from Overhead Lines..... 632
Long Distance Transmission of Power..... 298
Maintenance of Public Attractions by Railway Companies..... 438
Measure of a Manager's Ability..... 35
Meeting of the American Institute of Mechanical Engineers..... 483
Metropolitan Rapid Transit..... 298
Mileage and Cars for Two Years, A Comparison of..... 33
Need of a Standard for Street Railway Accounts..... 236
New York State Street Railway Association Meeting..... 570
Operating Expenses Per Car Mile..... 299
Our Financial Supplement..... 170
Our Supplement—"American Street Railway Investments"..... 367
Papers and Committee Reports at the Convention..... 719
Past Year, The..... 35
Perfection in Details..... 236
Pioneers in the Electric Railway Field..... 116
Plans for Increasing Traffic..... 170
Preliminaries for the Thirteenth Annual Convention..... 117
Progress of Electric Traction in the South.. 237
Rapid Transit Question in Boston..... 299

Report of the Massachusetts Board of Railroad Commissioners 171
Responsibility of Resisting Unjust Taxation. 117
Richardson, William, Death of 116
Rights of Bondholders 299
Special Papers at the Convention 719
State Street Railway Associations 633
"Street Car Wheels and Axles" 632
Street Railway Consolidations 779
Street Railway Mutual Insurance Co., A 571
Street Railways and the Financial Depression 367
Suggestions Concerning Exhibits at the Atlanta Convention 366
Use of Accumulators in Power Stations 570
Valuable Financial Articles by Mr. Higgins. 34
Value of Mutual Exchange of Information, The 502
Wear of Wheels in Electric Railway Service 780
Egyptian Franchise, An Investigation of an 100
Eighth Annual Meeting of the International Street Railway Association 161, 264
Electric and Cable Car Street Sprinkler (Day) .. *56
Electric Brake (Skinner) *251
Electric Brake in Practice, The (Sperry) *638
Electric Brakes in Philadelphia *581
Electric Car Heating (Hadaway) 464
Electric Cars, A Novel Use for 105
Electric Cars, Gas Lights in 491
Electric Conduit Road in New York 459
Electric Conduit System of Buda-Pesth 279
Electric Emergency Ambulances 377
Electric Equipment of the Baltimore City Passenger Railway, New *542
Electric Fountain, A New *615
Electric Freight Cars *382
Electric Freight Cars in Spokane *424
Electric Headlight, A New (Baumhoff) *585
Electric Headlight, An (Changeable Electric Headlight Co.) *385
Electric Heater, New (Consolidated Car Heating Co.) *393
Electric Heaters, A Large Order for 803
Electric Lathes and Motors, The Storey *52
Electric Launches for Street Railway Companies *474
Electric Launches for Street Railways 401
Electric Launches in Milwaukee *550
Electric Line Between Columbus and Cincinnati, O 486
Electric Long Distance Transmission Plant, at Portland, Ore *450
Electric Motors for the Erie Canal 218
Electric Plant of the New Haven Street Railway Co. *494
Electric Power Station Construction, The Arnold System of *392
Electric Railroad Construction in Baltimore 297
Electric Railway Ambulance 634
Electric Railway Apparatus of the Walker Manufacturing Co., New *231
Electric Railway at Everett, Wash *98
Electric Railway at Lyons 437
Electric Railway Combination in Pennsylvania, A Large 793
Electric Railway Construction in Europe 155
Electric Railway Construction in Philadelphia *1, *354
Electric Railway Equipment (Hubley Mfg. Co.) *747
Electric Railway of Genoa, Italy *426
Electric Railway Patrol System, Model *548
Electric Railway Sweeper, A New Type of (Brooklyn Railway Supply Co.) *590
Electric Railway System in Brooklyn, Extensive New 228
Electric Railway System of Wheeling, W. Va. *218
Electric Railway System, The Johnson-Lundell Surface Contact *378
Electric Railway, The Early Pioneers of the *111
Elevated Railway Traffic in New York, Distribution of *771
Electrical Railway Work of the New Orleans Traction Co., Some Details of the *768
Electric Railways, City and Suburban (Foster). 677
Electric Railways for Brussels 315
Electric Railways in Europe 490
Electric Railways, Narrow *vs.* Broad Gauge (Merrill) 233
Electric Railways, Theory *vs.* Practice on 330
Electric Road at Ashland, Wis., The *81
Electric Road in a New Field, An *97
Electric Signaling System for Cable Roads (Pearce) 268
Electric Signals for Street Cars 402
Electric Snow Sweeper, An Improved (Brooklyn Railway Supply Co.) 521
Electric Snow Sweepers (Lewis & Fowler) 539
Electric Street Railway in Hobart, Tasmania *487
Electric Switch, New Type of (Hill Electric Co.) *396
Electric Traction Co., of Philadelphia, Cars for the *289
Electric Truck, A Peculiar (McGuire Mfg. Co.) 332
Electric Welding in Brooklyn *460
Electric Welding of Rail Joints 36
Electric Welding of Rails in St. Louis 389
Electrical Clambake, An 582
Electrical Contract Awarded in Chicago 459
Electrical Currents, Destructive Effect of, on Subterranean Metal Pipes (Farnham) *331
Electrical Equipment of the Brussels Tramways Co. 430
Electricity, The Cost of Producing 264
Electrolysis of Underground Pipes in Brooklyn 169
Elliptical Spring Truck, New (Sheppard Mfg. Co.) *389
Emergency Wagons, The Demand for 592
Empire State Radial Truck at the Convention *744
Engine, A New Vertical 600 H. P. (Ball & Wood Co.) 220
Engine, Ball Engine Co.'s Direct Connected *191
Engine, Corliss, for Street Railway Work (Bass Foundry & Machine Works) *587
Engine and Dynamo, Direct Connected (Harrisburg Foundry & Machine Works) *324
Engine and G. E. Dynamo, Direct Coupled Russell *471
Engine and Generator, Direct Connected (Mather) *588
Engine and Generator, New Direct Connected (Ide & Son) *14
Engine Lathe, Forty Inch Standard (Lodge & Davis) *393
Engine Lathe, Motor Driven (Lodge & Davis) *326
Engine, New "American" *391
Engine, New Type of Vertical Compound (Ball) *322
Engine, New Vertical, of the Ball Engine Co., of Erie, Pa *655
Engine, The Ball Engine Co.'s Direct Connected *191
Engines Triple Expansion, in Central Stations (McIntosh, Seymour & Co.) *49
EQUIPMENT NOTES 68, 137, 204, 267, 335, 402, 475, 529, 594, 663, 805
English Track Construction, Comments on (Hodges) 17
Erie Canal, Electric Motors for the 218
Eureka Street Sweeper, The (Lewis & Fowler) *254
Europe, Electric Railway Construction in 155
European Street Railway Practice, Notes on (Braet) 31, 462
European Rapid Transit 721
Everett (Wash.) Electric Railway *98
Excellent Cable Record, An *99
Exhaust Steam, Heating by, at Springfield, Ill.. *224
Exhibit of the J. G. Brill Co *745
Exhibit of the J. A Fay & Egan Co. at the World's Fair *12
Exhibit of the Lodge & Davis Machine Tool Co. at the World's Fair *50
Exhibit of the Paige Iron Works *745
Exhibit of the Peckham Co *743
Exhibit of the Sperry Electric Railway Co 742
Exhibit of the Walker Manufacturing Co *742
Exhibit of the Westinghouse Electric & Manufacturing Co 744
Exhibits at the Convention 382, *732
Experiments with Fuses for 500 Volt Circuits ... 756
Expositions, Manufacturing, in Mexico and South America 803
Extensions in New York 643
Extensive Contract at Lancaster, Pa 589

Fair Haven & Westville Street Railway Co., The Steam Plant of the 552
Fare Register, The Vernon *747
Fares in Philadelphia, Reduction of 797
Fay & Egan Co., World's Fair Exhibit of the J. A. *12
Feeder Patent, Decision on a 631
Feeder Switchboard, A New (Bonta) *614
Feeder Wire Splicer (Ohio Brass Co) *527
Fender, A New 131
Fender, A New (Euphrat) 56
Fender, A New (Routh) *590
Fender, A New Type of (Leonhardt) *126
Fender, A New, in St. Louis (Baumhoff and Hegemann *191
Fender, An Improved, for Street Railway Cars (Eaton) *801
Fender Patent Decision 630
Fender Report in Baltimore 631
Fender, Severe Tests of a New (Leonhardt) 203
Fender, The Bragg *747
Fender, The Crawford New Automatic *798
Fender, The Darrach Automatic Duplex 746
Fender, The Foster ..... * 53
Fender, The Modemann 746
Fender, The Pfingst *51
Fender, The Trimble Car 800
Fenders Adopted in Paterson and Hoboken 400
Fenders, Crawford 399
Fenders for Newark Cars 517
Fenders in Washington 486
Fenders, Street Car (Root) 164
Fibre Conduits (Fibre Conduit Co.) *327
Fiftieth Street Power House of the Broadway Cable Railway, New York, Changes in the 285
Fifty Thousand Dollar Prize of the Metropolitan Traction Co., New York, The 463
Fifty Thousand Dollars for the Best Street Car Motor 57
Fighting Snow in Milwaukee 153
FINANCIAL: 77, 145, 212, 274, 342, 410, 482, 537, 599, 670, 813
"Financial and Commercial Chronicle," to be Published by a Company 483
Financial Supplement, Some Comments on Our. 534
Fire in a St. Louis Car House 222
Fire Insurance Rates, The Question of 569
First Annual Meeting of the Michigan Street Railway Association 616
First Electric Railway in Russia 614
First Trip of Brooklyn's Postal Car 580
Flanges, Sharp *781
Flexible and Adjustable Bracket for Poles (Wrought Iron Bridge Co.) *657
Flexible Pole Brackets (Creaghead Engineering Co.) *190 *586
Floating Center Equalizing Brake (Anger) *327
Flush Transfer Tables at the Union Railway Car House, New York *321
Flywheel Accident at Pittsburgh, Pa *437
Folding Gates, The "Pitt" Patent 203
Fort Wayne Co., Important Purchase by the ... 592
Foster Fender, The *253
Fountain, New Electric *615
Fowler, The J. W., Car Co., The Works of the ... *53
Franchise Case at Indianapolis 486
Franchise Decision in Detroit 795
Franchise Decision in Indianapolis 795
Frankfort, Ky., Capital Railway of *376
Freight Cars, Electric *382
Freight Cars, Electric, in Spokane *424
Friction Clutch, Patent Screw (Gifford Bros.) .. *48
Fuel, A New 325
Fulton Foundry & Machine Co., The Works of the *521
Fulton Truck & Foundry Co 72
Fulton Truck & Foundry Co., The "Imperial" Steel Truck *47
Fuses, Destructive Arcing of 500 Volt (Harrington) *699
Fuses for 500 Volt Circuits, Experiments with .. 756

G. E. 800 Motor, A Dissected *258
Gas Lights in Electric Cars 491
Gas Motors 319
Gas Motors for Street Railways, Progress in Europe of 551
General Electric Co., Business of the 68
General Electric Co., Change in the New York Offices of the 57
General Electric Co., Improvements in Paneled Switchboards *260
General Electric Co., Second Annual Report of the 329
General Electric Co.'s Exhibit *743
General Electric Exhibit at the Midwinter Fair, San Francisco, Cal 259
Generator, The Mather Improved *526
Generator, The Walker Standard *522
Generators, Compressed Air for Cleaning 647
Generators, New Walker 2,000 H. P 384
Genett Improved Air Brake *319
Genoa Electric Railway *426
Georgia, A New Street Railway Association in. 790
Gifford Bros. Patent Screw Friction Clutch *48
Gift, A Generous *28
Glasgow Subway, The *489
Gold's Storage Street Car Heating System *196
Government Tramways of New South Wales *86
Grade, Changing, in Chicago 290
Grade Climbing at Easton, Pa *492
Grand Rapids, Consolidation at 289
Graphical Records of Street Railway Statistics (Robb) *616
Grip, Pick-up and Throw-off, A Combined (Muller) *801

Handsome Publication, A 521
Hansell Equalizing Trucks *470
Harrisburg Foundry & Machine Works, Direct Connected Engine and Dynamo *324
Hazelton or Porcupine Boiler 470
Headlight, A New (Glazier Headlight Co) *656
Headlight, A New Electric (Baumhoff) *585
Headlight, An Electric (Changeable Electric Headlight Co.) *385
Heater Equipment, A Large *493
Heater, New Electric (Consolidated Car Heating Co) *393
Heater, Street Car, New Type of (Safety Car Heating & Lighting Co.) *798
Heaters, Electric, A Large Order for 803
Heating by Exhaust Steam at Springfield, Ill... *224
Hennegin Life Guard, The *471
Hercules Trolley Clamp (Gustin & Co.) *468
Hestonville, Mantua, & Fairmount Passenger Railway Co.'s Power Station *721
Hill Electric Co., New Lightning Arrester *258
Hobart Electric Street Railway, The *487
Hoosick Falls Railway, The (Vail) *554
Horses, The Clippping of, in Germany and Austria-Hungary 579
Hotel, A Modern 339
Hubley Manufacturing Co., Electric Railway Equipment *747
Hunt Air Brake, The *468

Ice and Sleet Cutting Trolley Wheel (Storm Mfg. Co.) *659
Ide & Son, Direct Connected Engine and Generator, New *14
"Ideal" Engines, Direct Connected *256
Inclined Plane Railway, Price Hill, of Cincinnati *492

Indianapolis, Boiler Accident at..... 610
Indianapolis Franchise Case..... 486
Indianapolis, Franchise Decision in..... 795
Indicator, The Robertson-Thompson..... *56
Industrial Press, Review of the..... 747
Industries of Dayton, O., Some of the Principal *518
Injector, The Brownlee..... 385
Insulating Conduit. Iron Armored (Interior Conduit & Insulating Co.)..... *527
Insulator for Trolley Guards (Hammond Cleat & Insulator Co.)..... *326
Insurance, High Rate of, on a Car House..... 525
Insurance Problem, The (Higgins)..... 559
Insurance "Rider." A Well Drawn..... 565
Interior Conduit & Insulation Co., Iron Armored Insulating Conduit..... *527
International Numeral Register..... *796
International Register Co.'s "Aluminum" Stationary Register..... *52
International Street Railway Association, Eighth Annual Meeting of the.....164, 264
Interurban Railway of the Wyoming Valley.... *764
Intramural Motors in Brooklyn..... *580
Intrinsic Value of Street Railway Investments (Higgins).....18, 101, 165, 226, 291, 360
Investigation of an Egyptian Franchise..... 100
Isle of Man Tramways, The..... *283
Issue of Trust Notes by the Brooklyn Heights Railway Co..... 671

Jenney Electric Co., Works of the, Indianapolis, Ind..... 520
Jersey City, Hoboken & Rutherford Electric Railway..... 424
Johnson Co., Business of the..... 68
Johnson-Lundell Surface Contact Electric Railway System..... *378
Johnston Rail Bond, The..... *385

Kinks in Station and Railway Practice. *558, *547, *791

Laconia Standard Truck..... *800
Lancaster, Pa., Extensive Contract at..... 589
Lathe, Forty Inch Standard Engine (Lodge & Davis)..... *393
Lathes and Motors, The Storey Electric..... *52
Launches, Electric, in Milwaukee..... *550
Launches, Electric, for Street Railway Companies *474
Legal.
Driver Giving Passenger Incorrect Change 36
Danger of the Trolley System..... 37
Street Railway Service—Injury to Passenger—Contributory Negligence—Question for Jury—Note..... 60
Street Railway Companies—Liability for Injury to Pedestrians—Swung Around a Corner..... 60
Excessive Speed of Electric Cars..... 118
Electric Railways—Rights of Property Owners..... 118
Electric Street Railway—Injunction..... 238
Elevated Railway—Consent of Property Owners to Construct..... 238
Street Railways—Negligence—Contributory Negligence—Expert Testimony—Pleadings..... 238
Collision With Vehicle—Personal Injuries—Evidence..... 440
Municipal Grant—When One Street Railway Company May Appropriate Track of Another..... 440
Street Railroads—Injury to Passenger—Voluntary Act..... 440
Street Railway—Injury to Passenger—Collision..... 440
Legal Decision Sustaining the Trolley System, in Cambridge, Mass..... 794
Legal Notes..... 795
Legal Responsibility for Accidents..... 795
Lehigh Valley, In the..... *428
Lexington Avenue Cable Power Station of the Metropolitan Traction Co..... *490
Leonhardt Fender, Severe Tests of a New..... 203
Life Guard, The Rennegin..... *471
Lightning Arrester, A New (Hill Electric Co)... *258
Limit Switches, Street Car (Sweet Electric & Mfg. Co.)..... *802
Line Appliances, New Types of (Lynn Mfg. Co.) *260
Lithographed Car Tickets..... 14
Liverpool Elevated Railroad, Traffic of the..... 217
Locomotive, Electric, for the Baltimore Belt Line Tunnel..... 803
Lodge & Davis Machine Tool Co.'s Works..... *473
Lodge & Davis Machine Tool Co.'s World's Fair Exhibit..... *50
Lodge & Davis Plain Milling Machine..... *583
Lodge & Davis Sixteen Inch Shaper..... *652
Location of Overhead Equipments and Rights at Crossings (Fisher)..... 568
London, The Development of Electric and Cable Railways in (McCallum)..... *153
London Underground Electrical Railways..... 770
Long Distance Transmission Plant at Portland, Ore..... *450
Lukenheimer Glass Oil Cup for Dynamos and General Engine Bearings..... *48
Lynn & Boston Railroad Co., Power Station of the, at Salem, Mass..... *10
Lyons, France, Electric Railway at..... 473

McGuire Mfg. Co., A Peculiar Electric Truck... 332
McGuire Manufacturing Co., "Columbia" Magazine Cast Iron Car Heater..... *465
Mail Carrying in Brooklyn, N. Y..... *517
Mail, Express and Freight Service on Street Railway Cars (McCulloch)..... 687
Mails, Carrying the, in Brooklyn, N. Y..... *517
Maine Street Railway Association, Annual Meeting of the..... 152
Maine Street Railway Association, Meeting of the..... 549
Manchester (England) Tramways, The..... *552
Manhattan General Construction Co., A New Arc Lamp..... *465
Manufacture of Veneer for Car Seats and Ceilings at Newport, Vt..... *262
Map of the City & Suburban Railway of Baltimore, Reference..... *288
Massachusetts State Board of Railroad Commissioners, Annual Report of the..... 201
Massachusetts Street Railway Association, Seventh Annual Meeting of the..... *646
Mather Direct Connected Engine and Generator.. *588
Mather Electric Co., Recent Work of the..... 659
Mather Improved Generator..... *526
Medical Side of Street Railway Practice, The—Part 3 (Tobias)..... 16
Mekarski Motors in Paris..... 647
Mechanical Draught (Roney)..... 433
Metropolitan Street Railway Co., New York, Repair Shops of the..... 786
Metropolitan Traction Co., Open Slot Electric Conduit for the..... 396
Metropolitan Traction Co., Removal of the Offices of the..... 59
Metropolitan Traction Co., The Offer of the..... 89
Metropolitan Traction Co.'s $50,000 Prize..... 463
Mexico and South America, Manufacturing Expositions in..... 803
Michigan Street Railway Association..... 424
Michigan Street Railway Association, First Annual Meeting of the..... 616
Midwinter Fair, San Francisco, General Electric Exhibit at the..... *259
Mileage and Cars for Two Years, A Comparison 33
Mileage Table..... 147
Milk, Transportation of, by Electric Cars..... 724
Milling Machine, Plain (Lodge & Davis)..... *583
Milling Machine, Universal (Lodge & Davis).... *796
Milwaukee, Electric Launches in..... *550
Modemann Fender, The..... 746
Montreal, Can., The Street Railway System of *573
Moore Brake and Fender Combined..... *131
Morrin Climax Steam Generator..... *197
Motor, $50,000 for the Best Street Car..... 57
Motor, A New Street Railway (Moore & Edenfield)..... *163
Motor and Controller, New (Steel Motor Co.).... *523
Motor Driven Engine Lathe (Lodge & Davis).... *326
Motor Driven Radial Drill (Lodge & Davis)..... *525
Motor Equipment for Brooklyn, A Large..... 260
Motor Repairs (Hobart)..... *640
Motor Support, New Method of (Walker Mfg. Co.) *466
Motor, The Card Electric Street Railway..... *380
Motor, The Twin Series, in New York (United Columbia Electric Co.)..... *159
Motor Truck, A New (Dorner & Dutton Mfg. Co.) *385
Motor Truck, A Reciprocating (Wilson)..... *582
Motor Truck, An Anti-Concussion (American Car Co.)..... *325
Motors, Care of Street Car..... 115
Motors, Gas..... 319
Motors of the Westinghouse Electric & Manufacturing Co., New..... *284
Mousam River Railroad, The..... *97
Movable Sidewalk, The Pier, Purchased..... 332

Name Plate, A Handsome..... *290
Narrow vs. Broad Gauge Electric Railways (Merrill)..... 233
National Electric Light Association, Annual Meeting of the..... 209
National School of Electricity..... 399
National Statistical Association, The..... 131
New Castle Car Manufacturing Co..... *128
New England Notes..... 194
New Haven Street Railway Co., The Electric Plant of the..... *494
New Orleans, Cars for..... *544
New Orleans, Track Construction at..... *375
New Orleans Traction Co., Some Details of the Electrical Work of the..... *768
New Publications.
A Few Plain Facts Concerning Water Tube Boilers..... 401
After the Fair: The Twenty-fifth Anniversary Souvenir of the Page Belting Co.... 207
Ajax Lightning Arrester..... 661
Alternating Current Wiring and Distribution. 661
Annual Meeting of the National Electric Light Association..... 209
Banker's Almanac and Register and Legal Directory for 1894..... 593
Best Light for City Railway Cars..... 528
Book of the Fair, The..... 334
Catalogue A of the Wallace Electric Co. Chicago..... 267
Catalogue of Electric Railway Equipment and Supplies of the Western Electric Co. 748
Catalogue of Electric Trucks, Manufactured by the Taylor Electric Truck Co., of Troy, N. Y..... 267
Catalogue of Rail Sections..... 475
Catalogue of Railway and Machinists' Tools and Supplies, January, 1894..... 72
Catalogue of the Barney & Smith Car Co.... 804
Catalogue of Berlin Iron Bridge Co., of East Berlin, Conn..... 267
Catalogue of the Curtis Railway Motor, Manufactured by the Curtis Electric Manufacturing Co..... 401
Catalogue of the Genett Air Brake for Cable and Electric Street Railways..... 334
Catalogue of the McGuire Manufacturing Co.'s Electric Car Trucks..... 136
Catalogue of the Vulcanized Fibre Co..... 334
Directory of Electric Light Central Stations and Electric Railways in North America 401
Dynamo and Motor Building for Amateurs, With Working Drawings..... 207
Electric Light and Power..... 805
Electric Lighting Plants, Their Cost and Operation..... 662
Electrical and Street Railway Reporter..... 267
Electrical Engineering Leaflets..... 529
Electricity at the Columbian Exposition, Including an Account of the Exhibits in the Electricity Building, etc..... 262
Electricity One Hundred Years Ago and Today..... 528
Elementary Lessons in Steam Machinery and the Marine Steam Engine..... 136
General Information in Regard to Electric Installations..... 528
Genett Air Brake for Cable and Electric Railways..... 207
Hand Book of Street Railway Track and Trolley Equipment..... *475
Hints to Engineers Operating Small Electric Light Plants..... 661
Horse in His Relation to Economic Agriculture and the Industries of Transportation, The..... 137
Illustrated Catalogue of the Lunkenheimer Co..... 804
Illustrated Catalogue No. 1, of the Laclede Car Co..... 267
Inventions Researches and Writings of Nikola Tesla..... 207
Laboratory Manual of Physics and Applied Electricity..... 662
Modern Methods of Handling Fuel as Practiced in Locomotive Coaling Stations, Electric Light and Steam Railway Power Plants..... 804
National Electric Light Association, Annual Meeting of the..... 209
Points on Perforated Belting..... 136
Railway Surgeon, The..... 528
Report of the Eleventh Annual Meeting of the Street Railway Association of the State of New York..... 528
Steam Engine and Other Heat Engines, The 475
Steam, Its Generation and Use. Twenty-eighth Edition. La Vapeur, Sa Production et Son Emploi; and Dampf, dessen Erzeugung und Verwendung..... 662
Steam Tables and Engine Constants for Facilitating All Calculations Upon Indicator Diagrams..... 661
Stresses in Girder and Roof Trusses for Both Dead and Live Loads, by Simple Multiplication, With Strain Constants for One Hundred Cases..... 805
Tables and Formulas for Electric Street Railway Engineers..... 334
Text Book on Electro-Magnetism and the Construction of Dynamos..... 267
Toronto, as Seen From the Street Cars; A Tour by Trolley..... 661
Twenty-seventh Annual Number of Poor's Manual of Railroads..... 593
White-Crosby Co., The..... 266
Zeitschrift fur Kleinbahnen for January, 1894..... 137
New South Wales, Government Tramways of.. *86
New York City, Possibility of an Underground Trolley in..... 222
New York City Street Railway Traffic..... 816
New York City, Transfers in..... 789
New York & Brooklyn Bridge Trustees, Annual Report of the..... *27
New York, Electric Conduit Road in..... 459
New York Electrical Works, Complete Line of Overhead Material..... *259
New York Elevated Railway Traffic, Distribution of..... *771
New York, Flush Transfer Tables at the Union Railway Car House..... *321
New York, New Car House of the Metropolitan Street Railway..... *731
New York Offices of the General Electric Co., Change in the..... 57
New York, Progress of the Columbus Avenue Cable Railway..... *545
New York Railroad Commissioners, Street Railway Recommendations..... 105
New York, Rapid Transit Plans in..... 60
New York, Starting the Cable Cars on Third Avenue..... *38

New York State Street Railway Association, Twelfth Annual Meeting of the.....*541,644
President's Address..... 644
Report of the Executive Committee..... 645
New York Street Railway Stock Market.....409,481
New York Terminal and Coaling Station of the Second and Third Avenue Elevated Railways *82
New York, The Lexington Avenue Cable Power Station of the Metropolitan Traction Co..... *490
New York Wood Vulcanizing Co., and Its Process for Preserving Ties, Poles, Crossarms etc..... *591
New Zealand, Good Cable Records in..... 732
Newark & South Orange Railway..... *603
Newark Cars, Fenders for..... 517
Newcastle-Upon-Tyne, England, The Rapid Transit Question in..... 430
Niagara Falls, Suspended Railway Bridge Across 328
North and West Chicago Street Railroad Cos., Annual Reports of the..... 132
North Metropolitan Tramways Co., Report of the..... 587
Northwestern Electrical Association, Summer Meeting of the..... 461
Notes from England.....30, 194, 318, 561, 734
Notes on European Street Railway Practice (Braet).....31,462

OBITUARY.

Andrews, Payson K..... 663
Babcock, George H..... 72
Barclay, Jacob Livingstone..... 267
Boone, Thomas C..... 136
Dalzell, John H..... 475
Ives, Hoadley B..... 267
Pullman, Albert B..... 72
Rhoads, Hiram R..... 267
Sayre, Thomas M..... 594
Slocum, Gen. H. W..... 334
Smith, Mrs. Josephine D..... 202
Stephenson, William J..... 662
Tallant, H. W..... 402
Wilcox, Stephen..... 72
Zanetti, Cesare..... 663
Offer of the Metropolitan Traction Co., The..... 89
Ohio Brass Co., Complete Line of Overhead Construction Material..... *396
Ohio Brass Co., Steel Bonding Caps..... *255
Ohio State Tramway Association, Thirteenth Annual Meeting of the..... 660
Ohio Trolley, The (Ohio Brass Co)..... *86
Oil Cup for Dynamos and General Engine Bearings, New Glass (Lunkenheimer)..... *48
Oiling System, Automatic (Wilson-Whiting-Davis Oiling Co)..... *524
Open Slot Electric Conduit for the Metropolitan Traction Co..... 396
Operation and Maintenance Percentages on a Southern Street Railway for 1893..... 297
Ottawa Electric Railway Co..... 461
Overhead Appliances, A New Line of..... *129
Overhead Construction Material, A Complete Line of (Ohio Brass Co.)..... *396
Overhead Equipments, Location of, and Rights at Crossings (Fisher)..... 568
Overhead Material, A Complete Line of (New York Electrical Works)..... *259
Overhead Railway Material, Aluminum Bronze for..... 470
Overhead Switch, New..... *396

Paige Iron Works Exhibit..... *745
Pan-American Exhibit, Permanent..... 401
Paper Weight, A Tasteful..... *258
Paper Weight, A Neat..... 59

PAPERS.

Best Method of Treating Accidents (Dyer).. 695
Brake Shoes (Evans)..... *689
Cable Traction, Recent Improvements in (McNulty)..... 621
Can the T Rail Be Satisfactorily Used on Paved Streets? (Hendrie)..... 681
City and Suburban Electric Railways (Foster)..... 677
Corrosion of Iron Pipes by the Action of Electric Railway Currents (Jackson).... 566
Cost of Indicated Horse Power (May)..... 437
Destructive Arcing of 500 Volt Fuses (Harrington)..... *699
Destructive Effect of Electrical Currents on Subterranean Metal Pipes (Farnham)... *331
Economy of Power House Operation (Craven). 627
Electric Conduit Railway Problem, Is there a Solution of the (Sachs)..... *773
Electric Brake in Practice, The (Sperry)..... *628
Importance of Complete Metallic Circuit for Electric Railways (Vail)..... *199
Index of Engineering Literature, Suggestions for (Shepardson)..... 773
Mail, Express and Freight Service on Street Railway Cars (McCulloch)..... 687
Mechanical Draught (Roney)..... 433
Metallic Circuit for Electric Railways, The Importance of Complete (Vail)..... *199
Perfection of the Electric Railway Motor (Nissley)..... 626
Power Brakes *vs.* Hand Brakes (Wessels)... 683
Power Losses in the Transmission Machinery of Central Stations (Aldrich)..... 435
Proper Rail Bonding (Malochee)..... 234
Recent Improvements in Cable Traction (McNulty)..... 621
Standard Form of Street Railway Accounts, A (Bettis)..... 673
T Rail Track Construction of the Terre Haute Electric Railway (Harrison)..... 697
Taxation (Foote)..... 624
Transfers on Street Railways (Beckley)..... 680
Trucks (George)..... 397
Use of the Booster on Electric Railway Circuits (Vail and Wynkoop)..... *701
Parades vs. Street Railway Service..... 795
Park of the Citizens' Street Railway Co., Indianapolis, Ind..... *551
Passengers Transferred Without Tickets..... 647
Passes, Constitutional Abolition of, in New York State..... 802
PATENTS, STREET RAILWAY: 73, 140, 207, 270, 337, 405, 531, 664, 750, 804
Paterson, Passaic & Rutherford Electric Railway Co..... *612
Patrol System, A Model Electric Railway..... *548
Paved Streets, T Rail Construction on..... *557
Paving, Wood, in Sydney, Australia..... 376
Peckham Automatic Life and Wheel Guard.... *390
Peckham Co.'s Exhibit..... *743
Peckham's Improved Extra Long Truck..... *470
Peckham Trucks in New York..... *290
Pennsylvania Street Railway Association, Third Annual Meeting of the.....545, *635
Pennsylvania Traction Co., Proposed Line of the 617
People's Traction Co., Philadelphia, Cars Put in Operation by the..... 517
Percentages of Operation and Maintenance on a Southern Street Railway for 1893..... 297
Perfection of the Electric Railway Motor (Nissley)..... 626
PERSONAL: 72, 136, 203, 266, 333, 400, 475, 529, 593, 662, 784, 804
Petersen Double Compartment Conduit System. *189
Pfingst Fender, The..... *51
Philadelphia, Cars for the Electric Traction Co. *289
Philadelphia Corporations, Some New..... 203
Philadelphia Electric Lines, New Cars for the *123
Philadelphia, Electric Railway Construction in *1, *354, *605
Philadelphia, New Suburban Line Near..... *359
Philadelphia, Reduction of Fares in..... 797
Philadelphia, Trolley Parties in..... 641
Pier Movable Sidewalk Purchased..... 332
Pioneers of the Electric Railway, Early..... *111
Pitch, Trinidad..... 29
"Pitt" Patent Folding Gates..... 203
Pittsburgh, Allegheny & Manchester Traction Co..... *157
Pittsburgh, Pa., Citizens' Traction Co., Report of 59
Plunger Pump, Compound, Duplex, Double for Boston (Deane)..... *390
Pole Bracket, Combination (Wood)..... *260
Pole Brackets, Flexible (Creaghead Engineering Co.)..... *190, *586
Portable Recording Wattmeter (Gen. Elec. Co.) *467
Portland Cement..... 802
Portland, Ore., Electric Long Distance Transmission Plant at..... *450
Possibility of an Underground Trolley in New York City..... 222
Postal Service, The Street Railway..... 780
Poughkeepsie City & Wappingers Falls Electric Railway (Vail)..... *726
Power Brakes *vs* Hand Brakes (Wessels)..... 683
Power House Breakdowns, Two..... 136
Power Losses in the Transmission Machinery of Central Stations (Aldrich)..... 435
Power Station Economy, Notes on (Davis)..... 788
Power Station of the Hestonville, Mantua & Fairmount Passenger Railway Co..... *721
Power Station of the Lynn & Boston Railroad Co. at Salem, Mass..... *10
Pressure Plate Switch, A (Pressure Plate Switch Co..... *56
Pressure Recording Gauge, A Well Known (Edson)..... *474
Price Hill Inclined Plane Railway of Cincinnati *492
Price Rail Joints and Bonds..... *658
Prize Competition, The J. G. White..... 483
Prize Tickets..... 59
Prizes Awarded in the Car House Competition 527
Prizes Offered..... 321
Prizes, $250 in..... 393
Problems in Straddled Track Construction..... *286
Proceedings of the Thirteenth Annual Convention of the American Street Railway Association..... *703
Process for Preserving Ties, Poles, Crossarms, etc., The New York Wood Vulcanizing Co.'s *591
Providence Steam Engine Co., Business of the 68

Rack Railway of S. Ellero-Santino..... *550
Radial Drill, Motor Driven (Lodge & Davis)..... *525
Rail Bond, Improved (Technic Electrical Works) *524
Rail Bond, The Johnston..... *385
Rail Bonding, Proper (Malochee)..... 234
Rail Joints and Bonds (Price)..... *658
Rail Joints, Electric Welding of..... 36
Rail Tests, Interesting..... 31
Rails, Electric Welding of, in St. Louis..... 389
Railroad Officials Thanked..... 714
Railway Ammonia Motor, The *257
Railway, an Electric, between Columbus and Cincinnati..... 486
Railway Bridge, Suspended, Across Niagara Falls..... 328
Railway Lines in Detroit Sold..... 486
Railway Statistics..... 80
Railway Supplies; Western Electric Co..... 464
Railways, Electric, in Europe..... 490
Railways in the United States, Statistics of.... 501
Rapid Transit in Europe..... 721
Rapid Transit Plan for New York City, New.... 114
Rapid Transit Plans in New York..... 60
Rapid Transit Question in Newcastle-Upon-Tyne, England, The..... 430
Rapid Transit Situation in Detroit..... 399
Rapid Transit in Vienna..... 153
Rapid Transit Wins in Cincinnati..... 60
Raw Hide Belting, Grooved (Shultz Belting Co.) *466
Rebuilding Short Cars in New York..... *732
Recent Work of the Mather Electric Co..... 659
Receipts and Expenses per Car Mile..... 297
Register, International Numeral..... 796
Register, The "Aluminum" Stationary (International Register Co)..... *52
Register, The Ames Portable and Stationary... *198
Removable Vestibules (Brill)..... *799
Repair Shops and Car House of the Albany Railway, Albany, N. Y..... *151
Repair Shops of the Metropolitan Street Railway Co., New York..... 786
Report of Citizens' Traction Co., Pittsburgh, Pa. 59
Report of the North Metropolitan Tramways Co., London, Eng..... 587
Report on Fenders in Baltimore..... 631
Requirements of Safety Appliances for Street Railways (Crawford)..... *58
Resolutions of Congratulations to Railroad Officials..... 714
Resolutions on the Southern Railway..... 714
Retrospect of the Past Year's Business: The Prospects for 1894..... 61
Review of the Industrial Press..... 747
Richardson, William, Death of..... *27
Roanoke, Va., The Street Railway System of... *722
Robertson-Thompson Indicator..... *256
Robinson "Ajax" Four Wheel Truck..... *467
Rockliffe Park, the Summer Resort of the Ottawa Railway Co..... *610
Roller Bearing, A New..... *128
Rope Driving, Practical Notes on (M. L.).....132, 316, *497, 562
Russell Engine, and G. E. Dynamos, Direct Coupled..... *471
Russia, The First Electric Railway in..... 614

Safety Appliances for Street Railways, Requirements of (Crawford)..... *58
St. Louis Car Co.'s Truck No. 8..... *190
St. Louis Car House Fire..... 222
St. Louis, Electric Welding of Rails in..... 389
St. Louis Notes..... 30
St. Louis, Statements From.....105, 321, 803
St. Louis Street Railways—Statistics of Mileage 803
St. Louis, Suburban Roads in..... 375
St. Paul, Battling the Snow in..... 223
Sachs Automatic Cable Signaling Device..... 60
Safety Clutch Brake Co., Improved Safety Clutch Brake..... *198
San Francisco Cable Sheaves..... *383
San Francisco, Important Purchase in..... 610
S. Ellero-Santino Rack Railway, The..... *550
Savannah Electric Railway Company, Reorganization of..... 816
Savannah Street Railway War..... 721
Scott, Charles, Spring Co..... 747
Screw Hoists, Double Chain..... *126
Section Switch, The Ajax Line (Van Nuis)..... *327
Second and Third Avenue, New York, Elevated Railways, Terminal and Coaling Stations of the..... *82
Southern Railway, Resolutions on the..... 714
Southern Station of the Brooklyn City Railroad, Boiler Plant of the..... *383
Southern Station of the Brooklyn City Railroad, Coal Handling Apparatus at the..... *277
Souvenir, Our..... 720
Souvenir Edition, Our Forthcoming..... 634
Souvenir Edition, Some Press Comments on Our 751
Souvenirs at the Convention..... 742
Speed of Trolley Cars, Ascertaining the (Hobart) 564
Sperry Electric Equipments, New..... 399
Sperry Electric Railway Co.'s Exhibit..... 742
Spillman Trolley Ear..... *468
Splicer for Feeder Wires (Ohio Brass Co.)..... *527
Springs, Graduated Car (Vose)..... *129
Shaper, Sixteen Inch (Lodge & Davis)..... *652
Shipments of the Ball Engine Co., Recent..... 602
Short Cars, Rebuilding..... *732
Short Electric Railway and the Brush Electric Cos., Annual Meeting of the..... 326
Short Lap Belting, What is?..... 74
Shultz Belting Co., Grooved Raw Hide Belting.. *466
Signal for Electric Roads, A Danger..... 383

Signaling Device, Automatic Cable (Sachs)..... 60
Signaling System, Electric, for Cable Roads (Pearce)..... 263
Signals, Electric, for Street Cars..... 402
Silvey Storage Battery Car..... *220
Siemens [illegible] Work..... 588
Skinner [illegible] Brake..... *251
Snow [illegible] Nozzle (Ryder)..... 133
Snow Plow for Heavy Drifts, A..... *217
Snow Sweepers, Electric (Lewis & Fowler)..... 539
Snow Sweeper, An Improved Electric (Brooklyn Railway Supply Co.)..... 521
Societies, [illegible] of the Conventions..... 712
Souvenir Edition, What is Thought of Our..... 810
Spokane, Electric Freight Cars in..... *424
Spokane, The Commonwealth Movement in..... *447
Sprinkler, Electric and Cable Car Street (Day) *56
Sprinkling Car at Toronto..... 425
Standard Form of Street Railway Accounts, A (Bettis)..... 673
Stanley Illuminated Car Sign..... *250
Stanwood Manufacturing Co., The..... 321
Station and Railway Practice, Kinks in *558,*647 *791
Statistical Association, The National..... 131
Statistics of Railways in the United States..... 501
Steam Fan, Special Steel Plate, With Double Enclosed Engine (Buffalo Forge Co.)..... *197
Steam Generator, The Morrin Climax..... *197
Steam Heating Plant, A Large, to Be Constructed in Scranton, Pa..... 321
Steel Bonding Caps (Ohio Brass Co.)..... *255
Steam Plant of the Fair Haven & Westville Street Railway Co..... 552
Sterling Supply & Manufacturing Co..... 746
Sterling Supply & Manufacturing Co., Recent Orders of the..... *586
Sterling Supply & Mfg. Co., Works of the..... *797
Storage Batteries in the Trolley Railway Plant at Zurich, Switzerland, The Use of..... *546
Storage Battery, A New (Haschke & Creelman) *583
Storage Battery Car, The Silvey..... *220
Storage Battery Cars, Performance of, in Snowy Weather..... 202
Storey Electric Lathes and Motors..... *52
Straddled Track Construction, Problems in..... *286
Street Car Curtains (Davis Car Shade Co.)..... *257
Street Car Fenders (Root)..... 164
Street Car Heating System, Gold's Storage..... *196
Street Railroads, Earnings of..... 384
Street Railroads of Cincinnati..... *413
Street Railway Association in Georgia, A New 790
Street Railway Association of Michigan..... 424
Street Railway Associations..... 702
Street Railway Consolidations..... 779
Street Railway Investments, The Intrinsic Value of (Higgins)..... 18, 101, 165, 226, 291, 360
Street Railway News. 134, 203, 262, 307, 374, 527, 592, 660, 748, 803
Street Railway Park Attractions at Toledo.... 728
Street Railway Postal Service, The..... 780
Street Railway Practice, Discussions on..... 265
Street Railway Recommendations by New York Railroad Commissioners..... 105
Street Railway Statistics, Graphical Records of (Robb)..... *616
Street Railway Stock Quotations: 75,143,210, 340, 272, 407, 479, 535, 597, 668, 811
Street Railway Strike at Bridgeport, Conn..... 136
Street Railway System in Terre Haute..... *357
Street Railway System of Bridgeport, Conn..... *730
Street Railway System of Montreal, Can..... *573
Street Railway System of Roanoke, Va..... *722
Street Railway Traffic in New York City..... 816
Street Railway Traffic of Chicago, in 1893..... 115
Street Railways of Washington, D. C., The..... *757
Suburban Line Near Philadelphia, New..... *359
Suburban Roads in St. Louis..... 375
Subway, The Glasgow..... *489
Summer Meeting of the Northwestern Electrical Association..... 461
Summer Resort of the Ottawa Electric Railway Co., Rockliffe Park, The..... *610
Swan Lamp Co., Annual Meeting of the..... 148
Sweeper, Electric, A New Type of (Brooklyn Railway Supply Co.)..... *590
Sweeper, Quick Construction of a..... 57
Sweeper, The Eureka Street (Lewis & Fowler) *254
Switch A Pressure Plate (Pressure Plate Switch Co.)..... *56
Switch, A 7,000 Ampere (Van Nuis)..... *657
Switch, Line Section, The Ajax (Van Nuis)..... *327
Switch, New Overhead..... *396
Switch, New Type of Electric (Hill Electric Co.). *396
Switch, The Battle Automatic..... *659
Switchboard, New Feeder (Bonta)..... *614
Switchboard, New Type of (General Electric Co.) *525
Switchboards, Improvements in Paneled (General Electric Co.)..... *260
Switches, Street Car Limit (Sweet Electric & Mfg. Co.)..... *802
Switching Facilities of the Chicago City Railway Co., New..... *577
Sydney, Australia, Wood Paving in..... 376
System of Cable Handling in Use by the Chicago City Railway Co. (Fitch)..... *496
T Rail, Can it Be Satisfactorily Used on Paved Streets? (Hendrie)..... 681
T Rail Construction on Paved Streets..... *557
T Rail Track Construction in Terre Haute..... *729
Tar Burners in Melbourne..... 641
Taxation (Foote)..... 624
Taylor Electric Truck Co., Electric Motor Trucks *254
Technic Electrical Works, Improved Rail Bond. *524
Technical Instruction by Correspondence..... 72
Technical Society of the Pacific Coast..... 197
Telephone, The Columbia..... *520
Testimonial, A Deserved..... 461
Terre Haute, All Steel T Rail Construction in.. *729
Terre Haute Methods of Promoting Traffic..... *725
Terre Haute, The Street Railway System in.... *357
Texas Street Railway Association, Organization of the..... 195
Theory *vs.* Practice on Electric Railways..... 330
Third Avenue Railway, New York, Air Brakes on the..... *516
Third Avenue Railway, of New York, The Bayard Street Station of the..... *448
Thomson Recording Wattmeter for Street Car Testing..... *263
Three-Phase Electric Transmission of Power Applied to Electric Railway and Mill Operation..... *280
Time Schedule for Running Cars..... 315
Toledo Street Railway Park Attractions..... 728
Toronto, A Sprinkling Car at..... 425
Track Construction at New Orleans..... *375
Track Construction in Terre Haute, All Steel T Rail..... *729
Traffic of the Liverpool Elevated Railroad..... 217
Tramway Interests in Greece..... 120
Tramways in the Isle of Man..... *283
Tramways Institute of Great Britain and Ireland, Meeting of the..... 500
Tramways of Manchester, England, The..... *552
Transfer of Passengers Without Tickets..... 647
Transfer Ticket, A New (Stedman)..... *252
Transfer Ticket, New Type of, (Milwaukee Street Railway Co)..... *461
Transfers in New York City..... 789
Transfers on Street Railways (Beckley)..... 680
Transformation of Baltimore, The..... *90, *160
Transportation, A New System of (Barrows)... *589
Transportation of Milk by Electric Cars..... 724
Trenton Trolley Wagon (Linburg, Sickel & Co.) *653
Trimble Car Fender..... 800
Trimble Car Works, The James A..... *328
Trimmings for Cars..... *394
Trinidad Pitch..... 29
Triple Expansion Engines in Central Stations (McIntosh, Seymour & Co.)..... *49
Trolley, A New (Duplex Trolley Co.)..... *195
Trolley, A New Type of (Griffiths)..... *233
Trolley Cars in Bremen..... *149
Trolley Clamp, New (Central Electric Co.)..... *796
Trolley Clamp, The Hercules (Gustin & Co.).... *468
Trolley Ear, The Spillman..... *468
Trolley Guard Insulator (Hammond Cleat & Insulator Co.)..... *326
Trolley Head, A New (Anger)..... *326
Trolley Head, A New Type of (Falk Mfg. Co.).. *583
Trolley Head, A Simple (Walker)..... *251
Trolley Head, New (Hubley Mfg. Co.)..... *588
Trolley Parties in Boston..... *798
Trolley Parties in Philadelphia..... 641
Trolley Pole, A Drawn Steel (U. S. Projectile Co.)..... 594
Trolley, The Ohio (Ohio Brass Co.)..... *586
Trolley Wagon, The Trenton (Linburg, Sickel & Co.)..... *653
Trolley Wheel, Ice and Sleet Cutting (Storm Manufacturing Co.)..... *659
Trolley Wheel, The "Economy"..... *329
Trolley Wire Brackets, Adjustable (Burnham & Duggan)..... *257
Trolley Wire in a New Role, The..... 296
Truck, A New (Chicago Electric Truck Co.)..... *124
Truck, A Reciprocating Motor (Wilson)..... *582
Truck, Bemis Standard Cable..... *585
Truck, Laconia Standard..... *800
Truck, New Elliptical Spring (Sheppard Manufacturing Co.)..... *389
Truck No. 8, St. Louis Car Co.'s..... *190
Truck Order, A Large, Awarded..... 592
Truck, The "Imperial" Steel (Fulton Truck & Foundry Co.)..... *47
Truck, The New Robinson "Ajax" Four Wheel. *467
Trucks (George)..... 397
Trucks, Electric Motor (Taylor Electric Truck Co.)..... *254
Trucks, Peckham, in New York..... *290
Trucks, The Hansell Equalizing..... *470
Tunnel at Chicago, New..... 290
Twin Series Motor in New York, The (United Columbian Electric Co.)..... *159
Two Passengers for One Cent..... 721

Underground Electrical Railways in London.... 770
Underground Pipes, Electrolysis of, in Brooklyn. 169
Underground Trolley in New York City, Possibility of an..... 222
Uniform Supplies..... *181
Union Railway Car House, New York, Flush Transfer Tables at the..... *321
Utica Belt Line Reorganized..... 539

Van Buren Mechanical Clip..... *800
Van Nuis Seven Thousand Ampere Switch..... *657
Veneer for Car Seats and Ceilings, The Manufacture of, at Newport, Vt..... *262
Vernon Fare Register..... *747
Vestibuled Cars, Handsome..... 586
Vienna, Rapid Transit in..... 153
Vestibules in Cleveland..... 33
Vestibules, Removable (Brill)..... *799
Vertical Compound Engine, A New Type of (Ball). *322
Vertical Engine of the Ball Engine Co, of Erie, Pa., New..... *655
Vertical 600 H. P. Engine, A New (Ball & Wood Co.)..... 220
Vose Graduated Car Springs..... *129

Wagons, Emergency, The Demand for..... 592
Walker Generators, New 2,000 H. P..... 384
Walker, John, Goes to Chicago..... 297
Walker Manufacturing Co., A New Departure for the..... 79
Walker Manufacturing Co., New Electric Railway Apparatus of the..... *231
Walker Manufacturing Co.'s Exhibit..... *742
Walker Standard Generator..... *522
Walker Trolley Head..... *251
Washington, Cost of Concrete Paving in..... 12
Washington, D. C., The Street Railways of..... *757
Wattmeter for Street Car Testing, Thomson Portable..... *263
Wattmeter, Portable Recording (General Electric Co.)..... *467
Water Gauge Shut-off Device..... *647
Welding, Electric, of Rails in St. Louis..... 389
Welding, Electrical, in Brooklyn..... *460
Well Drawn Insurance "Rider," A..... 565
West and North Chicago Street Railway Cos., Annual Report of the..... 132
West End Street Railway Company, of Boston, Annual Report of the..... 28, 777
Western Electric Co. Railway Supplies..... 464
Westinghouse Electric & Manufacturing Co., Annual Report of the..... 395
Westinghouse Electric & Manufacturing Co., Business of the..... 67
Westinghouse Electric & Manufacturing Co.'s Exhibit..... 744
Westinghouse Electric & Manufacturing Co., New Motors of the..... *284
Wheel, A New Type of Car (A Whitney & Sons). *656
Wheel and the Rail, The (Fitch)..... *431
Wheel Centers, Wrought Iron (Arbel)..... *255
Wheel Guard, The Peckham Automatic Life and *390
Wheel, Trolley Car, Service..... 783
Wheeler Surface Condensers..... *261
Wheeling, W. Va., The Electric Railway System of..... *218
Wheels, Cushioned Car (Bass Foundry & Machine Works)..... 321
Wheels, Street Railway..... 781
Sharp Flanges..... *781
Trolley Car Wheel Service..... 783
Wear of Wheels in Electric, Cable and Horse Car Service..... 784
Wear on Wheels and Brake Shoes..... 782
White-Crosby Co., The..... 266
White, The J. G., Prize Competition..... 483
Whitney, A., & Sons, New Type of Car Wheel... *656
Wilson-Whiting-Davis Oiling Co., Automatic Oiling System..... *524
Wissahickon Electric Passenger Railway..... *642
Wood Paving in Sydney, Australia..... 376
Wooden Faced Brake Shoes (Wm. Wharton, Jr., & Co.)..... *393
Woodman Manufacturing Supply Co., An Easy Car Pusher..... *326
Worcester Traction Co., Plant of the..... *13
Work at the Factory of the Barney & Smith Co. 263
Work of a Large Car Co., Recent..... 585
Works of a Large Wrought Iron Bridge Co..... *388
Works of the American Engine Co..... *654
Works of the Barney & Smith Car Co..... *125
Works of the C. & C. Electric Co..... 58
Works of the Card Electric Motor & Dynamo Co. *472
Works of the Curtis Electric Manufacturing Co. *386
Works of the Fulton Foundry & Machine Co., Brooklyn..... *521
Works of the J. W. Fowler Car Co..... *53
Works of the Jenney Electric Co., Indianapolis, Ind..... 520
Works of the Lodge & Davis Machine Tool Co. *473
Works of the Sterling Supply & Manufacturing Co..... *797
World's Fair, Exhibit of the J. A. Fay & Egan Co., at the..... *12
World's Fair Exhibit of the Lodge & Davis Machine Tool Co..... *50
Wright Device for Reducing Jolting..... *556
Wrought Iron Bridge Co., Flexible and Adjustable Bracket for Poles..... *657
Wyoming Valley Interurban Railway..... *764

Yonkers, Consolidation at..... 601
Youngstown Street Railway Strike..... 618

Zurich, Switzerland, Use of Storage Batteries in the Trolley Railway Plant at..... *546

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ELECTRIC RAILWAY CONSTRUCTION IN PHILADELPHIA.

The long fight between the advocates of rapid transit and the city authorities in Philadelphia, to secure the right, on the part of the street railway companies, to employ electricity as a motive power for their cars, is of so recent a date as to be still fresh in the minds of our readers. In Philadelphia, perhaps, more than in most cities, the needs of rapid transit were exceedingly pressing, and the old horse car had outlived its usefulness. In that city, however, the advocates of improvement in street car methods, as in other cities, found a considerable portion of the community ignorant of the features of the system which it was proposed to install, and opposed to any change. This class, by petitions and otherwise, brought a considerable pressure to bear against the permission for any change in the methods employed to operate cars, and it was only after a long time that the necessary rights were finally secured. When the overhead franchises were granted, however, steps were immediately taken by the different street railway companies to install electric cars, and during the summer and fall a great deal of work in this direction has been carried on.

A number of consolidations and leases among the street railway companies have been effected recently, so that all the lines of that city can now be divided into four systems controlled by the following companies: The Philadelphia Traction Company, the Electric Traction Company, the People's Traction Company and the Hestonville, Mantua & Fairmount Passenger Railway Company.

The construction now being carried on by each company is very interesting, and a general review of the work installed or under contemplation by each company will be found below.

THE PHILADELPHIA TRACTION COMPANY.

The Philadelphia Traction Company has progressed farther in the equipment of its system with electric power than any of the others. This company operates thirty-four miles of cable road in Philadelphia, and it is its horse lines which are now being equipped with electric power. The sub companies controlled by this company are: The Seventeenth & Nineteenth Streets Passenger Railway Company; the Thirteenth & Fifteenth Streets Passenger Railway Company; the Union Passenger Railway Company; the West Philadelphia Passenger Railway Company; the Philadelphia & Gray's Ferry Passenger Railroad Company; the Ridge Avenue Passenger Railway Company; the Empire Passenger Railway Company,



FIG. 1.—EXTERIOR OF 13TH STREET STATION—PHILADELPHIA TRACTION CO., PHILADELPHIA, PA.

the Schuylkill River Passenger Railway Company; the Continental Passenger Railway Company; the Catharine & Bainbridge Passenger Railway Company; the Philadelphia City Passenger Railway Company; the Philadelphia & Darby Railway Company, and the Twenty-second Street & Allegheny Avenue Passenger Railway Company.

The officers of the Philadelphia Traction Company are: President, P. A. B. Widener; first vice-president, W. L. Elkins; second vice-president, George D. Widener; treasurer, D. W. Dixon; general manager, J. T. Gorman. The chief engineer of the company is F. W. Darlington.

Power Stations:—This company has now in operation, or is about to install in the immediate future, three power stations, of 10,000, 7,500 and 3,000 H. P. ultimate capacity each, and located, respectively, at the corners of 13th Street and Mount Vernon Avenue, 33d Street and Market Street, and Southerland Avenue and Kansas Street. A view of the first mentioned station is given in Fig. 1. This station is of brick, with brownstone trimmings, and occupies an area of 171½ × 186 ft. At present about one-third of the equipment has been installed, and this is now employed in furnishing power for the Thirteenth & Fifteenth Streets line. On January 1, it was hoped that the Twelfth & Sixteenth Streets line would be in operation from this station.

The power house is composed of two buildings separated by a wall two feet in thickness, and is fireproof throughout. The arrangement of the boiler room is shown by the two diagrams (Figs. 2 and 3) which are, respectively, the cross and longitudinal sections of this portion of the station. The boiler equipment, when completed, will consist of twenty Babcock & Wilcox boilers of 375 H. P. each, arranged in two parallel rows, with a central passageway twenty feet three inches in width. As shown in the cross section, the coal for fuel is dumped, on the Andress Street side of the station, directly into vaults provided for the purpose. It is then carried by mechanical conveyors through an elevator shaft, provided for the purpose, to the top of the building whence it descends by chutes. The coal conveyors for hoisting the coal to the top of the building, are supplied by the Link Belt Company, and consist of 7 × 14 in. buckets located every eighteen inches on an endless chain. The ashes descend into ash tunnels, one located under each row of boilers, whence they are removed by a similar system of mechanical conveyors on the ash hopper, shown in Fig. 2, from which point they can be removed.

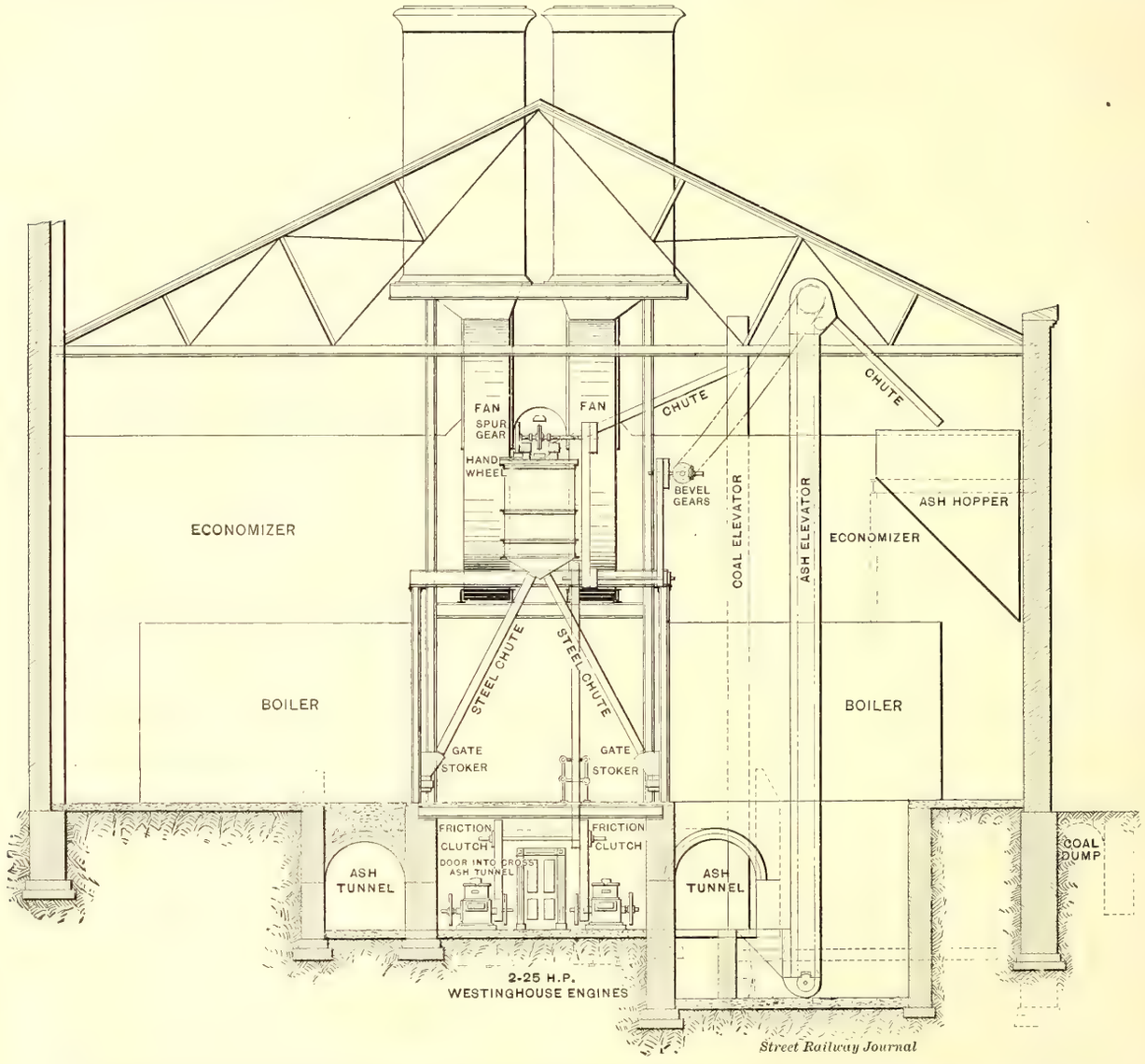


FIG. 2.—CROSS SECTION OF BOILER ROOM—13TH STREET POWER STATION OF PHILADELPHIA TRACTION CO.

Below the coal storage vaults, which are located under the boilers, as shown in Fig. 3, are two water tanks. These will contain the feedwater, which will be supplied by an artesian well, now being sunk for the purpose. Connection will also be made with the city mains for taking water from this source if necessary. The equipment of the boiler room also includes Chapman valves and Stratton separators. Four Goubert heaters of 2,000 H. P. each will be used.

An especially interesting feature of the plant is the forced mechanical draft system which was installed by Westinghouse, Church, Kerr & Co., and by means of which the necessity of the erection of large and costly stacks has been avoided. The system of forced draft in use here is the most extensive ever installed. The waste gases after leaving the boilers impart the greater part

of their heat to the feedwater by being passed through the economizers. These are of the Green type, manufactured by the Fuel Economizer Company, of Matteawan, N. Y., and are located in the center of the boiler room, on each side of the stack. Just beyond the economizers the smoke flues, which are two in number, contain two Sturtevant fans, one for each flue, which are driven by independent Westinghouse engines. These force the gases up the two iron stacks (see Fig. 2) which are ten feet six inches in diameter and only twenty-seven feet in height. The gases are so cooled during their passage through the economizers as not to burn the blades of the fan. The operation on so large a scale of the forced draft principle, as installed at this station, will be watched with interest by all steam users.

The engine room is well lighted and well ventilated, and measures 158 × 98 ft. An interior view of this room, with the four compound engines, which are at present in place, is given in Fig. 6. The engines were manufactured by the Westinghouse Machine Company, and furnished by Westinghouse, Church, Kerr & Company, and are of a rated horse power of 600 H. P. each. There is room provided for the installation of twenty of these engines before the capacity of the engine room is reached. The cylinder dimensions of these engines are 23 and 40 × 20 ins., and each is direct connected to a No. 6 Westinghouse M. P. generator, having an output of 746 amperes at 500 volts. The equipment of the engine room also includes a Sellers hand crane.

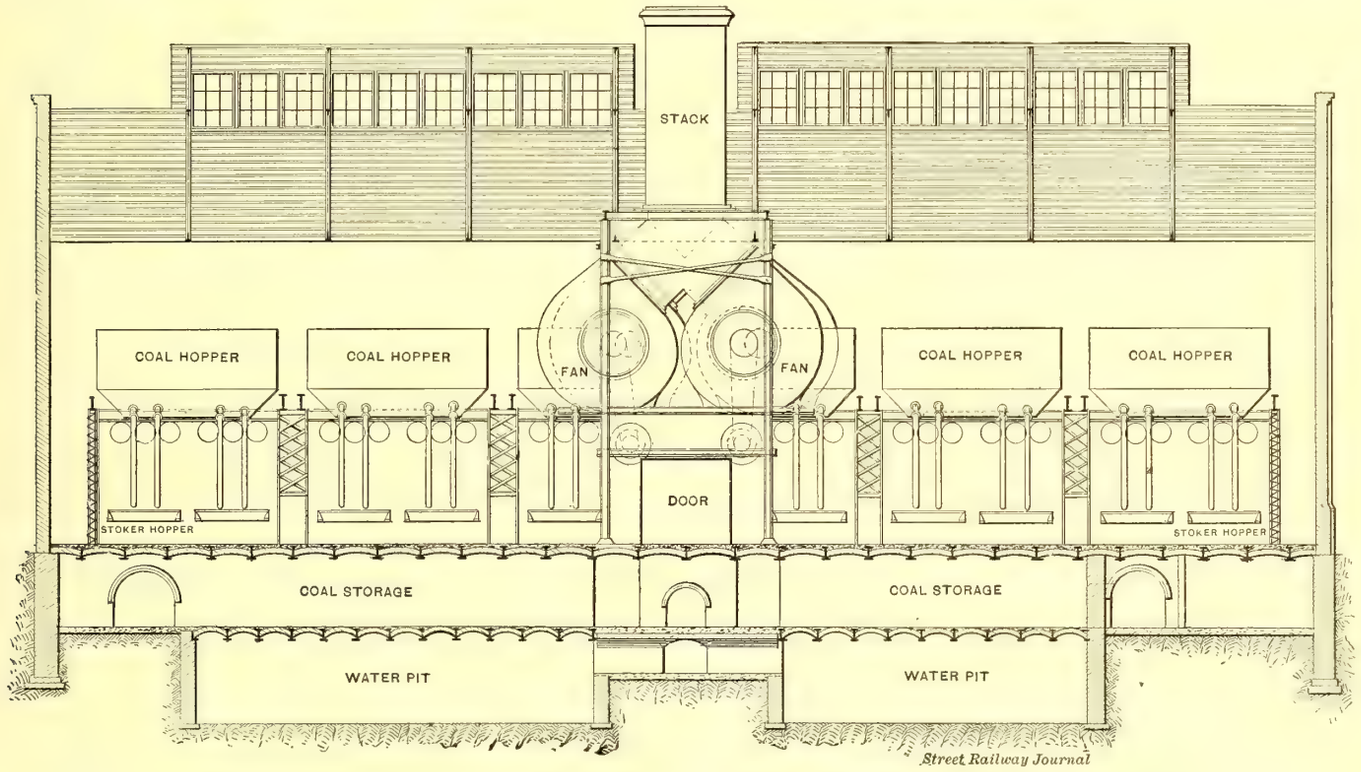


FIG 3.—LONGITUDINAL SECTION OF BOILER ROOM—13TH STREET STATION OF PHILADELPHIA TRACTION CO.

This crane has a span of ninety-nine feet one inch from center to center of the carrying wheels, and is fully capable for a load of ten tons. The bridge consists of two plate girders, each five feet six inches deep, and of equal depth throughout their length. They are connected together at the top by heavy horizontal and diagonal cross braces and by plates at the ends, thus forming a compound girder of great lateral stiffness in proportion to its weight. On the inner side of each girder, near the bottom, is placed a T rail, upon which the trolley wheels run, these rails being carried on shelf angles forming a portion of the lower flange of the girders. The eccentric load is met by diagonal struts on the outside, connecting the lower flange of the girders with the cross braces on top. The hoisting trolley runs upon these rails entirely within the bridge, and the whole arrangement insures freedom from vibration, and prevents any danger from the racking of the girders at the point of attachment to the end trucks, consequently it is extremely well adapted for such a long span.

The bridge is provided with steel tired wheels twenty-eight and a half inches in diameter, double flanged, operated by gearing at each end of the bridge, the two trains being joined by a squaring shaft to insure simultaneous action. Hand chains and sprocket wheels are provided at each end of the bridge for the bridge travel.

The trolley is operated by a hand chain operating a pinion gearing into two spur wheels attached to the truck wheels. The trolley is provided with a swivel clevis and a ten ton hoisting block, and the load is automatically sustained at all points by the patent retaining device of the makers of the crane. The length of the runway is about 145 ft.

A crane similar in arrangement, and of the same capacity, but for a span of eighty feet from center to center of the carrying wheels, was built by the same makers for the power house of the Philadelphia Traction Company, at 33d and Market Streets, Philadelphia. Both cranes work very satisfactorily.

At the southwestern end of the building is a handsome double decked switchboard. This, when completed, will be in the form of an L whose sides measure sixty-five and thirty-three feet, giving a total length of ninety-eight feet of board on each deck. The portion of the board already in place is shown in Fig. 5. The board has an iron framework, and the instruments are mounted on slate. The equipment includes Weston and Westinghouse appliances, lightning arresters, meters and other switchboard appliances. The switches used are of the Hill type. The upper deck of the switchboard, which is devoted entirely to the feeder connections, is set sufficiently back of the lower deck to afford a commodious passageway, or platform, in front of the appliances. The edge of this is protected by a handsome brass railing, giving a very handsome appearance to the board. The lower part of the board is devoted to both feeder and generator connections. The panel system has been adopted, and each panel contains the connection for two feeders or one generator. The board is some distance from the wall of the station, making all connections most easy of access.

South of the engine room are located the engineers' offices, men's reading room, store room and the electrical

testing room. The latter, a view of which is given in Fig. 4, has been constructed with a care unusual in railway power station construction, and forms a very interesting feature of the plant. The system of feeders in use necessitated the having of facilities for making careful electrical tests of insulation resistance, etc., and all the apparatus necessary for use is contained in the testing room. In the center is a table, 10 × 4 ft., for supporting the instruments. This table consists of a single slab of stone mounted on a solid brick pier carried down to solid rock and entirely disconnected from any of the walls of the power station building. In this way any of the vibrations of the building from the operation of the machinery will not be communicated to the supports of the instruments. The room is also protected from all external magnetic induction by being completely lined with corrugated iron. The instruments in use include all those necessary for careful insulation tests, including latest types of bridges, galvanometers, etc., all of which were supplied by Queen & Company, of Philadelphia.

The Line.—The feeder system adopted throughout all the lines in Philadelphia, except on the outskirts of the city, is underground, and a good idea of the immensity of the system can be appreciated when it is stated that the Thirteenth & Fifteenth Streets line alone, forming a small part of the entire system, required about 70,000 ft. of cable The cables adopted by the Philadelphia Traction Company were manufactured by the Standard Underground Cable Company, of Pittsburgh, Pa., and run in size from 211,600 to 850,000 circular mills. The center of the cable is of stranded lake copper. This is surrounded by an insulating material saturated with Ozite, this in turn being surrounded by a layer of lead. Outside is a fibrous jacket saturated with the Standard Underground Cable Company's anti-corrosive compound, as a protection against chemical action and mechanical injury. The insulation resistance maintained is 1,500 megohms per mile.

The cables have all been placed in conduits, principally of the National type, manufactured by the National Conduit Manufacturing Company, of New York, and consisting of cement lined, wrought iron tubes. On part of the underground feeder system, the Wickoff wooden tubes, made at Williamsport, Pa., are employed, instead of the National conduit. Junction boxes are located on an average of every 1,600 ft., and at such points the feeders are connected to the trolley wire. Manholes are placed at suitable distances to enable careful and efficient handling of the wires, and are equipped with cast iron covers and watertight plates. The conduits also contain a bare copper conductor for the return. This is for the most part of 1,000,000 circular mills.

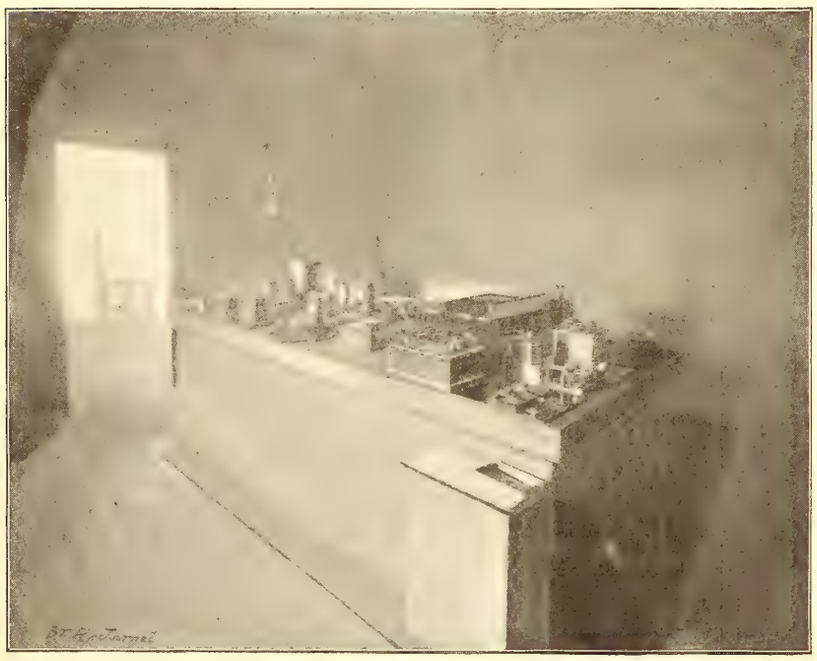


FIG. 4.—TESTING ROOM—13TH STREET POWER STATION OF PHILADELPHIA TRACTION CO.

The trolley wire, which was supplied by J. A. Roebling's Sons Company, of Trenton, N. J., is No. 0, B & S hard drawn copper. This is supported by a No. 3 B & S silicon bronze wire. Both the guard wires and the trolley wires are anchored with diamond guys every 1,000 ft., and the guard wires in addition to this are put up in insulated sections of 2,500 ft. All of the line appliances are of the H. W. Johns Company's type.

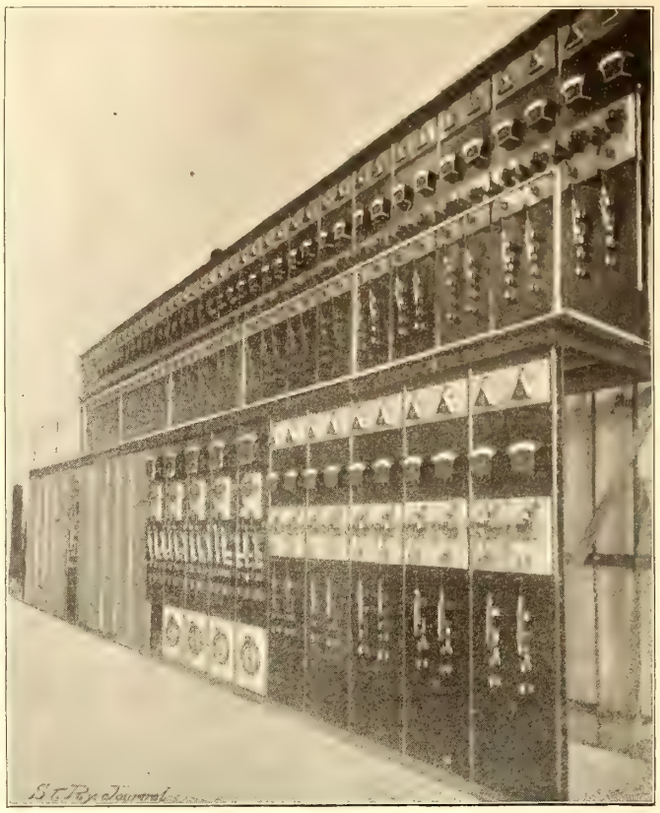


FIG. 5.—SWITCHBOARD—13TH STREET POWER STATION OF PHILADELPHIA TRACTION CO.

The poles are supplied by Morris, Tasker & Company. Almost every maker in the country submitted designs, but before a decision was arrived at a test was made of some of the leading makes. After this, without exception, the contracts were awarded to Morris, Tasker & Company, of Philadelphia. Some cases there were in which the contract was placed with them without the formality of asking bids from other manufacturers. From New Castle, Del., where its plant, with a daily capacity of 240 poles, is located, this firm has, within the past seven months, delivered upwards of 10,000 poles to Philadelphia and vicinity, while present prospects indicate a still larger demand for 1894.

The type of pole adopted for most of the work in Philadelphia is Morris, Tasker & Company's "Philadelphia Standard," 28½ ft. long, made up of three sections of 7, 6, and 5 in., extra heavy pipe. This pole has stood successfully the severest tests and it has been practically demonstrated that it will stand without measurable permanent deflection a continued strain of 2,300 lbs. on the span wire. In its construction the makers use the swedged telescopic joint.

The poles in Philadelphia, as a rule, have been set in a hole six and a half feet deep by twenty-two inches in diameter, the hole being filled in with a concrete of broken stone and cement. This combination of heavy pole and deep setting gives a staunchness and stability amply suf-

ficient to meet the most trying contingencies. No strain has yet developed any weakness or suggestion of inefficiency in either the pole or the setting. Many of the poles had to be set in deep subcellars, and other unlooked for complications were continually cropping up. For all these varying conditions special poles had to be made to surmount the difficulties presented. An innovation on what has been regarded as a precedent is the doing away with the familiar insulating cap at the pole top. The iron "petticoat casting" and wooden insulating plug, have been abandoned, and a wrought iron collar now supports the span wire with the insulation made in three places on the span wire.

The return circuit is made by connecting the ends of the rails with a No. o, soft drawn, tinned copper wire. This is laced back and forth one and one-half times so as to present three times the conductivity of a single No. o wire. It is held in place in the rail by bonding chucks. The return is also supplemented by connecting the rails at intervals with the underground return consisting of bare copper wire already mentioned as being carried in the feeder conduits. To still further improve the return circuit, galvanized iron rods are driven down into the ground at every manhole, and connected with the return feeder already mentioned. In the suburban districts, where the underground feeders are not used, an ordinary supplementary wire is employed.

The contractors for the outside electrical construction were: For laying the conduit, the manufacturers of the conduit; for driving the galvanized iron rods, bonding and overhead system, Pepper & Register, of Philadelphia; for all lines except the Twelfth & Sixteenth, Thirteenth & Fifteenth, Morris & Tasker and Gray's Ferry lines and the Long Lane extension. The greater part of the work on these lines was performed by Stern & Silverman, of Philadelphia, some of the work being done by the Field Engineering Company of New York. The mileage built by

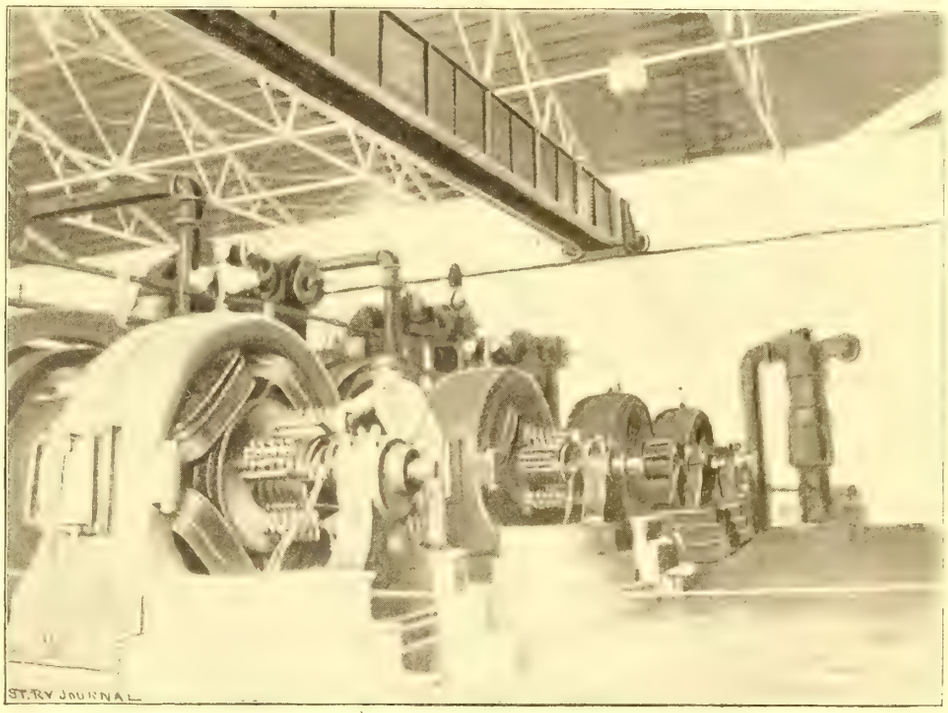


FIG. 6.—GENERATORS—13TH STREET STATION OF PHILADELPHIA TRACTION CO., PHILADELPHIA.

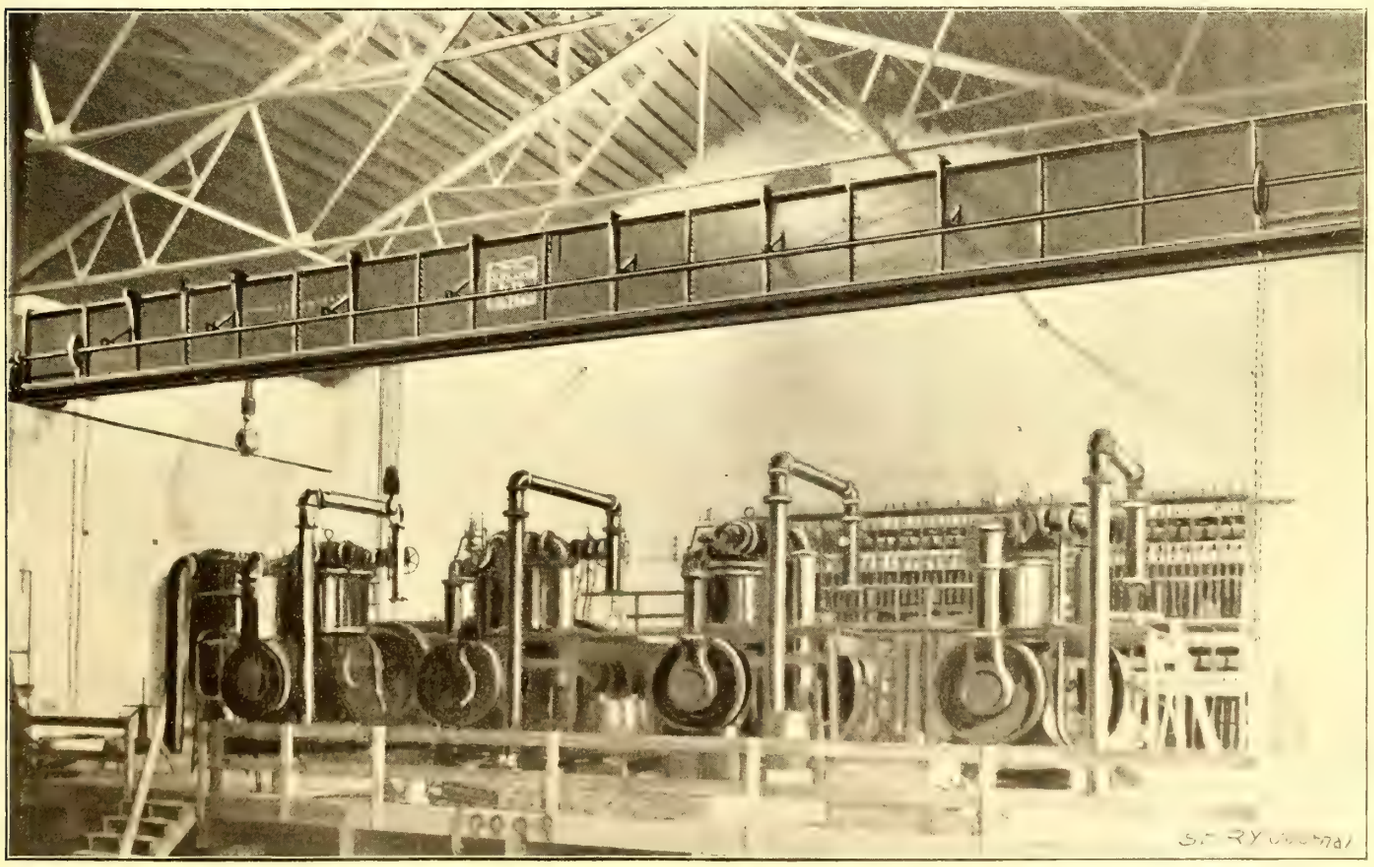


FIG. 7.—VIEW OF PART OF ENGINE ROOM—STATION OF PHILADELPHIA TRACTION CO., PHILADELPHIA.

Pepper & Register has been, up to date, about fifty miles, including the location and setting of about 4,000 poles, leaving nearly 100 miles yet to construct.

Fig. 8 gives a view of the feeder vaults at the 13th Street and Mount Vernon Avenue Station. All conduits lead to this vault which is fourteen feet high and quite commodious, occupying an L under the corner of the building at 13th Street and Mount Vernon Avenue. Junction boxes are placed in these vaults at the terminus of each conduit, and from these the cables are led directly to the switchboard.

Track.—The track construction adopted by the Traction Company is most substantial. The rail laid is a 90 lb., 9 inch girder with Philadelphia head, and was supplied by the following three manufacturers: Wm. Wharton, Jr., & Company, the Johnson Company, of Johnstown, Pa., and the Pennsylvania Steel Company, of Steelton, Pa. A section of the track at a tie rod is given in Fig. 11, and a section of the rail in Fig. 10. The ties are spaced three feet between centers, and on each tie are steel tie plates, 6 × 10 × ⅜ ins., with three 5 × ½ ins. hookhead spikes to each plate at each tie. The joints are standard eight bolt joints, twenty-six inches long, with eight seven-eighths of an inch bolts and nuts and lock washers; tie rods are used, measuring 1½ × ⅜ ins., three-quarters of an inch round ends, and spaced every six feet. Under the ties, at each joint, is a longitudinal tie which takes in the joint tie and one on either side of it. This method of construction was installed last year on the Catharine & Bainbridge Streets line of the Philadelphia Traction Company, and has been most successful in preventing the rolling of the joint tie. Every joint on that road is to-day in as good shape as it was originally.

All the special work, except the steam railroad crossings, is of the Wharton patented "Integral" style, and in many places where switches were used for emergencies, the unbroken main line switch of the same manufacturers was used. The car house of the Fifteenth & Sixteenth Streets line, at Cumberland Street, contains over a mile of track alone, which is connected with the straight tracks by curves made of Wharton grooved, No. 6, eighty-six pound rail. All curves on the line are made of this rail. A piece of an interesting piece of special work is shown in Fig. 9.

Other Power Stations.—As has already been mentioned, the plans of the Philadelphia Traction Company include the erection of three stations altogether, the other two being at the corner of 33d and Market Streets and Southerland and Camden Streets, respectively. The plans for the former, which is to be of 7,500 H. P. capacity, have not yet been fully decided upon. The latter has now a capacity of 750 H. P., has been in operation for some time, and was described in our issue for November, 1892.



FIG. 9.—PIECE OF SPECIAL WORK—PHILADELPHIA TRACTION CO.

This station was installed by the Field Engineering Company, of New York. The engines are three in number, of 250 H. P. each, and were furnished by Robert Wetherill & Company, of Chester, Pa. They are of the horizontal Corliss type, and are belted each directly to three four pole Westinghouse railway generators which run at 525 revolutions per minute. The engine cylinders are twenty-two inches in diameter by forty-eight inches stroke.

The boiler equipment consists of six horizontal, return tubular boilers which are seventy-two inches in diameter and twenty feet long, and were supplied by Robert Wetherill & Company who were also the manufacturers of the feedwater heater which is of the water tube type. Monitor injectors, Snow duplex feed pumps, and Chapman valves are used. Arrangements have been made for increasing the capacity of the plant to 3,000 H. P., when necessary, without material change in the arrangement of the machinery, building, etc.



FIG. 8.—VIEW OF FEEDER VAULTS—13TH STREET STATION OF PHILADELPHIA TRACTION CO.

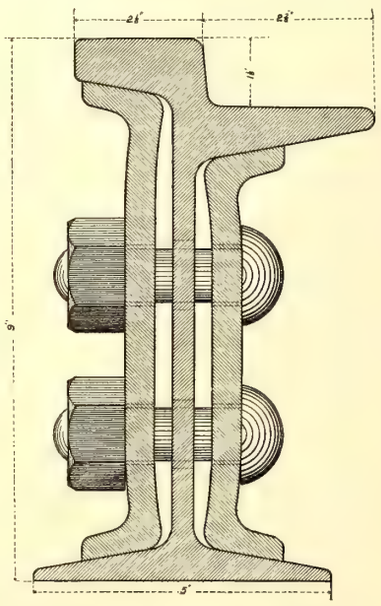


FIG. 10.—PHILADELPHIA NINE INCH RAIL.

Rolling Stock.—The Philadelphia Traction Company, some time ago, placed orders for cars with the Laclede Car Company, of St. Louis, and the J. G. Brill Company, of Philadelphia, for cars. The Laclede Company's order was for 300 cars, which will be used largely on the most recently equipped lines of the company. These cars (see Fig. 12) are eighteen feet inside and eighteen feet seven inches over corner posts, and twenty-six feet seven inches over platforms; they are equipped with auto-

matic double doors similar to those in use on the Broadway cable line of New York City, also built by the same company.

The interior of these cars presents a very handsome appearance, being finished throughout in natural cherry highly polished. The seats and backs are upholstered with curled hair and covered with crimson plush. The ceilings are of birdseye maple veneer very beautifully decorated. These, instead of being nailed in place, are secured by screws, with cherry mouldings secured in the same manner, thus facilitating their removal. The cars have six large windows on each side, are equipped with roomy platforms, and have two folding gates of the latest type on each platform, with standards running from the platforms to the hoods. The general design of the cars is graceful in outline, close attention having been paid to make all lines conform so as to produce a light and, at the same time, substantial appearance.

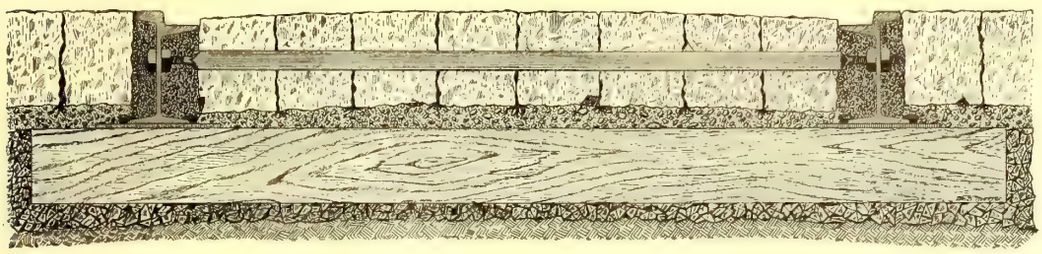


FIG. 11.—SECTION OF TRACK—PHILADELPHIA TRACTION CO.

The open cars are twenty feet four inches long over corner posts, and twenty-eight feet four inches over platforms. The seats run longitudinally through the center of the car, with an aisle on each side. There are four doors, one at each corner. The inside finish is of natural cherry, with birdseye maple ceilings. The design is similar to the open cars built for the Duquesne Traction Company, of Pittsburgh. These cars will all be equipped with the Crawford fender. St. Louis registers are used.

The trolley poles used on these cars were supplied by the R. D. Nuttall Company, of Allegheny, Pa., and are similar to the well known type manufactured by this company, though possessing a number of novel features necessary for the peculiar conditions to be met. The poles are rolled steel tubes, butt welded and tapered from a point about two-thirds above their base. They are perfectly smooth, and as they are rolled while cold, they are very stiff and their temper is uniform.

At one point of the line where the tracks run under a bridge, the trolley wire changes in height above the rails from twelve feet six inches to twenty-two feet within a length of eight feet, requiring the use of a pole tension which would respond to these abrupt changes, and yet not be excessive at any point. The base, which is of a special type, utilizes the well known Nuttall principle of compression springs with hinged poles and swiveling features similar to those of the standard Nuttall base. The standard is particularly novel and designed with reservoirs of oil, so as to avoid all possibility of oil and grease getting on the car roof. Tests with these poles, it is said, have shown a uniform upward pressure at all positions of the pole, from horizontal to practically perpendicular.

The Bemis truck used under these cars is of the type designed for service under twelve and twenty foot box cars and long open cars. It has few parts, is light, strong and durable, and carries the car without undue end motion. It is equipped with a noiseless, powerful and quick acting brake, which is easily adjusted.

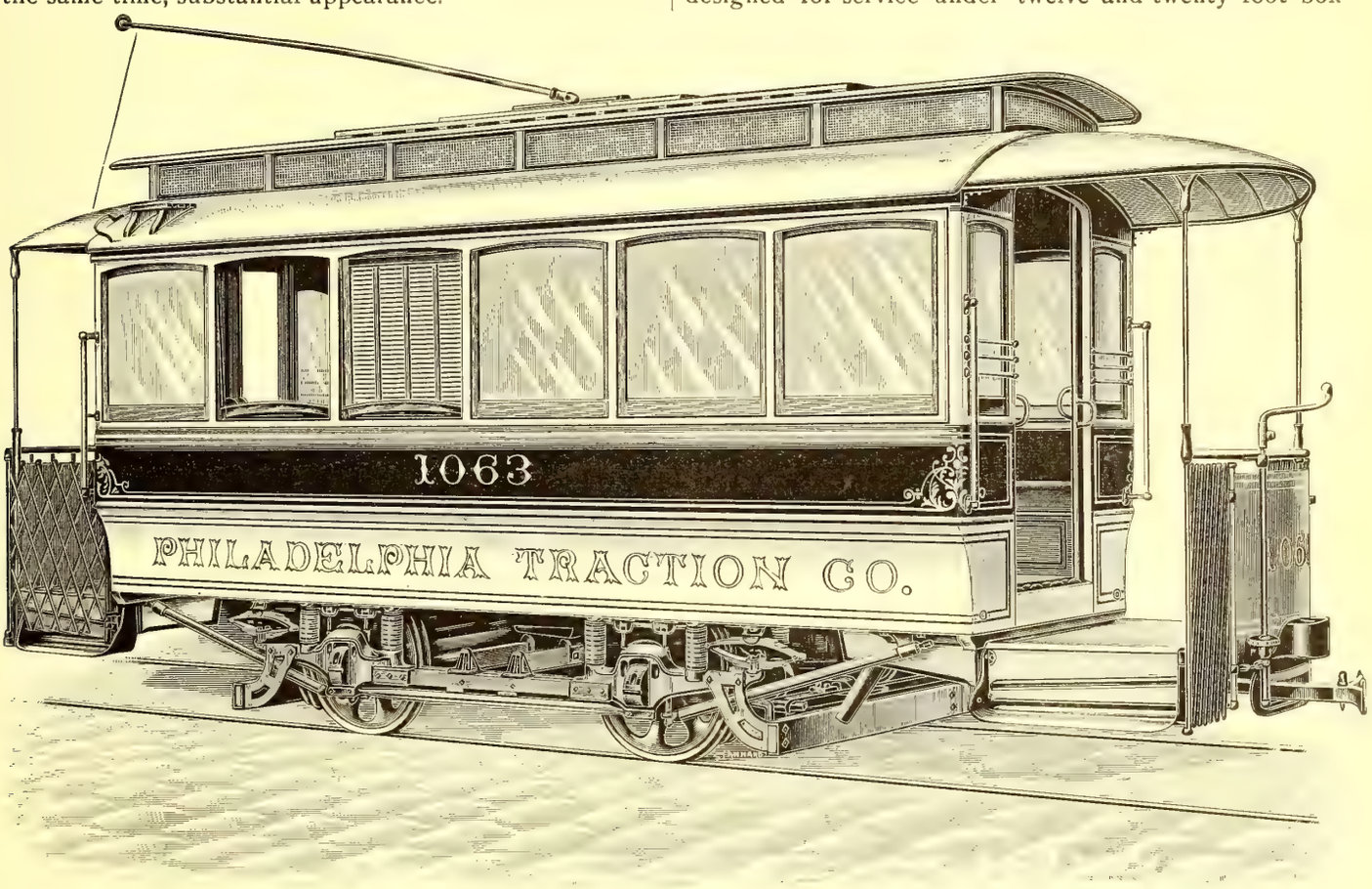


FIG. 12.—PHILADELPHIA TRACTION CO.'S CAR—LACLEDE CAR CO.

A view of the type of car furnished by the J. G. Brill Company, for the Catherine & Bainbridge Streets line is given in Fig. 13. These cars, which are very handsome, are sixteen feet long in body and six feet six inches at sill, and are finished on the inside with burl ash panels and decorated veneer ceilings. The seats are upholstered

with plush covered cushions, and the cars are mounted on Brill No. 21 independent, rigid motor trucks with six foot six inch wheel base, and thirty-three inch wheels. The platforms measure four feet from end panels to crown rails. The Brill gate and Brill patented ratchet brake handles are portions of the equipment. The cars, which the Brill company is now under contract with the Philadelphia Traction Company to deliver, are identically the same as the above, except that the length of the body will be eighteen feet.

Motors.—The electrical equipment for all of the cars was furnished by the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa. Each car is fitted with two Westinghouse single reduction motors, together with the controlling stands, switches, lighting arrester, fuse box, incandescent lamps and other parts which go to make up a complete equipment. The Westinghouse single reduction motor is so well known that an extended description of it is unnecessary. It may be said, however, that its reputation for reliability, strength and efficiency had an important bearing upon its selection by the Philadelphia Traction Company. An important feature of the Westinghouse motor, it will be remembered, is the manner in which the field is constructed in two halves, which are hinged to a frame. This arrangement secures the greatest accessibility, while the frame holds the armature shaft and the axle parallel, thereby assuring always an even meshing of the gears. The armature of the motor is of the drum type, and the winding of the armature is in the shape of lathe wound coils, each of which is wound and heavily insulated before being placed in the grooves in the core.



FIG. 13.—PHILADELPHIA TRACTION CO.'S CAR—J. G. BRILL CO.

Paving.—In connection with its work of track laying, the Traction Company has done an immense amount of street paving, the performance of this work being part of the conditions under which its franchise was awarded. 12th, 13th, 15th and 16th Streets have been laid with asphalt from Cumberland to Spring Garden Streets; from Spring Garden to South Belgian blocks have been used, and from there down asphalt; Chestnut and Walnut Streets are practically finished as far as Broad Street, asphalt being adopted for these streets as far as 5th, and Belgian blocks from that point to the river. Ridge Avenue has been paved for almost its entire length with block, making, with other streets paved, a total of between forty and fifty miles of paving as the record for the year.

PEOPLE'S TRACTION COMPANY.

The People's Traction Company is a corporation recently formed, with J. Lowber Welch, president; C. Kruger, secretary and treasurer, and L. H. McIntire, chief engineer. This company controls, by ownership of stock, the People's Passenger Railway Company, with the following officers: President, H. C. Moore; secretary and treasurer, David C. Golden; general superintendent, J. C. Lugar. The Germantown Passenger Railway Company and the Green & Coates Railway Company are leased to the People's Passenger Railway Company.

The People's Traction Company, like the Philadelphia Traction Company, is now engaged in the installation of an extensive electric system. Its power station, which is a handsome brick structure, is now approaching completion, though all the equipment of engines, dynamos, etc., yet remains to be installed. It is located between Delaware Avenue and Beach Street near Fairmount Avenue, and its dimensions are 80 × 150 ft. It is two stories in height, the boilers being located on the second floor.

The arrangements for the receipt of fuel, etc., are very complete. The coal will be taken from directly across the street, where it is received from the railroad tracks, and will be transported direct from the cars by mechanical conveyors. It will be delivered by the conveyors into pockets close to the roof, whence the automatic stokers will receive their supply. The boilers are of the Babcock & Wilcox type, and are twelve in number.

The engine equipment will consist of three Reynolds-Corliss engines of 200 H. P. each. These are of the twin tandem compound condensing type, and will drive each a 2,000 H. P. General Electric generator located between the pairs of cylinders, and whose armature is mounted directly on the engine shaft. The condenser is one of Engineer McIntire's own design, and will be driven by an independent Corliss engine. The iron work of the station was supplied and put in place by the Phœnix Iron Works Company, of Meadville, Pa. The station will have two brick stacks, each 150 ft. in height.

The company intends the immediate equipment of fifty miles of track with electric power, one-half of which will probably be completed next spring, when the start with electric power will be made. The electric rolling stock will consist of 400 cars, the orders for which had not been placed by December 20.

The first lines to be put in operation will be the 4th and 8th Streets division, the Germantown division and the Girard Avenue division.

Track construction is going on rapidly, and on the Girard Avenue line especially a great deal of activity is being shown. The rail selected is a ninety-three pound, nine inch Johnson girder rail. This is being laid on 5 × 9 in. yellow pine ties located fifteen to every thirty feet of rail. Tie rods are used about every seven and a half feet, and the rails are being bonded with the well known Benedict & Burnham type of bonds. The contractor for the track laying is Charles A. Porter, of Philadelphia.

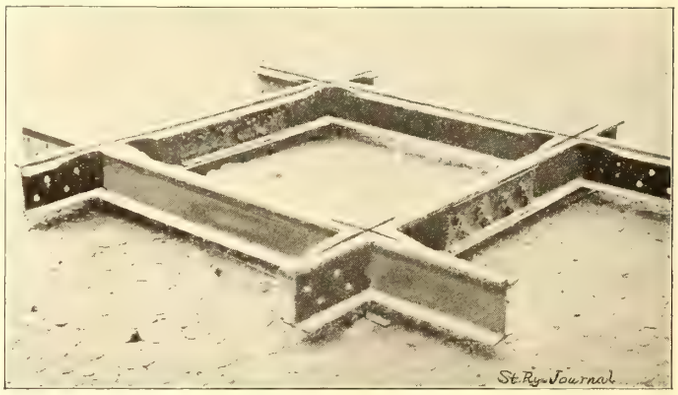


FIG. 14.—CAST STEEL CROSSING—ELECTRIC TRACTION CO., PHILADELPHIA.

In the overhead system Morris & Tasker and Walworth tubular poles are being used, and the company is doing its own work in overhead equipment. The feeder system will all be underground, as in the case of the

Philadelphia Traction Company, the feeders being laid in terra cotta ducts lined with cement.

THE ELECTRIC TRACTION COMPANY.

The Electric Traction Company is a corporation recently formed, with the following officers: President, Jeremiah J. Sullivan; vice-president George S. Gandy; secretary Frank Weckerley; treasurer, R. C. Brewster; superintendent, W. N. Janney; electrical engineer, Edward B. Ives. The main office of the company is at 425 Chestnut Street, and the engineer's office is at 11th and Colona Streets. The company also has depots at the latter place and at 2501 Kensington Avenue. It controls the Frankford & Southwark Railway Company, the Philadelphia City Passenger Railway Company, the Citizens' Passenger Railway Company, the Lombard & South Streets Passenger Railway Company, the Lehigh Avenue Passenger Railway Company, and the Second & Third Streets Passenger Railway Company. It also has a controlling interest in the Broad Street omnibus line. Like the other Philadelphia traction companies, it is busily engaged in electric railway construction.

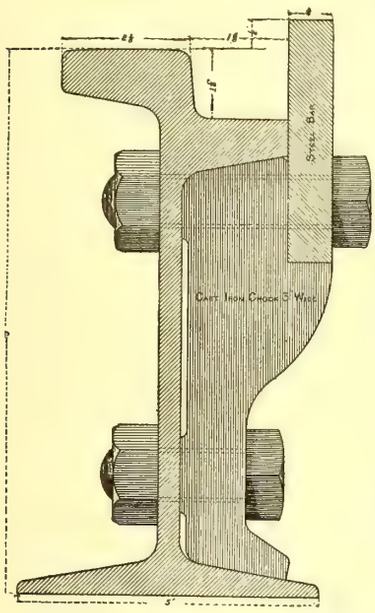


FIG. 15.—CURVE RAIL—ELECTRIC TRACTION CO., PHILADELPHIA.

Power Station. — The company is building a power station on Hutchinson Street near the corner of Oxford Street. This station is next to the tracks of the Philadelphia & Reading Railroad, so that fuel can be taken directly from the railroad cars without city transportation. The company will probably erect, later, a power station of 10,000 H. P. on the river, but the plans for this have not yet been drawn up. The walls of the station at present under construction are now only at a level with the street, and cars will not be run until next spring. The first equipment of the station under construction will consist of one McIntosh & Seymour tandem compound engine with cylinder dimensions 16½ and 36 × 17 ins. stroke, and two Porter-Allen engines, manufactured by the Southwark Foundry & Machine Company. with cylinder dimensions 14½ and 24 × 24 ins. stroke. Each of these will drive directly a 250 K. W. General Electric generator, the armature shaft of the latter being coupled direct to the engine shaft. The engines will run non-condensing. The boiler equipment will consist of four Babcock & Wilcox boilers of 250 H. P. each, set in two batteries of two each. The piping is so arranged that each engine can be run independently, and each can be cut out of connection with both live and exhaust piping systems. The waste gases from the boilers will be carried through two economizers, by means of mechanical exhaust draft, without being delivered to the stack which will be seventy-five feet in height. The station will be fully equipped with feedwater heaters, etc. The water supply will be from an artesian well.

The station is very compact, having a frontage on Hutchinson Street of sixty-seven feet three and a half inches, and being ninety feet deep. The engine room will occupy a depth of forty-five feet, and the boiler room of the same. It will be of plain brick, with no attempt at ornamentation, and will be absolutely fireproof. The fuel will be dumped from the cars directly in front of the boilers, the cars for this purpose being run on a trestle extending parallel with the boilers, and discharging the fuel into a vault which will have a capacity of one week's supply of fuel. The station is so designed that its capacity can be doubled, with very little additional expense, with increase of traffic.

Line.—The line construction of the road differs materially from that adopted by other companies in Philadelphia. Span wire construction will not be used, bracket poles being employed throughout the work. These, instead of being located on the same side of the street, as is usually done, will be set alternately on opposite sides of the street. The claims of advantage made for this construction are that, in the first place, a more symmetrical appearance is secured, and, in the second place, that in case of breakage of the trolley wire the tension will not fold all the brackets of a section to the destruction of the line. The company will use a No. 00 trolley wire. The size adopted by the other Philadelphia companies is the No. 0.

The method of bonding and the provision made for the return circuit differs also in several respects from that employed by the other companies. A bare copper No. 00 wire is used for electrically connecting the rails. This is laced in and out of the adjoining ends outside of the angle bars three times, as in the Philadelphia Traction Company's track, so that the carrying capacity of the bonds at each joint is three times that of a single, No. 00 wire and is equal to that of the rail. This wire is connected to the rails by a special bonding chuck of Stern & Silverman, of Philadelphia, shown in Fig. 16. This chuck, as will be seen from the engraving, is so arranged that it can be screwed into the rail, making a close electrical contact of bright surfaces. One end of the chuck, which is bored to fit the bond wire, is tapered and slotted. The action of screwing up the nut, then, is to bind the surfaces closely together, making good electrical contact. After the bonds are in place they are coated with P. & B. compound.

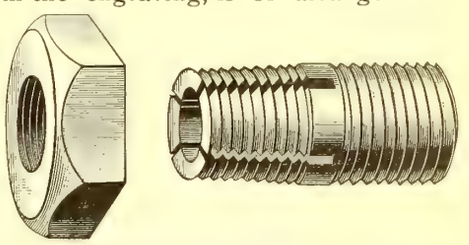


FIG. 16.—BONDING CHUCK—ELECTRIC TRACTION CO., PHILADELPHIA.

The underground system of feeders in use on the other roads is also employed by the Electric Traction Company, the ducts being of the McDonald and Wyckoff types. The return feeder is connected to the rails at every manhole. The company is making its outgoing circuit of the same resistance as its return circuit, but is not making its largest feeders of greater millage than 650,000. The cables and feed wires were supplied by the J. A. Roebling's Sons Company, and the poles and brackets, which are of wrought iron pipe. by Morris, Tasker & Company, of Philadelphia.

Track.—The track laid by the company includes the use of a ninety pound girder rail of the Pennsylvania Steel Company laid in a similar manner to that of the other companies.

Fig. 14 shows a square crossing of open hearth, cast steel, made in but two pieces, used largely by the Electric Traction Company. This type of crossing was exhibited at the Milwaukee Convention by its makers, the Pennsylvania Steel Company. A section of the nine-inch guard rail made by the same company, and used on the Electric Traction Company's lines, is given in Fig. 15. As will be seen, a three-quarter inch steel bar resting on a three inch cast iron chock, is bolted to the inside of the rail. This construction enables the company to connect the guard rails directly to the straight track without the use of compromise joints. The steel bar used as a guard can, of course, be readily renewed, when worn out, at slight cost.

During the process of track construction the railway company has repaved all the streets occupied by its rails, the same condition for the use of the streets existing in the case of all the companies. The charters of the companies, however, are perpetual, so that it can be seen that they can afford to do this work, which with a limited franchise might not be possible. Within a year's time

Philadelphia will probably be one of the best paved cities in the country.

The track construction on the Tenth & Eleventh Streets line is almost completed and that on the Lehigh Avenue line is almost as far along. The company will require forty cars for the operation of the first mentioned line, and probably fifty for the latter, but the contracts for the cars and for the motor equipment had not been given out at the time of writing.

THE HESTONVILLE, MANTUA & FAIRMOUNT PASSENGER RAILROAD COMPANY.

The work of electrical equipment on the lines of the Hestonville, Mantua & Fairmount Passenger Railroad Company is not so far along as that of the other companies, but is progressing rapidly under the supervision of Chief Engineer A. Langstaff Johnston. The officers of the Hestonville, Mantua & Fairmount Passenger Railroad Company are: President, J. Hopkins; vice-president, I. Blum; secretary and treasurer, W. B. Benson. The office of the company is at 4,300 Lancaster Avenue, and it operates twenty miles of track.

Station.—The plans and specifications for the new power house are being completed, and contracts will be awarded and work will be commenced in the early part of 1894. The power house will be a handsome brick and stone structure, and will be located on the Schuylkill River, at the corner of Callowhill and 26th Streets. Water for condensing purposes will be taken from the river, and fuel will be conveyed directly to the station in boats.

The station equipment will probably consist of four 500 H. P., compound, condensing engines belted directly to the generators.

Line.—The track construction adopted is practically the same as that already described in the case of the other companies, consisting of nine inch, ninety pound girder rails laid on 5 × 7 in. sawed ties placed three feet between centers. The rails will be connected by fishplates with eight seven inch bolts. All feed wires will be run through conduits.

The line, though small compared with the other lines in Philadelphia, is well arranged for operation by electricity, and serves a well populated territory.

It is said the street railway systems at Bridgeport will soon be purchased by a New Haven syndicate.

Power Station of the Lynn & Boston Railroad Company, at Salem, Mass.

The accompanying illustrations represent the new power station of the Lynn & Boston Railroad Company, at Salem, Mass., and which has recently been put into service with marked success. This is one of three stations belonging to the above road, and together with the other two, supplies power to 130 miles of line. The stations will have a capacity, when fully equipped, of about 10,000 H. P. The power house was designed by and constructed under the direction of J. H. Bickford, consulting and constructing engineer, of Salem, Mass., and is laid out for an ultimate capacity of 3,000 H. P., of compound, condensing engines. At present there are 400 H. P. engines installed and running.

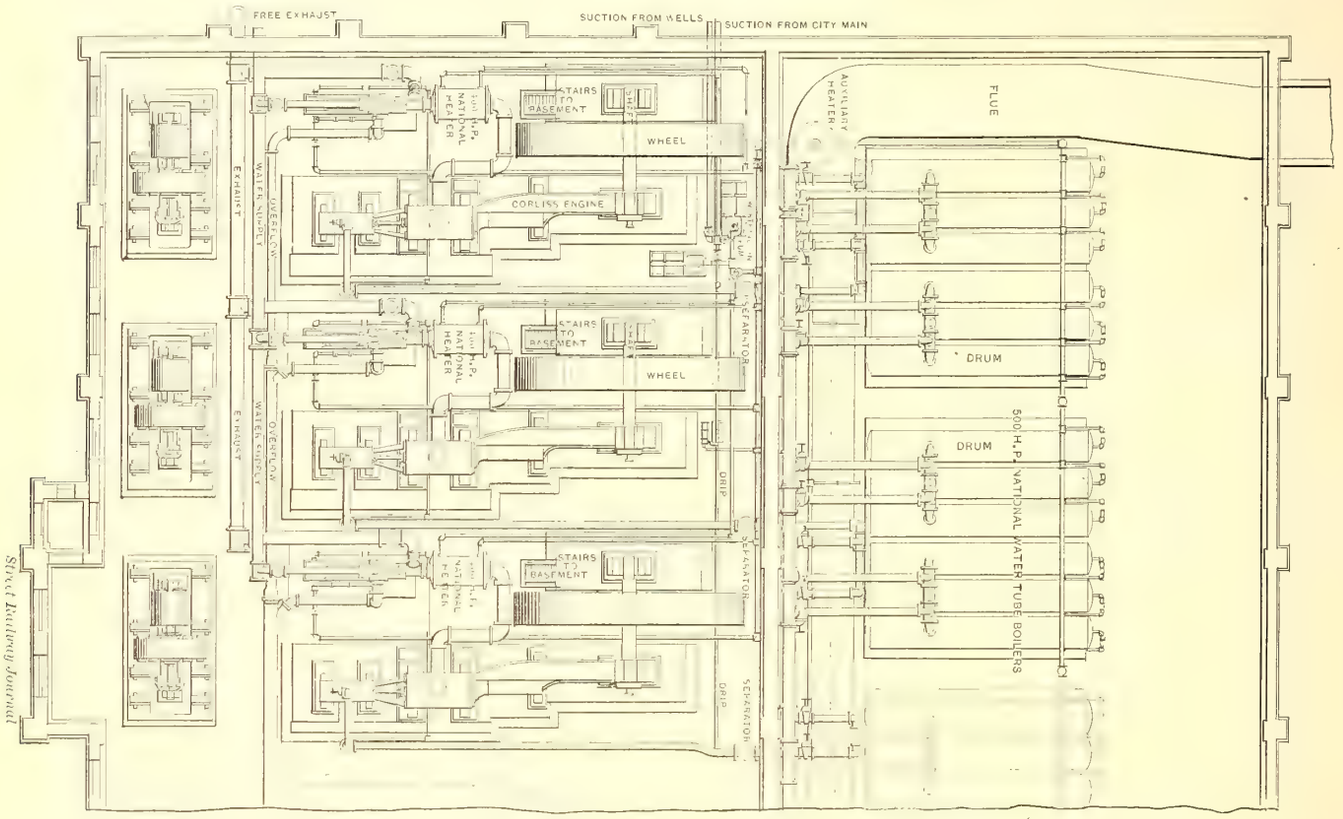


FIG. 1.—PLAN OF COMPLETED PORTION OF SALEM STATION—LYNN & BOSTON RAILROAD CO.

The engines are the Hamilton-Corliss, made by the Hooven, Owens & Rentschler Company, of Hamilton, O. Each engine is belted direct to an M. P. 300 General Electric generator, which makes 400 revolutions per minute, while the engines run at seventy-two revolutions per minute. The flywheels are twenty-two feet in diameter, giving a belt speed of about 5,000 ft. per minute. Each engine has an independent Deane jet condenser, and is so arranged that the loss of vacuum on one engine does not disturb in the least the others, although all of the condensers take water from one suction pipe. The water for condensing as well as for boilers, is taken from driven wells on the premises. The belts were supplied by Chas. A. Schieren & Co., of New York.

The boiler room has at present 1,000 H. P. of water tube boilers, made by the National Water Tube Boiler Company, of New Brunswick, N. J., while space is left for 1,000 H. P. more to be added as needed. National feedwater heaters, Stratton seperators and Worthington pumps are used.

Everything about the station is so arranged that there is very little chance of a shutdown by accident. The steam piping is duplicated throughout, as well as the feedwater piping. There are two sources for water supply as well. In fact, the station can be divided into two separate plants and run simultaneously. Under the engine room is a basement about eight feet in the clear, where are located the condensers, heaters and all the large suction, exhaust and overflow piping; all having been arranged for easy access. Plenty of light is obtained in the

basement by windows, as will be seen by the Fig. 3. A novel feature of the arrangement is that there is not a low pressure drip in the plant, and, consequently, no traps of any kind. The receiver drips are simply a by-pass around the low pressure cylinder, arranged in such a way that there is practically no loss of pressure in the receiver. All pipes leading to the condensers from the engines are graded in such a way as to drain all water into the condensing chamber, the heater connections being arranged to admit of doing this. All drips from the steam pipes in the boiler room are returned by gravity direct to the boilers, the main being located sufficiently high for the purpose. The drips from the steam pipes in the basement are all returned by gravity to a tank, and automatically pumped back to the boilers.

A feature of the feedwater system is a large auxiliary heater, through which the feedwater passes after going through the individual heaters. This auxiliary heater is made with a great amount of heating surface, exposing a large body of water to the heat in the exhaust steam from the condenser pumps, which is passed through the shell of the heater. The result is that, with all pipes and heaters uncovered, the feedwater is brought up to 208 degs. F, with but a very little steam being used to run the condensers. Fig. 1 shows the general arrangement of the piping in the basement, as well as an outline of the building.

The building itself is of brick, as will be seen from Fig. 3, with a roof supported by iron trusses and covered with slate. The chimney is 160 ft. high, and has a clear diameter inside of eight feet. It will be noticed that the feed wires enter the building through a perforated stone slab placed in the gable of a bay window on one side, and go directly to the switchboard located immediately back and in the center of one side of the engine room, and can be reached at the back by a door leading from a small entry or vestibule. The entire station has been arranged for permanency and economy, with a minimum amount of repairs, which are generally a large item in many previously constructed stations.

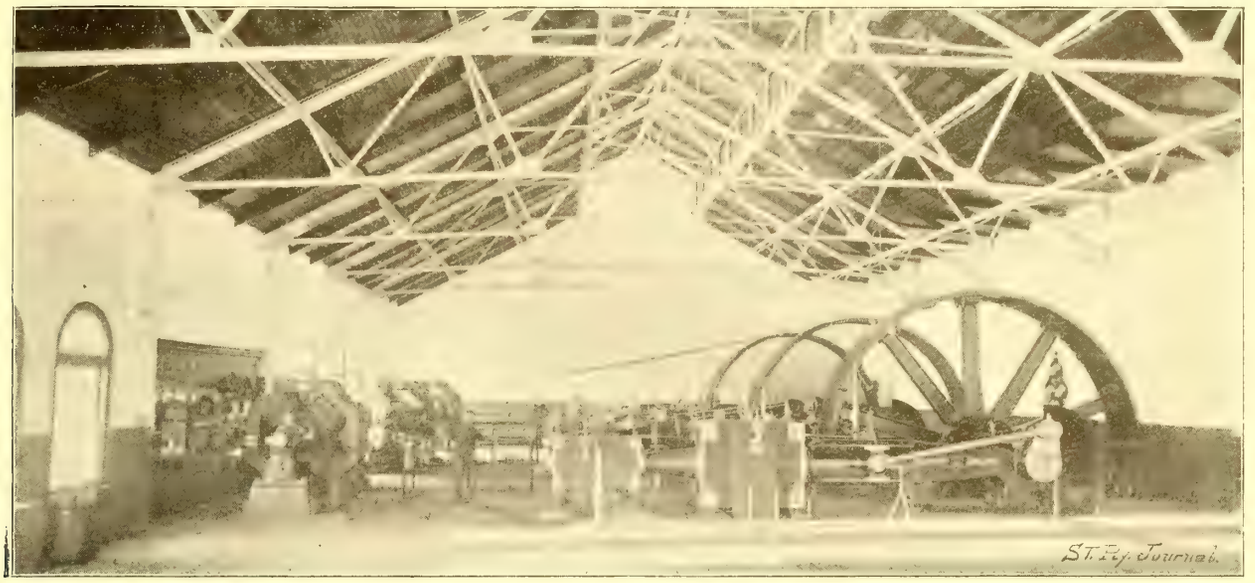


FIG. 2.—INTERIOR OF SALEM POWER STATION—LYNN & BOSTON RAILROAD CO.



FIG. 3.—EXTERIOR OF SALEM POWER STATION—LYNN & BOSTON RAILROAD CO.

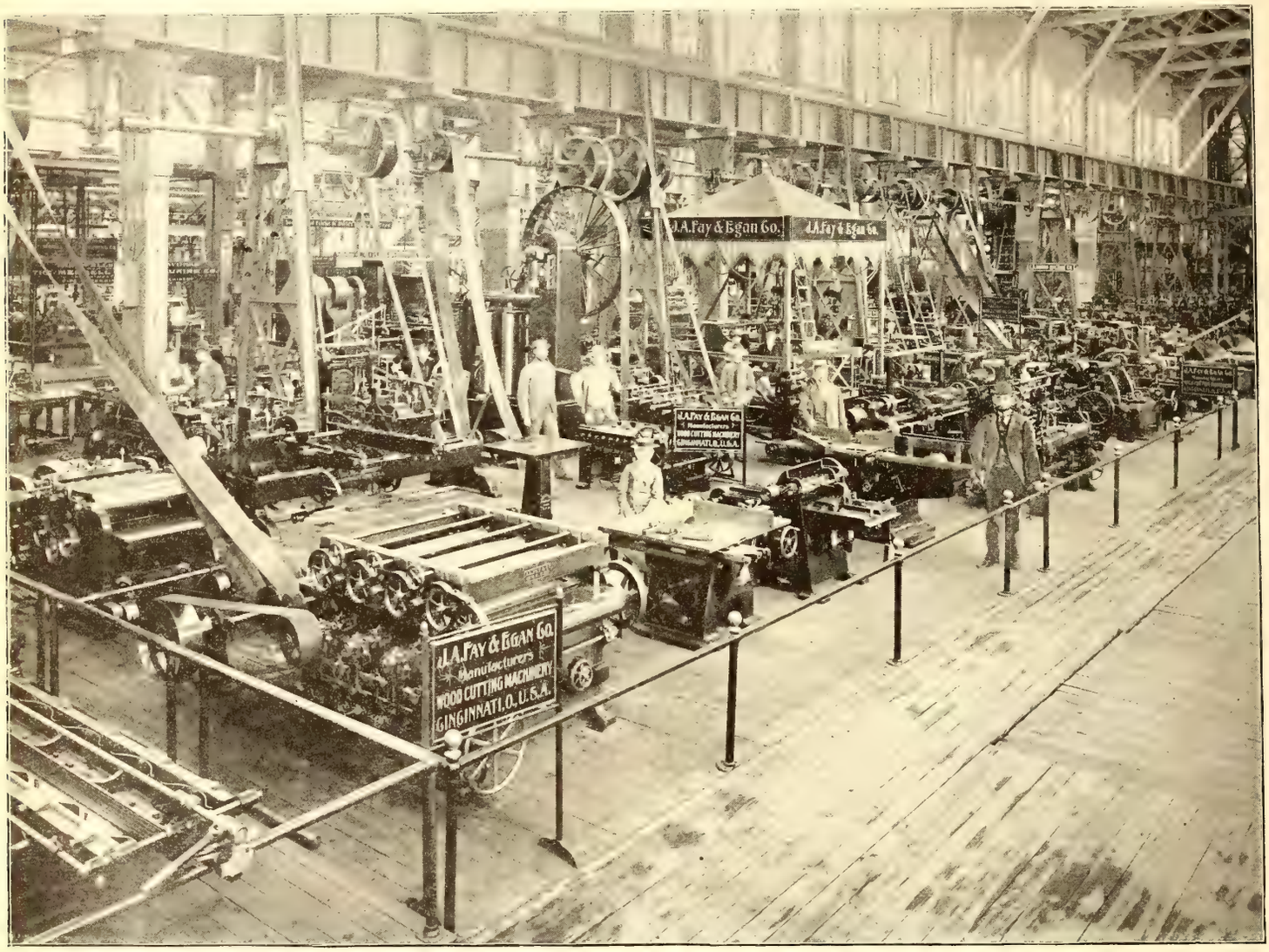
The Cost of Concrete Paving in Washington.

The report of the Commissioners of the District of Columbia for the year ending June 30, 1892, contains some interesting statistics on the cost of the concrete pavements in Washington. The term concrete is applied in that city to all the smooth pavements, whether cold tar distillate, asphalt or asphalt block. On July 1, 1892, the total area of these pavements laid was 2,411,446 sq. yds., divided as follows: Cold tar, 924,028; asphalt, 1,213,996; asphalt block, 271,425. The former cost, between 1886 and 1889, during which latter year its use was discontinued, $2 per square yard. The asphalt pavements, using Trinidad asphalt, and with a six inch concrete base, have cost, for many years, $2.25 per square yard, and $2 per yard with a four inch concrete of bituminous base, exclusive of grading. Asphalt block pavements have for several years cost $2 per square yard. All prices are exclusive of grading.

All pavements laid since 1888 have been kept in repair by the original contractors, without cost to the District, for a period of five years. The repairs made after the guaranty period have been made by the District under special contract. Under this contract, ordinary repairs are guaranteed for one year, and are made at the following prices: Asphalt service, $17 per cubic yard in place; binder, $7 per cubic yard in place; bituminous base, $3 per cubic yard in place, and hydraulic cement and concrete, $5 per cubic yard in place. Resurfacing is guaranteed as new pavement for a period of five years, and all repairs during that time are made at the contractors' expense. The prices are the same as for ordinary repairs, except that the asphalt surface itself is $1.02 per square yard. Experience has shown that the annual average cost of making repairs has been about three cents per yard. The cost of resurfacing, the Commissioners think, will probably remain constant at $1.50 per yard.

Exhibit of the J. A. Fay & Egan Company, at the World's Fair.

The J. A. Fay & Egan Company, of Cincinnati, O., made one of the most striking and noticeable exhibits in Machinery Hall for a display of its well known wood working machinery. This company is a recent consolidation of the important businesses of J. A. Fay & Company and the Egan Company, and the machines shown included those by means of which each of these companies has secured its well earned reputation. The space occupied was about 6,000 sq. ft., and forty-six machines altogether were shown, comprising all types of wood working and boring machines, saws, lathes, mortisers, tenoners, grinders, sanders, moulders, etc.



WORLD'S FAIR EXHIBIT OF THE J. A. FAY & EGAN CO.

The J. A. Fay & Egan Company claims to be making more than one-half of the wood working machinery being manufactured in this country, and its output consists of over 1,000 different types of machines adapted to every species of wood working. These machines are well known in the wood working shops of street railway companies and car builders.

The oldest street car driver, in point of service, in this country is said to be John Brynes who lives in Boston, and has driven cars for forty years, traveling in that time a distance equal to twenty-five times around the earth. He is sixty-four and in good health.

The Plant of the Worcester Traction Company.

In the STREET RAILWAY JOURNAL for July, 1893, was described at length the station of the Worcester, Mass., road which was at the time under process of construction. It will be remembered that the road was incorporated as a horse railroad up to about a year ago, under the name of the Worcester Consolidated Street Railway, and that the property was acquired by the Worcester Traction Company, of New Jersey, which has now equipped the road with electricity, and brought it up to the present modern standard.

In the article in question, E. J. Cook, of the Field Engineering Company, gave, in detail, particulars of the steam plant, etc. Since that was written certain small modifications have been made, and we are now in a position to take up the matter again.

The engines employed are of the vertical compound type and were furnished by the Lake Erie Engineering Works. The cylinders are of the four valve type, having two ports for steam and two ports for exhaust. Clearances vary from 2½ or 3 to 7 per cent., according to the diameter of the pistons. The double face slide valves are small, light and four-ported. The governor and steam valves are constructed to carry as far as three-fourths stroke in the first cylinder, permitting the engine to exert more power than any engine with releasing valve gear of the same diameter of cylinder and piston speed. This feature especially qualifies the engine for railway work. The movement of the high pressure admission valve is controlled by a centrifugal shaft governor consisting of two weights, one spring and four pivoted joints. The variation in speed of these engines in regular railway work does not exceed 1½ per cent. between frictional and rated load when running condensing or non-condensing, and not over 2½ per cent. when one-half the rated load of the engine is suddenly thrown off or on. The main bearings are so proportioned that the pressure thereon and the velocity of their rubbing surfaces are uniform, and the service is within the limits of remarkable durability. All bearings and slides are water jacketed and removable, a vital point in engines on electric service. The frames are of the "A" type, double box girder, cast iron. The pistons, piston rod, crosshead, connecting rod, etc., are of the best marine type. The crankshaft is of forged steel, built-up pattern, with counterbalance in one piece.



FIG 1.—ENGINE ROOM DURING CONSTRUCTION—WORCESTER.

The economy of these engines is the best obtainable; the cylinder condensation is low, the clearance is small and the steam distribution practically perfect. All steam, exhaust and condenser piping, was furnished by Best, Fox & Company, of Pittsburgh. The valves on the steam piping system are Climax bronze seated gates instead of Chapman, as mentioned in the previous article.

The electrical generating equipment is entirely General Electric, and consists at present of four 300 K. W., multipolar generators, each directly belted to one of the engines. The ultimate capacity of the station, as at present laid out, is 1,500 K. W., and space has, therefore, been left for another engine and another 300 K. W. generator. The speed of the dynamo is 400 revolutions per minute. The floor space is controlled by a traveling crane with a travel the full length of the building, thus enabling the placing of machinery at the absolute minimum of expense, and in the case of repairs it can be moved cheaply and quickly. It was designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn. The engraving (Fig. 1), shows the engine room while the equipment was being installed.

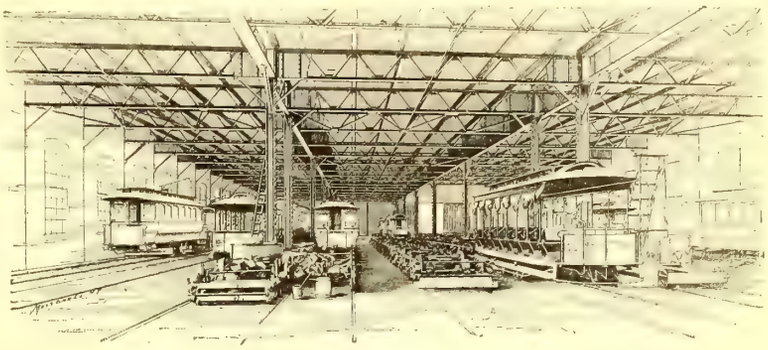


FIG. 2.—FIRST FLOOR OF CAR HOUSE—WORCESTER TRACTION CO.

The switchboard is built up of General Electric standard panels both for generators and feeders; of the latter there are thirteen. The panels are each fitted with an automatic circuit breaker with electrical reset—a new device which has already proved itself invaluable in railway operation.

The rolling stock consists of sixty-three motor cars and the same number of trailers. Twenty-five are twenty-two foot Laclede bodies, ten ten foot bodies of different makers, while the balance are sixteen foot bodies. The twenty-two foot bodies are mounted on Brill Maximum Traction trucks, and the smaller bodies on Brill No. 21 trucks.

Of the car equipments, forty-five are of the latest General Electric type, *i. e.*, two G. E. 800 motors to each car. These have already shown that the excellent qualities claimed for the new motor are by no means exaggerated. The other eighteen motor cars are equipped with Westinghouse motors, eight having two twenty horse power motors per car and ten having each two twenty-five horse power motors. All the General Electric equipments include the type K series parallel controller.

The car house is one of the best in the country. Fig. 2 is an interior view in the first floor, showing the general construction of the building. Fig. 3 is an interior view in the second floor. The entire framework of this building is of steel, the second floor and the roof being supported by steel girders, which in turn are supported by columns and girders in the interior of the building. The side walls are of brick, but made very light, the main support being through the steel columns which are bricked into the side walls. Very little woodwork is used about the construction of the building, being used only in the second floor and the roof plank, and here, on account of the heavy quality of the lumber used, the danger from fire is almost

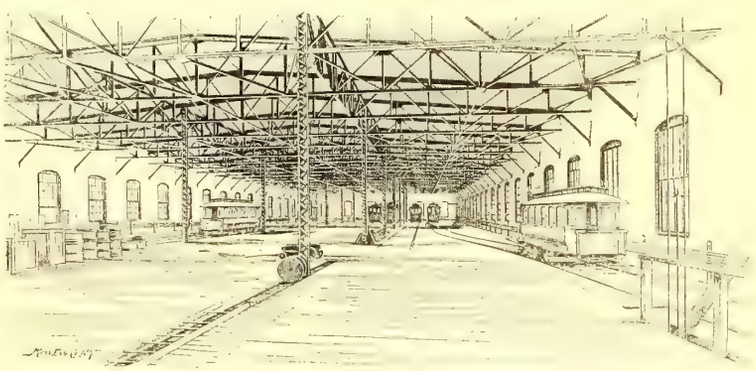


FIG 3.—SECOND FLOOR OF CAR HOUSE—WORCESTER TRACTION CO.

eliminated. It has a storage space for sixty cars on the main floor, and thirty to forty cars up stairs in the paint shop and storage room. It was designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn.

The length of the road is thirty-one miles. Of these, twenty-three are laid with ninety pound Wharton nine inch girder rail spiked directly to the ties, set two feet six inches between centers, four are laid with seventy pound girder rail, and the remaining four miles with fifty pound T rail. The rail bonds are of galvanized iron, set in with channel pins, and the entire system is triple bonded.

The general design of the plant is such that the boilers, engines and dynamos are located in the best position to avoid, as far as possible, loss in transmission of the different forms of energy from the coal to the line. The lighting is both incandescent and arc, in General Electric Company's systems.

The officers of the road are: E. J. Moore, president; Thos. C. Ban, secretary; C. Ford Stevens, treasurer, and J. N. Akarman, general manager.

Lithographed Car Tickets.

Where the practice exists of selling packages of tickets at a reduction on the price of single fares, or where commutation rates are in vogue, the desirability of using neatly engraved or lithographed tickets is a point which is often not carefully considered. Too frequently it is thought that almost any piece of pasteboard with the name of the company painted thereon will answer the purpose, but with a slight or practically no additional original outlay, a ticket can be issued which is both attractive and difficult to counterfeit. In this way, a company will often in a short time, not only save more than the additional cost of tickets by the prevention of the use of bogus tickets, but will keep before its patrons the idea that its policy is a liberal one.

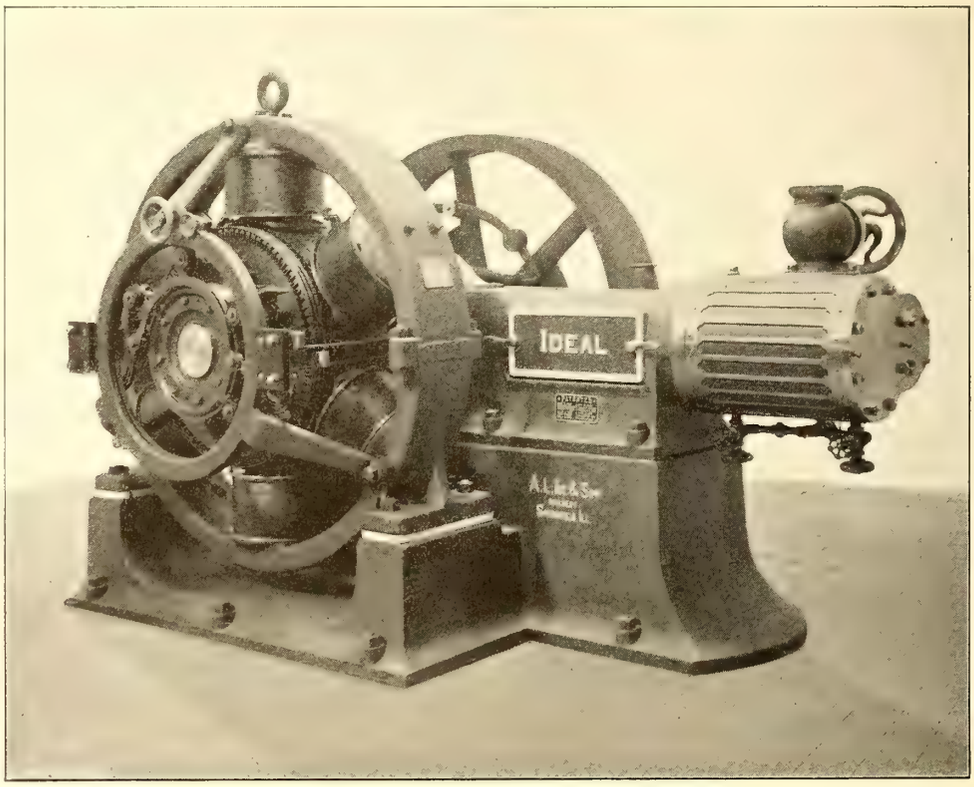
A new company, known as the Lithograph Street Car Ticket Company, has recently been organized in Cleveland for the manufacture of lithographed street car tickets of a high grade, street railway stock certificates, bonds and all kinds of lithograph work. E. Rettberg, who will be at the head of this concern, has had a long experience in this business, and promises the street railway managers a finer line of tickets than has yet been produced. The company will also make a specialty of printing transfer tickets. Its plant will contain the latest improved machinery for this class of work. Some work which this company has performed for the Knoxville (Tenn.) Electric Railway Company and the Citizens' Street Railway Company is of a very high grade.

The Middletown-Goshen Traction Company, of New York, has recently completed three miles of road, and expects to add about twelve miles as soon as the season for track laying again opens. Electric cars will be run about April 1. The power plant is well under way, and when completed will have a capacity of 300 H. P. M. J. Wightman is the electrical engineer of the road.

Permission to build an electric railway has been given by the Baltimore County Commissioners to the Walbrook, Gwynne Oak & Powhatan Railroad Company, the road must be completed within eighteen months.

New Direct Connected Engine and Generator.

The state of perfection at which the latest types of steam engines have arrived is shown in nothing so clearly as in the increasing demand for automatic types of engines to be direct connected to dynamos. The fluctuations in load, especially in street car service, are so great and so numerous—fluctuations of 25 to 100 per cent. of the entire load occurring almost instantaneously—that it has taxed the inventive genius of our engine builders to the utmost to produce engines that will stand the strain. In the case of belt driven dynamos, a severe short circuit will usually cause the belt to fly off and thus relieve the engine, but a direct connected engine must not only be able to maintain a uniform speed under these sudden changes of load, but it must not fly to pieces if a short circuit brings the engine to a sudden stand still. To meet the demand for direct connected engines and generators, the engine shown in the accompanying cut has been built by A. L. Ide & Son, of Springfield, Ill. The illustration is taken from one of three Ideal engines recently shipped by this firm for use in lighting the new Southern Hotel in St. Louis, Mo. Two of these engines had 14 × 14 cylinders, the third had a 13 × 12 cylinder. All were regulated to run at 275 revolutions. Each of these engines had a General Electric Company's armature keyed on the crankshaft in place of the plain pulley. The construction of the armature and engine is such that no outboard bearing is required. The two 14 × 14 engines are to drive dynamos belted from the governor pulleys in addition to the direct connected armatures.



NEW DIRECT CONNECTED ENGINE AND GENERATOR.

The points of superiority claimed by the builders of these engines for this form are as follows: They claim that they will not vary over 1 per cent. in speed for a sudden change of 100 per cent. in load. They are perfectly self-contained and balanced. Every engine was adjusted, before leaving the works, to run at its specified speed under full load, and so balanced as to run without shaking with all anchor bolts removed, excellence in workmanship and material, steel and bronze entering into its construction to an unusual extent. The engines are provided with the well known Ideal system of self-oiling, which supplies all the working parts with a constant stream of oil that is used over and over again. There is

positively no oil scattered in any direction. The armatures are therefore entirely free from any danger that could result from a splash of oil.

That these engines are peculiarly adapted to work in places where space is valuable, will be apparent from these dimensions:

The 14 × 14″ engines, with armatures attached complete, as shown in the illustration, can be placed in a box 68 ins. high, 81 ins. wide, 10 ft. 3 ins. long, and their rated horse power is 125. The 13 × 12″ engine, 100 H. P., can be placed in a box 68 × 74 ins. × 9 ft. 11 ins.

A New Car and Truck.

We illustrate herewith a new car and truck recently built by the Barney & Smith Car Company, of Dayton, O., which is one of a number ordered by the City Railway Company of that place for the Dayton & Soldiers' Home line which it controls. The car shown in Fig. 2 has a sixteen foot body, and is twenty-four feet four inches long over the platforms.

The outside is paneled in red and white with window frames of oak. The hood is the standard semi-circular shape manufactured by the Barney & Smith Company. There are six windows on a side, fitted with Burrows roller shades and glazed with double thick French glass. The inside finish is in quartered oak with oak doors and window sashes. The seats and backs are upholstered with loose cushions, and the car is lighted by a center light consisting of two electric and one oil lamps and with additional electric lamps at either end.

The truck on which this car is mounted, and which is illustrated in a separate engraving, was recently brought out, and is being manufactured by this company. It has been in successful operation for about three months, and promises to be one of the best on the market. The points aimed at in this truck are: Superior riding qualities, eliminating the objectionable end tilting, strength, simplicity and moderate cost. The first is accomplished by

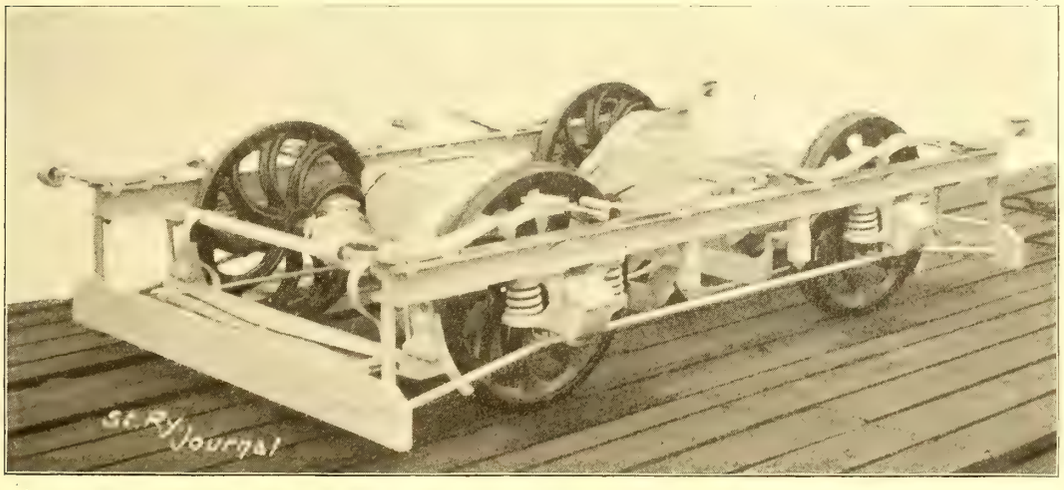


FIG. 1.—NEW TYPE OF TRUCK.

interposing between the car body and the truck side frames, four sets of half elliptic springs, one set of three frames over each journal. These springs are so proportioned and connected that a load applied at any one of the points of support is felt equally by the whole set, and and is thus distributed over a considerable distance on both car body and truck frame. In addition to these there are short spiral springs placed between the truck frame and the journal boxes. The object of these is to absorb the shorter vibrations and at the same time protect the truck frames; it is well known that a frame without some cushion between it and the axles is very troublesome to maintain, its different members are continually breaking, and the joints and bolts are nearly always loose.

The strength of this truck is principally owing to the fact that the side frames are continuous and straight, which will be appreciated by those acquainted with built-up frames. An examination of the cut will show the simplicity of the frame; the wheel beams are constructed of two steel channel bars placed back to back, with an intervening wood filling one inch thick. This filling is introduced

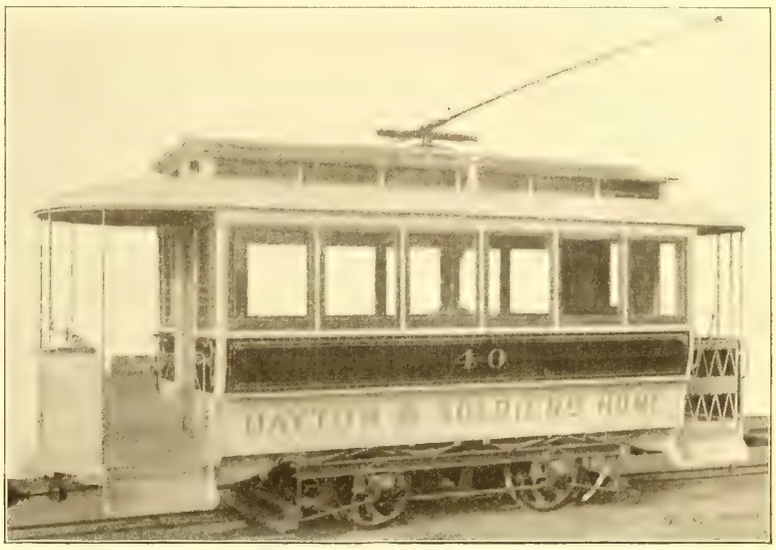


FIG. 2.—CLOSED CAR FOR DAYTON & SOLDIERS' HOME RAILWAY—DAYTON, O

to deaden the noise, the strength of the frame in no wise depending upon it. The iron end sills of rectangular section, are attached to the side frames by means of strong malleable iron corner plates, which are provided with flanges engaging with the edges of the bars, thus taking all side strains off the bolts. The springs rest in malleable iron sockets, and are securely fastened to the frame with clips and bolts. The pilot brackets, pedestal braces and brake beams are of wrought iron. The manner in which the side beams are constructed makes it possible to use any kind of motor support that might be selected without drilling holes in the iron work.

THE Chesapeake & Ohio Transportation Company has been incorporated at Hagerstown, Md., by C. K. Lord, H. Crawford Black and Alexander Shaw, of Baltimore, Lloyd Lowndes, of Cumberland, and J. Clarence Lane, of Hagerstown. Its capital stock is $250,000 and its object is to operate canal boats on the Chesapeake & OhioCanal, by the electric trolley system such as tested on the Erie Canal. The shares of the company are of $100 par value each, and they are mostly held by coal mine owners in Western Maryland.

THE Belgium Government has received from the tramway company operating from Ixelles to Boendael, near Brussels, a request for a franchise for a movable sidewalk extending from the entrance of the St. Hubert galleries to the Namour gate. This moving sidewalk will be constructed under a recent patent granted to Mr. Empain.

IT is stated that the youngest electrical superintendent in the country is Edmund H. Perry, of Bloomfield, N. J., who is only fifteen years old.

The Medical Side of Street Railway Practice.

Part III.

By George J. Tobias, M. D., Chicago, Ill.

In describing railway injuries it will be necessary to make some division of the different forms of wounds, and to classify them in a brief and simple manner so that we may be enabled to intelligently consider appropriate treatment.

For convenience, and for the purpose of a simple classification of railway injuries, we shall consider them under three separate heads:

1. Injuries of the soft parts.
2. Injuries of the bones.
3. Injuries involving both.

Wounds of soft parts may be contused, lacerated, incised or punctured. The two former being most frequently met with in street railway injuries, we shall confine our attention principally to them.

A contused wound (*contundo*, to bruise) is one, that, generally speaking, is produced by injury from a blunt weapon, or collision with some foreign body, without breaking the skin or covering of the injured part. In cases where there is a breach of the surface, in contused wounds, the injury generally extends far beyond the area of the external wound. Subcutaneous contused wounds are very misleading in their general appearance, and are often of grave importance, as the injury is not localized, and its extent cannot be made out by a single inspection of the external parts. Such injuries require the most accurate examinations, and demand the greatest care in treatment.

From a clinical point of view contused and lacerated wounds might well be classed together, the element of contusion considered as a complication of the wound, and the distinction one of degree and not of kind. But in railway injuries we have many contusions to treat where there is no breach of the surface, as contusions of the hip joint, shoulder, knee, or, in fact, any part of the body. Many cases that we examine for alleged injuries are devoid of all objective signs of traumatism, and the only tangible symptom of disorder is pain in the back, which might emanate from other various causes other than injury.

And yet just such cases are brought into court claiming damages for contusion of the back, "concussion of the spine," etc. etc. It can be readily seen that advantage is often taken of the circumstances which connect some dishonest persons with a railway accident in which they were in nowise injured, but are desirous of gaining compensation by fraud. In well marked injuries, which are properly classified as contused wounds, we find swelling and acute inflammation of the part. There is pain and tenderness on touch, loss of function, and usually there is more or less discoloration which soon becomes apparent on account of the delicate subcutaneous tissues which are torn, and the rupture of blood vessels, which give rise to hemorrhage. A simple discoloration caused by diffused blood, is called ecchymosis, but when the hemorrhage is so profuse as to cause a lump or blood tumor, it is named hematoma. The treatment of contusions consists, first, in the relief of the general shock, and second, of the local pain. The injured part should be placed at rest. If voluntary immobilization is not sufficient, place the patient in a recumbent position in bed, and resort to bandages or splints if necessary; at any event secure rest, for in so doing we lessen the local irritation, and hasten the absorption of effused fluids. Hot fomentations are of great value in reducing inflammation or to allay pain. Cold applications are frequently found to be of service; but their use should not be continued for any great length of time, as the vitality of the parts may become depressed.

In mild forms of contusions, evaporating lotions are very useful, such as tincture of arnica, aconite, belladonna, camphor, witch hazel, etc., their efficiency being largely due to the alcohol which they contain. When we find the bruising severe and subcutaneous hemorrhage present, the indications are that some important blood vessel has been wounded, and it will be proper to make a free incision in order to expose the ruptured vessel and apply a ligature to it.

If there be danger of septic infection, or in cases where contusion is followed by severe inflammatory reaction, it will be necessary to combat the disorder upon general surgical principles, including such constitutional measures as may be required to relieve pain, reduce fever and sustain the strength and vitality of the patient.

A laceration is that form of wound in which the tissues have been forcibly torn or crushed. The surface presents a rough and irregular appearance, giving rise to a gaping and ragged condition of the tissues involved.

In many instances we find severe contusion accompanied by extensive laceration of the soft parts; this condition is, of course, produced by the mingled elements of the injury, the character and cause of such disorder being similar. We have in such cases, not alone the bruising and disorganization of tissues to contend with, but the depressed vitality of the injured part which must take up a new circulation in order to establish resolution, and, therefore, the result of the injury (so far as the treatment is concerned) depends, not alone upon the surgical care of the case, but the susceptibility of the wounded part for prompt healing and repair. In lacerated as well as incised wounds the divided or torn tissues have a tendency to retract, causing more or less gaping, the hemorrhage which follows being the effect of every open wound. Pain is a usual accompaniment, which is due to the disordered condition of the sensory nerves. The amount of pain varies with the nerve supply of the wounded part and the general sensitiveness of the patient. The most painful and sensitive parts of the body are the lips, tongue, nipples and external genitals. The temperament of the individual always modifies the pain. In severe forms of lacerated wounds, the nerve irritation is so great as to mark the immediate effect upon the individual, causing profound general depression. This condition is called "shock." Age, mental conditions and temperament also modify shock.

The degree of shock may be influenced by the physical condition of the patient and the natural powers of resistance. In severe forms the vital forces are so profoundly depressed as to cause, not alone general prostration, but conditions of the most grave importance, which are characterized by such symptoms as feeble pulse, impared respiration, clammy skin, cold extremities, peculiar shrunken appearance of the features, and loss of consciousness.

Fright often tends to increase the general collapse, and in some cases it has been known to produce great psychical depression which has resulted in "cardiac syncope" and death. A remarkable case of death by mental emotion is related by Lauder Brunton, and is quoted by numerous medical writers.

Thus it will be seen that shock does not necessarily depend upon actual injury, and further, that the mental condition (which is a factor in all cases of shock) is largely responsible for the degree of severity of the depression.

Just how far corporations are liable for the emotions and mental attitudes possessed by their passengers is a question for the courts to decide, but it would seem unreasonable (from a scientific point of view) to expect payment from a railway company for an alleged injury or condition which may have been the result of fright, and where the alleged injury would have made no serious impression upon a well balanced mind. It must be remembered that railway companies do not stand guarded by medical examiners, like life insurance associations, who make it a study to select only healthy people to do business with. The street car company must carry all passengers who behave themselves, whether they are healthy or otherwise. How often have we noticed invalids and pregnant women riding in street cars, who at that very time should have been under the care of a nurse or attendant. How many instances have occurred where actual childbirth has taken place in public conveyances. Such matters as these should be fully considered by courts and juries.

(*To be Continued.*)

Comments on English Track Construction.

BY ARTHUR HODGES, LATE CHIEF ENGINEER OF THE WEST END RAILWAY, BOSTON, MASS.

I have been much interested in the article on "English Methods of Street Railway Track Construction," which has run through the last three numbers of the STREET RAILWAY JOURNAL.

I intend simply to discuss similar practice in this country and to suggest some objections, which occur to me, to fully carrying out the form of construction described. But, incidentally, I cannot refrain from saying a few words in reference to the false impressions which, judging from this paper, seem to be current in England concerning our practice in track construction.

They are mistaken in thinking that the practice in America has been to multiply the number of parts instead of lessening them. The construction to which the paper refers as "having the rails secured by cotter bolts to pan or metal stringers," and "these again tied by rods which are often cottered to the stringers" is almost unknown in this country. A statement to the contrary gives a very wrong impression to persons not acquainted with our track construction, and although some parts of the paper show that the writers have some knowledge of our tracks, this goes to make one think that it must be very superficial. They say also: "We believe, however, that within the last year or two the girder rail is obtaining more favor, and is being adopted by many companies," etc. The well known facts are that the girder rail has been in use in this country for fourteen or fifteen years, and has been used *extensively* for several years, so that the mileage is now up among the thousands.

In the matter of "points," as the English people term what we call switches, the practice in England seems to be in no manner in advance of American practice. With us the built up switch is found to give the best results, and the movable tongue, which we find to give the best satisfaction, is made from highly tempered crucible steel, forged to the requisite dimensions.

We have long used tie rods which are identical with those described in Part II. Built up switches and crossings are, by no means, new to us, and long strides have lately been made in their improvement. We have been through nearly the same experiences in references to switches for turnouts as are described in this paper, and have arrived at the point from which we started, using movable tongues, and where electric or steam motors are to be used we have for several years used movable tongues on both rails, that is, in both switch and mate, as we call them.

In the matter of heavy "fish joints" with large bolts, we are not behind. We have used one inch bolts for two or three years, and some of our engineers have suggested and advised bolts of larger diameter. Even in the matter of paving, the concrete foundation and the grouting with pitch after the joints have been filled with pea gravel is getting to be a very common practice. The development of the street railway in England, as described in this article, is so nearly coincident with that of our own, that there seems little left to discuss between us other than the foundation or substructure.

The first difficulty which suggests itself in the adoption of the concrete foundation with a six or seven inch rail is the fact that in this country the specifications for paving blocks in the large cities call for a depth of seven or eight inches. As it is necessary to have a bed of from one and a half to two inches, it will at once appear that the English plan for a concrete foundation is impracticable under such conditions. But this can be overcome by the use of a nine or ten inch rail. Such a rail has been used here during the last two years, and the paving laid in connection with it has been placed upon a concrete foundation with a bed of about two inches of gravel, and has been grouted with pitch after the joints had been filled with pea gravel. This class of paving has been used in American cities for three or four years, and is giving good satisfaction.

Another way of obtaining sufficient depth for our paving stones is by the use of chairs spaced as may be specified in the contract for track construction. Such a track was laid in Washington Street, Boston, in the summer of 1892, in which the rail is a girder, with rolled steel chairs electrically welded to its foot. At the joints there are long chairs which admit of deep, heavy fishplates. This track was paved as just described for the nine inch rail, and has been in constant use, under heavy traffic of electric cars, for more than a year, and is in excellent condition. Some idea of the test to which it has been subjected may be obtained from the statement that from 170 to 180 cars pass over it every hour. The tracks above described are placed upon oak or chestnut ties, or ties of vulcanized hard pine.

Owing to the peculiar conditions and disadvantages under which we labor, I am afraid it will not be advisable at present to depend entirely upon concrete for the support of our tracks. Unfortunately our streets are liable to frequent disturbance by some of the many corporations which have franchises permitting them to occupy certain portions of them, and by the city authorities themselves. Such corporations, in making the excavations necessary for repairs or extensions of their underground works, unavoidably undermine the street railway tracks which lie in their way, and frequently the line of their pipes, or other underground construction, coincides with the line of the tracks above it for a long distance. It will be seen, without argument, that the concrete foundation would be utterly destroyed by the excavation in such cases, and this condition of things is so nearly universal as to make it a very serious objection to the form of construction under consideration, and to demand a track which can be suspended, in the event of undermining, and put again in running order with the least possible expense.

In addition to the foregoing objections to the concrete foundation, our climate may well be considered as worthy of a place in the discussion. It is well known that the frost penetrates the ground to a depth varying from two to six feet, and its influence is seriously felt in all work the foundation of which is not carried below the depth to which the frost reaches. How far this would affect the track, in outlying districts, constructed with no other support than concrete, I am not prepared to say, and it may perhaps be a subject for experiment, but there are many localities where the first cost of a concrete foundation would be prohibitive, *i. e.*, where a cheap track must be built—the cheapest possible—or none at all. In many cases a foundation of concrete would certainly double the cost of the track.

The objection to a rail with a groove one inch wide is at once apparent to one familiar with our light carriages. Such a rail is used to some extent in America, notably in Washington and Boston, but great care is needed in the use of light carriages in streets where it is laid. The head of a rail much used in our large cities is much better adapted to our streets. I refer to the semi-grooved rail largely entering into track construction in New York, Buffalo, Boston, etc., and originally known as the "Richards Improved" rail. This rail, while it posesses many of the advantages of the full grooved rail, is without its objections.

In the matter of cable construction I am inclined to think that we have not much to learn, as yet, from our British cousins. The conditions are very different with us from those prevailing in the cities of Great Britain.

One of the principal difficulties which we must guard against here is the danger of the closing of the slot from frost pressure. The argument might be used that with a shallow conduit the tendency to the closing of the slot would be less, and more easily overcome. But we have not arrived at a point where we can use the shallow conduit, and as long as it is deep we must have a yoke of great stiffness. There is no doubt but that it is an advantage to have the rails connected with such a yoke.

THE new electric line between Newton (Mass.) and Mt. Auburn was opened December 13.

THE INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS.*

BY EDWARD E. HIGGINS.

FIRST PAPER.

The rapid increase of street railway mileage during the past five years, the extensive adoption of electricity and the cable in place of horses, and the general reconstruction of roadbed made necessary by change of motive power have made heavy demands upon the speculative and investment capital of the United States. It is probable that not less than $125,000,000 in cash and in financial and commercial credits have been brought into this field since 1888, this sum representing perhaps 25 per cent. of the total investment to date in American street railways.

There has been a large increase in capital liabilities. It is safe to say that the gross mortgage indebtedness of our street railways is to-day double what it was in 1888; that the capital stock has been increased in an even greater ratio, and that the gross capitalization per mile of track (including the capitalization of "Traction Companies") is so far in excess of that of 1888 that the entire difference cannot be explained on the score of cost of reconstruction and change of motive power. The volume of securities in existence to-day may be considered as representing:

First. The purchase of the old horse railway properties at a large, and in some cases an abnormal advance on their original costs.

Second. The reconstruction and re-equipment of such properties accompanying a change of motive power, at a cost usually in excess of that for which the same or superior work could now be done.

Third. The extension of the reorganized properties into new territory.

Fourth. The development of entirely new properties in unoccupied territory.

Fifth. Construction, promotion, banking and brokerage profits.

The present distribution of the new securities cannot be known with accuracy. It is certain that a very large portion have not yet found the ultimate investor, but are held in more or less speculative channels awaiting favorable markets. Nearly all of the mortgage bonds have been negotiated in the East, although a few issues have been brought out in Chicago, which probably owns also the greater part of its local street railway securities. Two or three of the great Western cities are carrying their own mortgages, but in general the rapid street railway development in the West (which preceded that in the East) has been financed almost exclusively in New York and Boston. The New England clientage of Boston banking houses has, in particular, invested large sums in this field partly by direct purchase of recommended bonds, and partly by the purchase of collateral trust issues secured by underlying street railway bonds. Certain New York and Philadelphia houses, with foreign connections, have secured Scotch, English and German capital for special issues. It is known, however, that a large amount of these bonds are still held by bankers, brokers and syndicates, and are not pressed for sale because of the belief that much higher prices can be realized when the reconstruction period is over and the properties are showing the great increase in net income reasonably to be expected. Little attempt has yet been made to market the new stock issues. Rarely representing actual cash investment, they are held chiefly by syndicates, promoters and traction companies, as a source of future, rather than present profits. It must not be forgotten that recent street railway development has been marvelously rapid. We can look back but five years to the first successful electric road, and it is clearly impossible to find many roads which have been in operation under the new conditions long enough to obtain the full advantage of the change.

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Now the vast sums which have been drawn from ordinary investment channels into this field are exciting some uneasiness in conservative financial circles. Will the general confidence in street railway investments be justified by results? Is the rapid development normal? Is it not a repetition on a smaller scale of the steam railway "boom" of 1869–73, and will not disaster come? All these are pertinent questions hardly possible to answer wisely as yet. Overcapitalization of costs is almost universal. It is certain, too, that there has been in some places overcapitalization of earning power, so that reorganization and the scaling down of nominal values will soon be necessary. Elsewhere, however, "syndicates" have often been contented with smaller paper profits, and it is not unreasonable to suppose that such properties, if well managed, will return dividends for years to come. The work of separating the good from the bad—speculative from investment values—is of grave importance. We are in the midst of great—almost fundamental changes, whose effect cannot yet be foretold. We are hampered by the natural unwillingness of street railway managers to furnish full and reliable data on which their properties can be judged. Yet it is not impossible, even now, to lay down certain principles which will serve to determine the limits of success in particular cases, and to establish the broad lines of a "theory of values" in this comparatively unknown financial field. I shall attempt this in the following pages, claiming for my effort nothing more than that it is a careful, conscientious and painstaking endeavor to throw some light upon an exceptionally difficult subject, and knowing well that many of the conclusions which I shall draw may be open to present criticism, or may prove erroneous in future.

GENERAL CONDITIONS.

The municipal transportation industry in the United States is intrinsically profitable—much more so than abroad. This is due primarily to the peculiarities of the American character. Our national passion for "getting there" forced the introduction of street railways long in advance of their adoption in other countries. "Perpetual" franchises, high fares, freedom from burdensome conditions, all were instantly—almost impatiently granted in the eagerness for facilities. To-day, these old time franchises are immensely valuable and almost perfectly protect the interests of their owners. This is the first effect of "American energy." The second is equally characteristic. The average American is careless of small economies. He has no time to "split a nickel;" he despises a penny and, in some parts of the country, will throw it away; he will willingly pay five cents to save three minutes in a half mile ride, and he will doubtless be the same man fifty years hence. Attempts have been made in a few cities to reduce the now almost universal nickel fare. They have rarely succeeded, not always because the reduction could not have been forced, but because no interest could be aroused among the people. It might appear at first that this argument for the investment value of our street railways is flippant or superficial. It is not. It is fundamental. Americans are free riders, and their insatiable craving for more facilities arouses mingled feelings of gratification and anxiety in the minds of street railway managers.

Under the influence of this pressure, and with the realization that cars propelled by animal power but imperfectly fulfil the whole function of a street railway, the cable and electric systems of motive power have come into being. They were first introduced in the belief that the actual reduction in operating expenses would be sufficient to yield satisfactory returns on the additional investment required. This expectation has not been precisely

realized. Total operating expenses have been somewhat greater than before, instead of less, because the sudden and amazing increase in traffic brought about by greater speed and clean, attractive and easy riding cars has made it necessary to greatly increase the car service. But the operating expenses per car mile and per passenger carried, and the percentage of operating expenses to gross receipts are, in general, sensibly reduced. The intrinsic advantage of steam over animal power is very great. Coal is far cheaper than grain, and the labor required to run a power station less than that of caring for horses, so that in spite of unexpectedly large repair accounts caused by imperfections of early apparatus and severe usage of track, the results of the change have encouraged the belief that the cost of carrying a passenger under the new conditions will be materially less than with horses.

Summarizing the above, it is certain that our street railways, as a whole, have been profitable even when operated by horses, and that the general adoption of electricity and the cable has invariably brought about a substantial increase in gross receipts and almost invariably an even greater proportional increase in net. The real question becomes, therefore, whether or not there has been serious overcapitalization of the permanently safe net earnings. This question can best be answered in an examination of actual statistics, and, as the conditions vary greatly with the scale of operations, and as we cannot here deal with units of less magnitude than the entire street railway systems of the different population centers, I shall continue the discussion under the following groupings:

Class I. Surface railways in American cities and towns of less than 15,000 inhabitants.

Class II. Surface railways in American cities and towns of from 15,000 to 25,000 inhabitants.

Class III. Surface railways in American cities of from 25,000 to 50,000 inhabitants.

Class IV. Surface railways in American cities of from 50,000 to 100,000 inhabitants.

Class V. Surface railways in American cities of from 100,000 to 500,000 inhabitants.

Class VI. Surface and elevated railways in American cities of over 500,000 inhabitants.

Class VII. Interurban electric railways in America.

Class I. Surface Railways in Cities and Towns of Less Than 15,000 Inhabitants.

There are about 500 cities, towns and boroughs in the United States of from 5,000 to 15,000 inhabitants. Of this number over 300 now contain local, or are served by interurban street railways,* about 120 having been invaded since 1890. Many of the smaller places, too, have street railway facilities, although few of less than 5,000 are served by strictly local roads. Late returns show that the motive power on about 25 per cent. of the total mileage is horse, on about 70 per cent. electric, and on the remainder steam and miscellaneous.

Local roads of this class have little general interest, and it would be useless to examine their statistics in detail. There are no comprehensive laws governing their success or failure, everything depending on local conditions and management. Before the era of electricity a large majority of the horse roads were unprofitable to a greater or less extent, the small areas served not permitting lengths of road sufficient to induce traffic. Gross receipts ranged from $0.25 to $2 per capita per annum, rarely exceeding $1. Operating expenses, with the closest economy and with minimum expenditures for salaries and maintenance, generally absorbed all, or nearly all the gross receipts, and in the rare instances where net earnings (?) were paid out in interest and dividends it was usually at the real expense of the assets. In many cases such roads actually refused to earn current operating expenses, to say nothing of interest, dividends or proper maintenance charges, and it became an interesting problem to know what to do with them. "Reorganization" was impossible without some surplus, or hope of surplus, however small. "Receiverships," without net earnings, would have become unpaid disbursing agencies without funds. Abandonment, though not always easy of accomplishment where franchises are construed as contracts, would have proved in many cases the only resort had not the advent of electricity given to these roads a fictitious value for the purposes of promoters or in consolidations with interurban systems.

The equipment of these small roads by electricity has sometimes—but by no means always improved the financial outlook. Gross receipts have always increased and frequently in a very large ratio—100, 200, even 300 per cent. This is the natural result of radical improvements in service and of the novelty of electric traction. But it has been, and is now difficult to crowd down operating expenses to a point where returns can be regularly made on the necessarily increased capitalization. "Electricians" are costly (sometimes in more ways than one). The fixed expenses of a power station, when distributed over but three, four or five cars, frequently make the cost of motive power excessive; nor can this charge be greatly reduced by hiring power from local lighting stations. In small towns the latter rarely operate more than six to eight hours out of the twenty-four for lighting service. In order to furnish power to an electric railway they must add new engines, boilers, special dynamos and apparatus, and must employ another set of men. The slight saving in general expenses per unit output is more than counterbalanced by the profit necessarily charged by the lighting company. Depreciation of track is greater with electric operation than with horses, and the cost of maintaining the earlier types of electric motors has been disheartening. Nor can we forget that all the items of the profit and loss account are on so small a scale, that a single accident causing loss of life or limb may result in successful damage suits, entirely wiping out a year's net earnings.

The evil of overcapitalization was almost wholly absent in the horse railways of this class, but is decidedly present in their electric successors of to-day, though with a better excuse for being than is always the case with larger systems In the early days of electric railroading when manufacturing and construction costs were a well guarded mystery, high prices for apparatus and for all kinds of contract work were demanded, particularly when the contractors were obliged to take part payment in bonds. A great majority of the smaller roads could be financed only in this way and were burdened with heavy interest charges hard to meet even at first with road and equipment comparatively new, and presumably in the best condition for profitable operation. Defaults have already occurred, and must be expected henceforth with greater and greater frequency.

While the above discussion applies to the great majority of roads serving less than 15,000 inhabitants, there are many cases which seem to be, and a few which actually are exceptions to the rule. When a population of from 12,000 to 15,000 is scattered along a narrow territory such as a valley or river front, and if there is constant necessity for travel between the different parts of this district, an electric, or even a horse railway will occasionally show true profits on the actual cost of construction. Even so, however, there can be little margin for mistakes of management or for accidents, both of which are a constant menace to net receipts. Again, a "summer road" situated in a small town, but serving a much larger transient population bent on pleasure, is frequently profitable on a moderate scale; but such roads evidently do not properly belong in this class. In still other cases local conditions favor larger gross and net earnings than the average.

I have not thought it wise to incorporate in the Table of Statistics examples of these small properties, because of the impossibility of doing justice to so large a number of roads by the selection of typical cases. The above conclusions are believed to be justified by a careful and patient examination of all available statistics and a somewhat intimate knowledge of the difficulties under which many individual roads are laboring.

*In this and subsequent papers the distinction between roads which are purely local in character, not extending outside the limits of single population centers, and interurban roads serving two or more population centers, must be kept clearly in mind. The latter are treated separately as their statistics differ materially from those now under consideration.

Class II. Surface Railways in American Cities and Towns of from 15,000 to 25,000 Inhabitants.

There are ninety-one cities and towns in the United States of from 15,000 to 25,000 inhabitants.* Fifty-seven of these cities are located in the Eastern States, twenty-one in the Central, nine in the Southern, and four in the Western. All but ten have local street railway systems; eight of the ten are connected with larger metropolitan systems, and street railways are projected in the two towns not yet served. The total track mileage exceeds 1,000, of which about 80 per cent. is electric, 16 per cent. horse, and the balance steam and miscellaneous.

Much that has been said about the street railways of Class I is equally true of those now under consideration. The proportion of successes to failures becomes greater, however, as we enlarge the scale of operation, and we find in this class a number of properties which will earn fair returns on a reasonable capitalization. The areas of the cities proper are still too small for large mileage, but the outlying districts have been lately opened up for residence to a surprising extent, so that a service of less than 2,500 inhabitants per mile of road is not unusual. Needless to say that this rapid development is heavily discounting the future, and is frequently an adjunct of real estate speculation. There is no question that the territories affected are being greatly benefited. The census of 1900 will show large additions to urban areas and populations, and many of the systems of this class may eventually become safely profitable. Meanwhile, however, the original security holders will be fortunate if the scaling down of capital liabilities by the reorganization process do not rob them of much of their expected profit.

In the Table of Statistics are given a number of examples of the roads in this class so large as to be fairly representative of all types and conditions developed up to 1892. Many cases are complete, and show the changes made in two years of operation; in others, the returns for 1890 alone are given, later figures not being obtainable. In still others, the statistics of mileage and capitalization for both years are given, but those of operation for 1892 are omitted from lack of full or reliable information.

Of eighteen railways operating by horses in both 1890 and 1892, five only have had a gross passenger income (reported) in either year exceeding $30,000. Case No. 13 (17,000 population) serves a fashionable winter resort in the South, and its local patronage is greatly increased by the transient. The gross income in 1890 was $49,000, due to the cause above mentioned and (probably as a consequence) to an exceptionally heavy car service. The cost of the latter was reflected in operating expenses which exceeded the income and left a small deficiency. Cases No. 14 (17,000 population) and 17 (18,000 population) serve two manufacturing cities in an Eastern state; were moderately capitalized in 1890; earned respectively $36,000 and $38,000 gross, and $5,700 net; equivalent to 11 and 6 per cent. upon the respective capital liabilities. Case No. 24 (20,000 population) is perhaps the best horse railway statement in the table. It serves a somewhat important manufacturing city and its suburbs. The capitalization is moderate; there is no floating debt; the car service is good, but not excessive; the passenger income is about $50,000 gross; $6,000 per mile of track, $0.25 per car mile, and $2.50 per capita; and the net earnings are apparently sufficient to return from 12 to 16 per cent. on the actual investment. This road is now being extended and equipped by electricity, and bonds have been issued conservatively. Case No. 31 (21,000 population) is an excellent statement for so small a road, showing 10 per cent. return on a large capitalization.

But five railways were in operation by electricity both in 1890 and 1892. Case No. 3 (16,000 population) earned $32,000 gross in 1890, and has presumably earned much more since, as the mileage has been greatly increased and the capital liabilities multiplied by eight. Case No. 4 is unimportant. Case No. 15 (17,000 population) serves a suburb of a large Eastern city; the road is moderately capitalized; the car service is fair; the passenger income is now over $40,000 gross; $3,300 per mile of street, $0.28 per car mile, and $2.50 per capita; and the net earnings, though smaller in 1892 than in 1890, were sufficient to return 7 per cent. on the capital liabilities in 1890 and 4.6 per cent. in 1892. Case No. 20 (19,000 population) serves a fashionable coast resort in the East; is heavily capitalized; its passenger income is $40,000 gross, $9,400 per mile of street and $2 per capita; and its net earnings, for practically the first year of complete electric operation, are 8 per cent. on the capital liabilities. Case No. 46 (25,000 population) serves a manufacturing town. It is moderately capitalized; its car service is small; its passenger income has decreased since 1890, although the car miles have increased; the passenger income per capita is but $1.09; the operating expenses are increasing, and the net earnings, though sufficient to return 11 per cent. in 1890, were in 1892 but 6.5 per cent. on capital liabilities.

There are seven fully reported cases which were in operation by horses in 1890 and by electricity in 1892. It is worth while to examine these in some detail in order to note the effect of the change of motive power upon their success.

Case No. 6 serves a small but prosperous manufacturing town of the East, and was a poor and insignificant property when operated by horses. Its development began in 1891. An extension of about ten miles was built to a lake resort which attracts large numbers of people from all over the country during the summer. The new equipment and construction work are excellent. The population figure (16,000) does not properly represent the actual population served in 1892, because of the new extensions and the heavy transient patronage. The tremendous increase in passenger income from $12,000 to $53,000 is, therefore, due less to the introduction of electricity than to the increase of mileage and population served. It is significant, however, that the passenger income per mile of street was $4,200 in 1892 as against $3,500 in 1890, a very satisfactory result, and one which shows that the mileage has not been unduly pushed. The fact that the operating expenses have absorbed practically all of the passenger income would be surprising were it not that 1891–92 was the year of reconstruction, and the passenger income is probably less and the operating expenses more proportionately than will be the case in the following year. The capital liabilities given are very small, but have been increased in 1893 to $550,000, or at the rate of $25,000 per mile of track, which is overcapitalization of costs to a moderate extent.

Case No. 10 serves a small manufacturing city in the East, of little value as a street railway town, although its passenger income is large for but three miles of track. The net earnings are partly due to the sale of electric power for small factories. The railway, lighting and power accounts are so mixed up that it is impossible to determine the operating expenses of the railway plant alone.

Case No. 12 shows the results of electrical equipment without increase of mileage. The passenger income has increased about 50 per cent., due largely to the fact that the car service has been nearly doubled. The passenger income per car mile is about 25 per cent. less than with horses, and the passenger income per capita has risen from $0.89 to $1.27. The net earnings with electric operation show a return of over 6 per cent. on a capitalization of $12,500 per mile. This return is small for the first year of electric operation, and it is probable that the surplus will be more than wiped out as the maintenance charges increase.

Case No. 28 serves a prosperous manufacturing city. A consolidation of the street railway and electric light companies was made in this city, and the joint enterprise was heavily capitalized, the railway standing at $67,300 per mile of track. The mileage has been doubled, the car service greatly increased, and the passenger income is nearly quadrupled. The net earnings (due in part to sale of power by contract with the electric light company) were sufficient to show 4.5 per cent. return on the excessive capitalization, but the financial depression of 1893 caused the factories in this town to shut down, and the receipts decreased to such an extent that the road has passed into the hands of a receiver.

*By census of 1890 in all cases.

Case No. 37 shows unusual earnings in 1892. It serves a prosperous manufacturing city, whose operatives receive high wages. The road was operated by horses prior to 1890, but operation was suspended in 1890 owing to certain accidents. This is a remarkable case, the full meaning of which is not evident from the statistics, nor is it known to me.

Case No. 38 is in a small manufacturing city in the East which can barely support a street railway system of any kind. The city has grown but little for the past ten years, and is off the main lines of travel. The introduction of electricity has increased the passenger income by about 200 per cent., and the operating expenses about 100 per cent., the net earnings being apparently very fair. The capitalization per mile is excessive, however, and it is doubtful if the road will be permanently profitable.

Case No. 44 serves a quiet fishing town on the coast, with some popularity as a summer resort. The introduction of electricity has been accompanied by an increase of about 50 per cent. in track and car mileage, and the passenger income is increased in about the same proportion; the passenger income per mile of street, however, shows a slight falling off, but will doubtless increase again, while that per car mile is very closely the same as with horses. The percentage of operating expenses to passenger income is radically reduced, and the net income indicates a return of 7 per cent. on a capitalization of $28,000 per mile as against 4 per cent. on $19,000 with horse operation.

ITEM.	1890. Horse.	1890. Electric.	1892. Horse.	1892. Electric.
MILES OF TRACK.				
No. of miles operated	247	42	128	322
CAPITAL LIABILITIES PER MILE OF TRACK.				
No. of miles not reporting	..	...	55	30
" " capitalized at less than $5,000	5	....	....	....
" " " at from $ 5,000 to $ 10,000	40	7	...	28
" " " " 10,000 " 15,000	62	16	20	14
" " " " 15,000 " 20,000	41	6	10	64
" " " " 20,000 " 30,000	72	13	24	63
" " " " 30,000 " 40,000	13	....	18	62
" " " " 40,000 " 50,000	...	....	....	13
" " " " 50,000 " 75,000	14	....	....	55
" " " " 75,000 " 100,000	....	....	....	....
" " " over $100,000	....	...	....	3
POPULATION SERVED PER MILE OF STREET.				
No. of roads not reporting	1	....	9	17
" " serving less than 1,000 inhabit. per mile of street.	....	....	....	....
" " " from 1,000 to 2,000 " " "	7	1	....	3
" " " " 2,000 " 3,000 " " "	7	1	3	....
" " " " 3,000 " 4,000 " " "	4	1	2	1
" " " " 4,000 " 5,000 " " "	11	2	2	4
" " " " 5,000 " 6,000 " " "	4	....	1	2
" " " " 6,000 " 8,000 " " "	5	....	2	....
" " " " 8,000 " 10,000 " " "	....	....	....	....
" " " over 10,000 " " "	3	....	....	....
CAR MILEAGE PER CAPITA.				
No. of roads not reporting	15	1	19	21
" " giving a service of less than 5 car miles per capita.	2	1	....	2
" " " " of from 5 to 10 " " "	14	2	1	2
" " " " " 10 " 15 " " "	6	....	....	....
" " " " " 15 " 20 " " "	4	....	....	....
" " " " " 20 " 25 " " "	1	....	....	....
" " " " over 25 " " "	1	....	1	....
PASSENGER INCOME.				
No of roads not reporting	1	...	10	16
" " earning less than $10,000 gross per annum	5	....	1	..
" " " from $10,000 to $15,000 gross per annum	7	....	....	....
" " " " 15,000 " 20,000 " " "	9	1	3	1
" " " " 20,000 " 25,000 " " "	6	1	2	2
" " " " 25,000 " 30,000 " " "	2		2	2
" " " " 30,000 " 35,000 " " "	4	3	1	....
" " " " 35,000 " 40,000 " " "	2	...	....	1
" " " " 40,000 " 50,000 " " "	5	...	....	1
" " " over $50,000 " " "	1	...	1	3
PASSENGER INCOME PER MILE OF STREET.				
No. of roads not reporting	1		11	15
" " earning less than $1,000 per mile of street	1	..	1	....
" " " from $1,000 to $ 2,000 per mile of street	3		....	....
" " " " 2,000 " 3,000 " " "	7	1	1	....
" " " " 3,000 " 4,000 " " "	11	1	2	2
" " " " 4,000 " 5,000 " " "	8	1	2	2
" " " " 5,000 " 7,500 " " "	8	2	2	4
" " " " 7,500 " 10,000 " " "	1	....	1	2
" " " over $10,000 " " "	2	....	1	..
PASSENGER INCOME PER CAR MILE				
No of roads not reporting	14	1	19	22
" " earning less than 10 cents per car mile	9	1	....	....
" " " from 10 to 15 " " "	10	.	....	....
" " " " 15 " 20 " " "	3	1	....	....
" " " " 20 " 25 " " "	1	....	...	1
" " " " 25 " 30 " " "	1	1	....	3
" " " " 30 " 35 " " "	2	1	1	....
" " " " 35 " 40 " " "	2	....	....	....
" " " over 40 " " "	....	....	....	....

ITEM.	1890. Horse.	1890. Electric.	1892. Horse.	1892. Electric.
PASSENGER INCOME PER CAPITA.				
No. of roads not reporting	1		10	16
" " earning less than $ 50 per capita	4	...	1	...
" " " from $ 50 to $ .75 per capita	8	....	....	..
" " " " .75 " 1.00 "	8	....	4	1
" " " " 1.00 " 1.25 "	6	2	2	1
" " " " 1.25 " 1.50 "	5	1	1	3
" " " " 1.50 " 1.75 "	....	....	....	....
" " " " 1.75 " 2.00 "	5	2	1	....
" " " " 2.00 " 2.50 "	3	...	....	2
" " " " 2.50 " 3.00 "	2	...	1	1
" " " over $3.00 "	....		..	2
OPERATING EXPENSES PER CAR MILE.				
No. of roads not reporting	14	1	19	22
" " operating at less than 10 cents per car mile	10	2	..	....
" " " from 10 to 15 cents per car mile	10	1	...	..
" " " " 15 " 20 " "	3	1	....	2
" " " " 20 " 25 " "	1	1	....	2
" " " " 25 " 30 " "	1		1	....
" " " " 30 " 35 " "	1		....	....
" " " over 35 " "	1	...	..	..
PERCENTAGE OF OPERATING EXPENSES.				
No. of roads not reporting	1	..	11	18
" " operating at less than 60 % of pass. income	3	....	....	1
" " " from 60 to 70 % of pass income	4	1	1	1
" " " " 70 " 80 % " "	7	1	1	3
" " " " 80 " 90 % " "	8	2	2	2
" " " " 90 " 100 % " "	10	..	3	1
" " " over 100 % " "	9	1	2	....
NET EARNINGS.				
No of roads not reporting	1		10	16
" " showing a loss from operation	7	1	2	....
" " earning less than $1,000 net	7		2	....
" " " from $1,000 to $ 2,000 net	4		2	1
" " " " 2,000 " 3,000 "	3	1	....	1
" " " " 3,000 " 4,000 "	3	1	1	....
" " " " 4,000 " 5,000 "	2	....	....	....
" " " " 5,000 " 7,500 "	6	....	1	3
" " " " 7,500 " 10,000 "	4	....	1	....
" " " over $10,000 "	6	1	1	5
PERCENTAGE OF NET EARNINGS TO CAPITAL LIABILITIES.				
No. of roads not reporting	2	...	11	16
" " earning nothing on capital liabilities	7	1	2	....
" " " less than 1 % on capital liabilities	4	....	1	1
" " " from 1 to 2 % on capital liabilities	2	....	....	..
" " " " 2 " 3 % " "	4	...	2	2
" " " " 3 " 4 % " "	5	....	1	..
" " " " 4 " 5 % " "	2	..	....	2
" " " " 5 " 10 % " "	9	3	1	4
" " " " 10 " 15 % " "	6	1	2	1
" " " over 15 % " "	1		....	....

The condensation on this page of the principal information to be obtained from the Table of Statistics will repay careful study in spite of the great irregularity in results. With full knowledge of, and allowance for the imperfections of the tables, and in the added light of experience drawn from other sources, we are brought to the following general conclusions concerning the financial outlook for the roads in this class:

1. A large majority are capitalized at from two to three times the *present* cost of duplicating their tangible assets. This has been done by several methods, one of which has been already described, that of purchasing apparatus and equipment at the high prices of early days, and for bonds. Other methods of overcapitalization will be referred to in more detail in later papers.

2. A majority of the roads are, and will probably be in future unable to permanently earn the interest on their mortgage indebtedness. This conclusion is not wholly justified by the tables alone, since it would appear that many of the roads there shown have no trouble as yet in meeting fixed charges, while others, though less successful, have not been in operation by electricity long enough to derive the full benefit of the change. Nevertheless, when we remember that the charges for maintenance will increase from year to year as the new track and equipment wear out in service, and when we realize how small are

TABLE I.—AMERICAN STREET RAILWAY SYSTEMS

PART I.—STATISTICS OF CAPITALIZATION.

See "Intrinsic Value of Street Railway Investments" Horse Railways are given in Roman figures.

Case Number	Miles of Track					Miles of Street	Capital Stock			Funded Debt			Capital Liabilities			Floating Debt		Case Number
	Horse	Electric	Cable	Miscel.	Total		Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Memo.	
A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T
1	3.4				3.4	3.2	50,000	14,700	3.30	25,000	7,400	1.70	75,000	22,100	5.00	5,160	Net.	1
	3.4				3.4	3.3	50,000	14,700	3.30	25,000	7,400	1.70	75,000	22,100	5.00	7,401	"	
2	6.7				6.7	z 6.7	50,000	7,500	3.30	125,000	18,700	8.30	175,000	26,200	11.70	30,164	"	2
	6.7				6.7	z 6.7	50,000	7,500	3.30	125,000	18,700	8.30	175,000	26,200	11.70	47,110	"	
3		7.0			7.0	6.0	41,200	5,900	2.60	18,500	2,600	1.20	59,700	8,500	3.70	74,546	B. P.	3
		17.0			17.0		300,000	17,700	18.80	175,000	10,300	10.90	475,000	28,000	29.70			
4		4.5			4.5	4.0	50,000	11,100	3.10				50,000	11,100	3.10			4
		7.0			7.0													
5	3.5				3.5	3.0	35,000	10,000	2.20	25,000	7,100	1.60	60,000	17,100	3.80	14 928	Net.	5
	3.5				3.5	3.0												
6	4.0				4.0	3.4	100,000	25,000	6.30	25,000	6,300	1.60	125,000	31,300	7.80	1,315	"	6
	14.3				14.3	12.5	100,000	7,000	6.30	25,000	1,700	1.60	125 000	8,700	7.80	973	"	
7	8.8				8.8	8.5	60,000	6,800	3.80				60,000	6,800	3.80			7
	11.0				11.0		60,000	5,500	3.80	100,000	9,100	6.30	160,000	14,500	10.00			
8	4.0			11.0	15.0	z 15.0	300,000	20,000	18.80	20,000	1,300	1.30	320,000	21,300	20.00			8
	23.0				23.0		300,000	13,000	18.80	200,000	8,700	12.50	500,000	21,700	31.30			
9	4.0				4.0	3.5	80 050	20,000	5.00	33,100	8,300	2.10	113,150	28,300	7.10			9
	7.0				7.0		92,500	13,200	5.80	52,000	7,400	3.30	144,500	20,700	9.10			
10	1.6				1.6	z 1.6	15,000	9,400	.90				15,000	9,400	.90			10
	3.0				3.0	z 3.0	250,000	83,300	14.70	170,000	56,700	10.00	420,000	140,000	24.70	11,207	Net.	
11	5.0			11.0	16.0	z 16.0	25,000	1,600	1.50	76,500	4,800	4.50	101,500	6,400	6.00	20,600	B. P.	11
	5.0	3.3		12.0	20.3													
12	3.6				3.6	3.3	43,110	12,000	2.50				43 110	12,000	2.50	12,758	Net.	12
	3.2				3.2	3.0	40,000	12,500	2.40				40,000	12,500	2.40	1,064	"	
13	11.7				11.7	9.9	135,500	11,600	8.00				135,500	11,600	8.00	3,500	B. P.	13
	13.5				13.5													
14	5.0				5.0	4.2	66,000	13,200	3.30	30,000	6,000	1.50	96,000	19,200	4.80			14
	6.5				6.5													
15		11.7			11.7	11.2	122,200	10,400	7.20				122,200	10,400	7.20	21,133	Net.	15
		13.4			13.4	12.8	132,200	9,900	7.80				132,200	9,900	7.80	55 203	"	
16	4.5				4.5	z 4.5	30,000	6,700	1.80				30,000	6,700	1.80			16
	5.5				5.5													
17	4.0				4.0	3.5	50,000	12,500	2.80				50,000	12,500	2.80	30,000	B. P.	17
	3.5				3.5													
18	5.0				5.0	4.0	65,000	13,000	3.60				65,000	13,000	3.60			18
	17.8				17.8		199,000	11,200	11.10	71,500	4,000	4.00	270,500	15,200	15.10			
19	4.8				4.8	z 4.8	37,500	7,800	2.10				37,500	7,800	2.10			19
	4.0				4.0													
20		4.2			4.2	z 4.2	98,100	23,400	5.20				98,100	23,400	5.20	56 500	Net.	20
		4.2			4.2	z 4.2	100,000	23 800	5.30	50,000	11,900	2.60	150,000	35,700	7.90	1,200	"	
21	4.9				4.9	3.9	20,000	4,100	1.10				20,000	4,100	1.10	45.614	B. P.	21
	9.5				9.5													
22	2.9				2.9	2.6	100,000	34,500	5.30				100,000	34,500	5.30	2,000		22
	4.0				4.0	3.6	100,000	25,000	5.30	25,000	6,250	1.30	125,000	31,250	6.60	3,506		
23	6.0				6.0	5.2	42,500	7,100	2.10				42,500	7,100	2.10			23
	18.0				18.0		300,000	16,700	15.00	300,000	16,700	15.00	600,000	33,300	30.00			
24	7.6				7.6	7.3	100,000	13,200	5.00				100,000	13,200	5.00	s 8,691	Net.	24
	10.0				10.0	9.5	190,000	19,000	9.50				190,000	19,000	9.50			
25	14.0				14.0	11.0	600,000	42,900	30.00	400,000	28 600	20.00	1,000,000	71,400	50.00			25
	11.0				11.0	10.5	600 000	54,500	30.00	200,000	18,200	10.00	800,000	72,700	40.00			
26	7.4				7.4	7.0	93,935	12,700	4.70				93,935	12,700	4.70	9,000	B. P.	26
	7.4				7.4	7.0	93 960	12,700	4.70				93,960	12,700	4.70	9,950	"	
27	3.4				3.4	3.3	21,434	6,300	1.10				21,434	6,300	1.10			27
	10.5				10.5													
28	2.3				2.3	2.0	25,000	10,900	1.30	30,000	13,000	1.50	55,000	23,900	2.80	16,908	Net.	28
	5.2				5.2	4.5	300,000	57,700	15.00	50,000	9,600	2.50	350,000	67,300	17.50	s 46,419	"	

s. Current assets exceed current liabilities. z. Approximate.

SERVING FROM 15,000 TO 25,000 POPULATION.

PART II.—STATISTICS OF OPERATION.

Electric, Cable and Steam Railways are given in italics.

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Case Number	Population Served	Area Served	Population Per Mile Street	Population Per Square Mile	Year Ending	Car Mileage Total	Car Mileage Per Capita	Passenger Income Total	Passenger Income Per Mile Street	Passenger Income Per Car Mile	Passenger Income Per Capita	Operating Expenses Total	Operating Expenses Per Car Mile	Operating Expenses % Passenger Income	Net Earnings Total	Net Earnings Per Car Mile	Net Earnings % Passenger Income	Net Earnings % Cap. Liab.	Case Number
a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u
1	15,000	....	4,700	.....	9-30-1890	67,102	4.5	21,531	6,700	.320	1.43	21,436	.319	99.5	1,301	.019	6.1	1.7	1
	15,000	....	4,500	.....	9-30-1892	92,330	6.2	27,995	8,500	.303	1.87	24,375	.264	87.1	5,003	.054	17.9	6.7	
2	15,000	....	2,200	.....	6-30-1890	.....	.....	15,087	2,300	....	1.01	14,004	....	92.7	1,083	....	7.2	.6	2
	15,000	....	2,200	.....	6-30-1892	.....	.....	a 4,152	600	....	.28	4,832	....	116.4	d 268	.....	.....	.....	
3	*16,000*	....	*2,700*	.....	*6-30-1890*	*428,500*	*26.8*	*31,661*	*5,300*	*.074*	*1.98*	*28,477*	*.066*	*89.9*	*3,184*	*.007*	*10.1*	*5.3*	3
	16,000	....	.....	.....	*11- 1892*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
4	*16,000*	....	*4,000*	.....	*6-30-1890*	*100,000*	*6.3*	*16,053*	*4,000*	*.161*	*1.01*	*13,509*	*.135*	*83.8*	*2 544*	*.025*	*15.7*	*5.1*	4
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
5	16,000	....	5,300	.....	6-30-1890	122,027	7.6	9,259	3,100	.076	.58	14,983	.123	161.7	d 5,705	.....	.....	.....	5
	.....	....	.....	.....	.....	b	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
6	16,000	....	4,700	.....	6-30-1890	.....	.....	11,761	3,500	....	.74	9,093	....	77.0	3,041	....	25.8	2.4	6
	16,000	....	*1,300*	.....	*6-30-1892*	.....	.....	*52,678*	*4,200*	....	*3.30*	*52.275*	....	*99.2*	*1,066*	....	*2.0*	*.8*	
7	16,000	....	1,900	.....	6-30-1890	201,845	12.6	34,596	4,100	.171	2.16	27,867	.138	80.6	7,306	.036	21.1	12.2	7
	16,000	....	.....	.....	*6- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
8	*16,000*	....	*1,100*	.....	*6-30-1890*	*118.395*	*7.4*	*17,621*	*1,200*	*.149*	*1.10*	*20,239*	*.171*	*114.7*	d *1,957*	.....	.....	.....	8
	16,000	....	.....	.....	*6- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
9	16,000	....	4,600	.....	6-30-1890	118,344	7.4	10,084	2,900	.085	.63	14,180	.120	139.6	d 4,008	.....	.....	.....	9
	16,000	....	.....	.....	11- 1893	.....	.....	.....	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	
10	17,000	....	10,600	.....	6-30-1890	.....	.....	5,082	3,200	....	.30	3,397	....	66.9	685	....	13.5	4.6	10
	17,000	....	*5.700*	.....	*6-30-1892*	.....	.....	c *22,755*	*7,600*	....	*1.34*	e	.....	.....	*11,476*	.....	.....	*2.7*	
11	*17,000*	....	*1,100*	.....	*6-30-1890*	*324,860*	*19.1*	*30,241*	*1,900*	*.093*	*1.78*	*34,310*	*.106*	*113.5*	*345*	....	*1.1*	*.3*	11
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
12	17,000	....	5,200	.....	9-30-1890	40,424	2.4	15.236	4,600	.376	.89	14,898	.369	98.0	794	.020	5.2	1.8	12
	17,000	....	*5,700*	....	*9-30-1892*	*78,794*	*4.6*	*21,613*	*7,200*	*.274*	*1.27*	*19,357*	*.246*	*89.8*	*2.556*	*.033*	*11.9*	*6.4*	
13	17,000	....	1,700	.....	6-30-1890	503,230	29.6	48,645	4,900	.097	2.86	49,820	.099	102.4	d 263	.....	.....	.....	13
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
14	17,000	....	4,800	.....	6-30-1890	121,180	6.1	37,749	9,000	.312	1.88	33,089	.273	87.8	5,676	.047	15.1	5.9	14
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
15	*17,000*	....	*1,500*	.....	*9-30-1890*	*103,697*	*6.1*	*32,420*	*2,900*	*.312*	*1.91*	*23,781*	*.229*	*73.5*	*8,498*	*.082*	*26.2*	*7.0*	15
	17,000	....	*1,300*	.....	*9-30-1892*	*153,198*	*9.0*	*42 711*	*3 300*	*.279*	*2.51*	*37.823*	*.248*	*88.5*	*6,081*	*.040*	*14.2*	*4.6*	
16	17,000	....	3,800	.....	6-30-1890	113,880	6.7	16,450	3,700	.145	.97	15,710	.138	95.2	990	.009	6.0	3.3	16
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
17	18,000	....	5,100	.....	6-30-1890	255,500	14.2	36,010	10,300	.141	2.00	31,081	.122	86.4	5,694	.022	15.8	11.4	17
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
18	18,000	....	4,500	.....	12-31-1890	128,589	7.2	12,384	3,100	.096	.69	10,750	.084	87.1	1,659	.013	13.4	2.6	18
	18,000	....	.....	.....	*2- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
19	18,000	....	3 700	.....	6-30-1890	.....	.....	13,626	2,800	....	.76	8,183	....	60.1	5,443	....	40.0	14.5	19
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
20	*19,000*	....	*4 500*	.....	*6-30-1890*	.....	.....	*23,867*	*5 700*	....	*1.26*	*27,391*	....	*114.6*	d *2,088*	.....	.....	.....	20
	19,000	....	*4.500*	.....	*6-30-1892*	.....	.....	*39.510*	*9,400*	....	*2.08*	*28,254*	....	*71.6*	*11,822*	....	*29.7*	*7.9*	
21	19,000	....	4,900	.....	9-30-1890	138,860	7.3	21,749	5,600	.157	1.14	20,210	.145	93.1	2,569	.018	11.8	12.8	21
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
22	19,000	....	7,300	.....	12-31-1890	.....	.....	2,440	940	....	.13	2.955	....	121.3	d 501	.....	.....	.....	22
	19,000	....	5 300	.....	12-31-1892	.....	.....	17,628	4,900	....	.93	f 17,738	.....	.....	f 186	.....	.....	.....	
23	20,000	....	3,800	.....	6-30-1890	120,450	6.0	13,860	2,700	.115	.70	10.120	.084	72.6	3,740	.003	26.9	8.8	23
	20,000	....	.....	.....	*5- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
24	20,000	....	2,700	.....	6-30-1890	202,027	10.1	49,238	6,700	.244	2.46	33,730	.167	68.5	16,194	.080	32.9	16.2	24
	20,000	....	2.100	.....	6-30-1892	.....	.....	53,337	5,600	....	2.67	32,599	....	61.2	22,107	....	41.5	11.6	
25	20,000	....	1,800	.....	6-30-1890	102 200	5.1	40,890	3.700	.400	2.04	17,479	.172	42.8	23,411	.023	57.3	2.3	25
	20,000	....	.....	.....	*8- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
26	20,000	...	2,900	.....	6-30-1890	150,380	7.5	20,378	2,900	.136	1.02	21,769	.145	107.0	d 6	.....	.....	.....	26
	20,000	....	2,900	.....	6-30-1892	.....	.....	19,135	2 700	....	.96	20,742	....	108.0	d 517	.....	.....	.....	
27	20,000	....	6,200	.....	6-30-1890	115.933	5.8	14,254	4,400	.123	.72	11,559	.100	81.1	2,695	.023	18.8	12.6	27
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
28	20,000	....	10,000	.....	6-30-1890	.....	.....	8,515	4,300	....	.43	9,697	....	114.0	i 992	.....	.....	.....	28
	20,000	....	*4,400*	.....	*6-30-1892*	.....	.....	*28,742*	*6,400*	....	*1 44*	.....	.....	.....	g *15 941*	.....	.....	*4.5*	

a. Service rapidly deteriorating. b. Operation suspended January 1, 1891, owing to growing deficiencies. c. Plus $20,546 from sale of current.
d. Deficiency. e. Operating expenses due to railway business cannot be separated from total. f. "Operating Expenses" include interest on funded debt. "Net Earnings" are applicable to returns on capital stock. g. Including $16,090 from sale of current.

TABLE I.—AMERICAN STREET RAILWAY SYSTEMS

PART I.—STATISTICS OF CAPITALIZATION.

See "Intrinsic Value of Street Railway Investments."

Horse Railways are given in Roman figures.

Case Number	Miles of Track					Miles of Street	Capital Stock			Funded Debt			Capital Liabilities			Floating Debt		Case Number
	Horse	Electric	Cable	Miscel.	Total		Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Memo.	
A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T
29	5.5				5.5	5.0	58,000	10,500	2.80	58,000	10,500	2.80	116,000	21,000	5.50			29
		5.5			5.5													
30	8.5				8.5	7.5	30,000	3.500	1.40	136,000	16,000	6.50	166,000	19,500	7.90			30
31	3.0				3.0	2.8	50,000	16,700	2.40	31,000	10,300	1.50	81,000	27,000	3.90	s 6,420	Net.	31
	3.0				3.0	2.8	50,000	16,700	2.40	31,000	10.300	1.50	81,000	27.000	3.90	s 6,892	"	
32	8.0				8.0	4.5	100,000	12,500	4.80				100,000	12,500	4.80			32
		15.0			15.0		100,000	6,700	4.80	200,000	13,300	9.50	300,000	20.000	14.30			
33	5.3				5.3	i 5.3	24,000	4,500	1.10	59,000	11,100	2.80	83,000	15,700	4.00	2,452	Net.	33
	6.6				6.6	6.4	24,000	3,600	1.10	59,000	8,900	2.80	83.000	12.600	4.00	16,266	"	
34	3.8				3.8	3.0	50,000	13.300	2.40				50,000	13,300	2.40			34
		8.0			8.0		200,000	25,000	9.50	180,000	22.500	8.60	380,000	47 500	18.10			
35	5.4				5.4	5.0	52,540	9,700	2.50				52,540	9,700	2.50	20,000	Net.	35
	5.9				5.9	5.5	85,700	14,400	4.10				85,700	14,400	4.10	8,300	"	
36	8.5	8.5			17.0	i 17.0	200,000	11,800	9.10	200,000	11,800	9.10	400,000	23,500	18.20			36
	9.5	4.5			14.0		200,000	14,300	9.10	250,000	17,800	11.40	450,000	32,100	20.50			
37							100,000		4.60				100,000		4.60	105,460	B. P.	37
		i 14.0			i 14.0	i 14.0	137,500	9,900	6.30	197,000	14 100	9.00	334.500	24.000	15.20	23.932	"	
38	2.0				2.0	i 2.0	20,000	10,000	.90	7 500	3,800	.30	27,500	13 800	1.30	s 297	Net.	38
		5.3			5.3	4.7	125,000	23,600	5.70	112 500	21,200	5.10	237.500	44 900	10.80	s 1,452	"	
39	8.6				8.6	7.8	120.000	14,000	5.50	80.000	9.300	3.60	200,000	23,300	9.10			39
		17.0			17.0		550,000	32,400	25.00	550,000	32.400	25.00	1,100,000	64,700	50.00			
40	4.3				4.3	3.3	77,955	18,100	3.60	12,000	2,800	.60	89,955	20,900	4.10	s 3,058	Net.	40
	4.3				4.3	3.3	79,673	18,500	3.60	12,000	2,800	.60	91,673	21,300	4.20	s 2,715	"	
41	9.0				9.0	8.0	75,000	8,300	3.30	30,000	3,300	1.30	105 000	11,700	4.60			41
	8.3				8.3													
42	4.8				4.8	i 4.8	40,000	8,300	1.70	100,000	20,800	4.40	140,000	29,200	6.10	44,205	Net.	42
	4.8				4.8	i 4.8	40,000	8,300	1.70	150,000	31,300	6.50	190 000	39,600	8.30	9.168	"	
43	6.3				6.3	4.5	150,000	23.800	6.30	40,108	6,400	1.70	190,108	30,100	7.50	15,000	B. P.	43
		25.2			25.2		207,000	8,200	8.60	220.000	8.700	9.20	427,000	16,900	17.80			
44	5.4				5.4	5.0	60,000	11,000	7.40	43.000	8,000	1.70	103.000	19,100	4.10	s 1,162	Net.	44
		8.6			8.6	8.1	180,000	20,900	7.20	60,000	7,000	2.40	240 000	27,900	9.60	30,225	"	
45	13.5				13.5	12.0	232,000	17,200	9.30				232,000	17,200	9.30			45
		25.0			25.0		500.000	20,000	20.00	500,000	20,000	20.00	1,000 000	40,000	40.00			
46		6.2			6.2	6.0	50,000	8,100	2.00	50,000	8,100	2.00	100,000	16,100	4.00	27,030	Net.	46
		6.2			6.2	6.0	50,000	8,100	2.00	50,000	8,100	2.00	100,000	16,100	4.00	24 865	"	
47	17.3				17.3	16.3	163,000	9,400	6.50	188,500	10 900	7.60	351,500	20,300	14.10			47
		22.0			22.0		750,000	34,100	30.00	650,000	29 500	26.00	1,400,000	63,600	56.00			

i. Approximate. s. Current assets exceed current liabilities.

the totals of net earnings, we cannot but fear that the latter will gradually dwindle to the point of disappearance.

3. Few of the entire number will be able to earn a 5 per cent. dividend on their capital stock after meeting true operating expenses and fixed charges.

4. None of the securities are worth the consideration as investments of other than local capitalists, who may be able to give personal time and care to the management of the properties.

THE TABLE OF STATISTICS.

The Tables of Statistics which accompany these papers cannot be made complete nor wholly satisfactory. The frequent refusal of street railway managers to furnish information, even for anonymous use, is not unnatural, although it is doubtless a mere matter of time before the recognized right of the public to have knowledge of the profits derived from municipal franchises will be exercised in all our states as it now is in several of the East. The figures given in the table are obtained chiefly from official sources, and are believed to be as nearly correct as can be expected where such great differences in bookkeeping methods exist. Nearly all of these official returns are given under oath, which does not always prevent, however, careless or intentional misstatements. This can only be detected by most careful inspection and comparisons of balance sheets from year to year, and I have been under the necessity of rejecting many cases otherwise highly interesting. The figures finally admitted to the tables are believed to be reliable, except as to the items of "operating expenses" and "net income." In these, the soundness or honesty of the various methods of distributing expenditures, particularly where "construction accounts" exist, is by no means guaranteed. It may be said in this connection that the uniform system of accounting prescribed for street railways in Massachusetts by the Board of Railroad Commissioners has, for many years past, secured returns whose substantial correctness is hardly open to question. The New York returns also, though less perfect in some details, are nearly as reliable as those of Massachusetts. Those of Maine and Rhode Island are believed to be honest, but, being given in much less detail, discrepancies cannot be so readily detected. The published returns of Pennsylvania are arranged in such a way as to be in the highest degree chaotic, inconsistent and misleading, and those of

SERVING FROM 15,000 TO 25,000 POPULATION. (*Continued.*)

PART II.—STATISTICS OF OPERATION.

Electric, Cable and Steam Railways are given in italics.

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Case Number	Population Served	Area	Population Per Mile Street	Population Per Square Mile	Year Ending	Car Mileage Total	Car Mileage Per Capita	Passenger Income Total	Passenger Income Per Mile Street	Passenger Income Per Car Mile	Passenger Income Per Capita	Operating Expenses Total.	Operating Expenses Per Car Mile	Operating Expenses % Passenger Income	Net Earnings Total	Net Earnings Per Car Mile	Net Earnings % Passenger Income	Net Earnings % Cap. Liab.	Case Number
a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u
29	21,000	....	4,200	.....	6-30-1890	351,350	16.7	18,700	3,700	.053	.89	10,670	.030	57.2	8,030	.023	42.7	6.9	29
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
30	21,000	....	2,800	.....	6-30-1890	373,125	17.8	26,713	3,600	.072	1.27	31,837	.085	119.1	h 8,016	....	30.0	4.8	30
	.....	....	.....	.....	.....	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
31	21,000	....	7,500	.....	6-30-1890	.....	.....	29,045	10,300	....	1.38	21,766	....	75.2	8,500	....	29.3	10.5	31
	21,000	....	7,500	.....	6-30-1892	.....	.....	30,977	11,100	....	1.48	23,644	....	76.1	8,162	....	26.3	10.1	
32	21,000	....	4,700	.....	6-30-1890	292,000	13.9	25,000	5,600	.086	1.20	19,575	.067	78.4	5,575	.019	22.3	5.6	32
	21,000	....	.....	.....	*8- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
33	21,000	....	4,000	.....	6-30-1890	.....	.....	17,912	3,400	....	.85	15,591	....	87.2	2,865	....	16.0	3.5	33
	21,000	....	3,300	.....	6-30-1892	.....	.....	25,826	4,000	....	1.23	24,343	....	94.2	1,787	....	6.9	2.2	
34	21,000	....	7,000	.....	6-30-1890	216,810	10.3	15,075	5,000	.070	.72	14,775	.068	98.0	1,815	.008	12.0	3.6	34
	21,000	....	.....	.....	*2- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
35	21,000	....	4,200	.....	6-30-1890	124,968	6.0	13,769	2,800	.110	.66	10,301	.082	74.6	3,505	.028	25.3	6.7	35
	21,000	....	3,800	.....	6-30-1892	.....	.....	19,933	3,600	....	.95	18,469	....	92.9	1,971	....	9.9	2.3	
36	22,000	....	1,300	.....	6-30-1890	.....	.....	30,399	1,800	....	1.38	16,936	....	55.6	13,463	....	44.4	3.4	36
	22,000	....	.....	.....	6- 1893	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
37	22,000	....	.....	.....	6-30-1890	.....	.....	k	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37
	22,000	....	*1,600*	.....	*6-30-1892*	.....	.....	*86,032*	*6,100*	....	*3.91*	*37,852*	....	*44.1*	o *48,200*	....	*56.0*	*14.4*	
38	22,000	....	11,000	.....	6-30-1890	.....	.....	6,494	3,200	....	.30	6,477	....	99.8	17	....	.3	....	38
	22,000	....	*4,700*	.....	*6-30-1892*	.....	.....	*17,740*	*3,800*	....	*.81*	*12,713*	....	*71.8*	*5,027*	....	*28.4*	*2.1*	
39	22,000	....	2,800	.....	6-30-1890	238,318	10.8	43,376	5,600	.182	1.97	26,896	.113	61.9	16,669	.070	38.5	8.4	39
	22,000	....	.....	.....	*6- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
40	22,000	....	6,700	.....	6-30-1890	.....	.....	16,955	5,200	....	.77	17,045	....	100.0	499	....	2.9	.6	40
	22,000	....	6,700	.....	6-30-1892	.....	.....	20,189	6,100	....	.92	17,277	....	85.6	3,341	....	16.5	3.6	
41	23,000	....	2,900	.....	6-30-1890	.....	.....	18,533	2,300	....	.80	13,129	....	70.8	5,615	....	30.4	5.4	41
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
42	23,000	....	4,800	.....	6-30-1890	.....	.....	24,795	5,200	....	1.08	24,493	....	98.8	302	....	1.2	.2	42
	23,000	....	4,800	.....	6-30-1892	.....	.....	24,188	5,000	....	1.05	24,059	....	99.6	417	....	1.7	.2	
43	24,000	....	5,300	.....	6-30-1890	197,100	8.2	22,577	5,000	.115	.94	18,537	.094	81.9	4,108	.021	18.2	2.2	43
	24,000	....	.....	.....	*12-31-1892*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
44	25,000	....	5 000	.....	9-30-1890	132,322	5.3	34,436	6,900	.261	1.38	31,280	.237	91.0	4,173	.032	12.1	4.0	44
	25,000	....	*3,100*	.....	*9-30-1892*	*189,834*	*7.6*	*52,431*	*6,500*	*.276*	*2.10*	*35,861*	*.189*	*68.5*	*16,834*	*.088*	*32.1*	*7.0*	
45	25,000	....	2,100	.....	6-30-1890	438,000	17.5	44,049	3,700	.101	1.76	38,912	.089	88.4	15,134	.034	34.3	6.5	45
	25,000	....	.....	.....	*11- 2-1892*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
46	*25,000*	....	*4,200*	.....	*9-30-1890*	*117,450*	*4.7*	*30,144*	*5,000*	*.258*	*1.21*	*19,479*	*.167*	*64.8*	*11,427*	*.097*	*37.9*	*11.4*	46
	25,000	....	*4,200*	.....	*9-30-1892*	*121,244*	*4.8*	*27,343*	*4,600*	*.226*	*1.09*	*21,375*	*.177*	*78.4*	*6,518*	*.054*	*23.9*	*6.5*	
47	25,000	....	1,500	.....	6-30-1890	558,450	22.3	74,781	4,500	.134	3.00	55,041	.099	73.5	20,054	.036	26.8	5.7	47
	25,000	....	.....	.....	*8- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	

h. Including $12,000 from rentals. k. Operation not commenced. o. From operation.

New Jersey are even more valueless, though for different reasons. The census investigations in charge of Henry C. Adams, from which many of the 1890 statistics in the present tables are taken, was admirably planned and patiently followed up by detailed correspondence. The results are the most complete of the kind in existence for the one year period covered. It is impossible, however, to be certain that the returns were correct, though as they were in nearly all cases signed by responsible officers of the roads, they are here presumed to be so.

The method of arranging the Table of Statistics is believed to be the best for present purposes. Street railway systems serving population centers of the same size are directly comparable and in practically the same years of operation. In many cases comparisons may be made between the operating year ending in 1890 (which marked the beginning of the recent era of street railway development), and the operating year ending in 1892. It should be noted that these street railway "cases" are frequently combinations of two or more independent companies operating within the same territorial limits. The exact method of making up the tables is described in detail as follows:

Column A. Case numbers. For reference.

Column B. Miles of track operated by horses (or mules), measured as single track including sidings.

Column C. Miles of track operated by electricity, measured as single track including sidings.

Column D. Miles of track operated by cable, measured as single track including sidings.

Column E. Miles of track operated by motive powers (chiefly steam dummies) other than horse, cable and electric, measured as single track including sidings.

Column F. Miles of track operated by all motive powers, measured as single track including sidings.

Column G. Miles of street containing track, equivalent to the miles of single track roadbed (not including sidings) plus the miles of double track roadbed.

Column H. Capital stock, actually issued and outstanding, not including treasury stock.

Column I. Capital stock per mile of track, $= \frac{H}{F}$; results carried to nearest $100.

Column K. Capital stock per capita population, $= \frac{H}{b}$; results carried to nearest $0.10.

Column L. Funded debt, actually incurred and on balance sheets;

includes mortgage bonds and (rarely) other secured indebtedness except collateral notes and subsidiary real estate mortgages, which are found in Column R.

Column M. Funded debt per mile of track, $= \frac{L}{F}$; results carried to nearest $100.

Column N. Funded debt per capita population, $= \frac{L}{b}$; results carried to nearest $0.10.

Column O. Capital liabilities, $= H + L$.

Column P. Capital liabilities per mile of track, $= \frac{O}{F}$; results carried to nearest $100.

Column Q. Capital liabilities per capita population, $= \frac{O}{b}$; results carried to nearest $0.10.

Column R. Floating debt, where marked "net" in Column S, consists of current liabilities in the balance sheet (bills and accounts payable, and miscellaneous items not protected by mortgage), less current assets (cash, bills and accounts receivable and miscellaneous items), the letter "S" signifying that the current assets exceed the current liabilities; when marked "B. P." or "B. A. P." in Column S, consists of bills payable, or bills and accounts payable respectively, without reference to offsets in current assets. Entire absence of figures signifies that the floating debt cannot be ascertained.

Column S. Memoranda concerning floating debt; see column R for explanation.

Column T. Case numbers; identical with column A.

Column a. Case numbers; identical with columns A and T.

Column b. Population served by the various street railway systems numbered; census of 1890 in all cases; suburbs included wherever it is known that they are served.

Column c. Area served in square miles; official census returns not yet issued.

Column d. Population per mile of street $= \frac{b}{G}$; results carried out to nearest 100.

Column e. Population per square mile $= \frac{b}{c}$; results carried out to nearest 100; official figures not yet obtainable.

Column f. Year for which operating report is made.

Column g. Car mileage made during operating year.

Column h. Car mileage per capita population, $= \frac{g}{b}$; results carried out to nearest 0.1; shows comparative service given by different systems, and has a bearing on gross receipts.

Column i. Passenger income for operating year; not including income from any source other than passengers.

Column k. Passenger income per mile of street, $= \frac{i}{G}$; results carried out to nearest $100.00.

Column l. Passenger income per car mile, $= \frac{i}{g}$; results carried out to nearest $0.001.

Column m. Passenger income per capita population, $= \frac{i}{b}$; results carried out to nearest $0.01.

Column n. Operating expenses; includes all charges properly distributed to the four accounts of "General Expenses," "Transportation," "Maintenance of Way and Structures" and "Maintenance of Equipment," together with taxes, state and local.

Column o. Operating expenses per car mile, $= \frac{n}{g}$; results carried out to nearest $0.001.

Column p. Percentage of operating expenses to passenger income, $= \frac{n}{i}$; results carried out to nearest 0.1 per cent.

Column q. Net earnings; the figures in this column are made up with great care after careful inspection of the respective profit and loss accounts; they represent the difference between passenger income (Column i) and operating expenses (Column n) plus miscellaneous income, such as car advertising, sales of by products, interest and dividends on treasury assets, rentals of track (which might also be credited to maintenance account in operating expenses), etc.; minus miscellaneous disbursements not chargeable to operation, such as interest on floating debt, rentals of track, etc.

Column r. Net earnings per car mile, $= \frac{q}{g}$; results carried out to nearest $0.001.

Column s. Percentage of net earnings to passenger income, $= \frac{q}{i}$; results carried out to nearest 0.1 per cent.

Column t. Percentage of net earnings to capital liabilities, $= \frac{q}{O}$; results carried out to nearest 0.1 per cent.

Column u. Case numbers; identical with columns A, T, a.

In all the calculations, three significant figures are used where the results are given with three or less significant figures, and four when required by the results.

When the motive power on one half or more of the track mileage is horse, Roman figures are used. When the motive power on more than one half the track mileage is electric, cable or steam, the figures are given in italics.

Curves and Turnouts for Electric Railways.

By F. A. Bryan.

Electric railroads have been so extended into the suburban districts during the last few years that, in the strict sense of the word, many can no longer be called street railways. In this extension steam road practice has to a certain degree been followed in the construction, but not to the extent that it should be. Too often do builders seem to think simply of getting the rails down irrespective of other factors. The general impression seems to be that because a car can go around a curve within a thirty-five foot radius, it ought easily to travel one with 150 ft. radius. This, of course, is the case, but, can we not, by reducing the curvature to a minimum, reduce the wear and tear, the needed power and the liability of derailment; and, above all, add to the comfort of the passengers, making our road more popular? Is not a sudden shock or jar to a dozen passengers holding to the straps as undesirable as it is on a steam road? The curvature on suburban roads should be of as small a degree as possible, but it is usually made up of fifteen to thirty degree curves, while a maximum on good steam roads in mountain districts is but ten degrees. Such

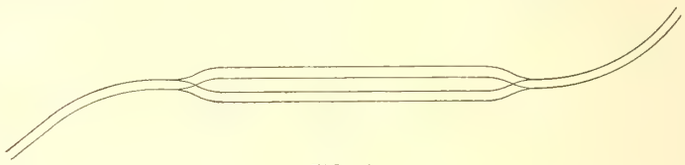


FIG. 1.

curves should always be spiraled, thereby blending insensibly together the tangent at one end and the curve at the other, and thus removing the sudden shock and jerk otherwise felt when a car enters a curve.

For some reason, probably on account of being more familiar with street roads proper, electric railway man-



FIG. 2.

agers and engineers seem to entertain the idea that for a single track road, the only desirable passing siding is the standard diamond turnout. Of course, on straight track in streets this is desirable, but in many cases on public roads, where the track is on the company's property, there

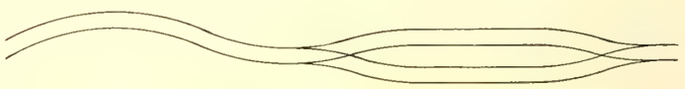


FIG. 3.

is seldom any reason for the use of such a turnout. The writer has several instances in mind where the engineer seems to have taken special pains to have diamond turnouts in locations such as shown in Fig. 1. Why should we not profit by the best steam road practice, and build a passing track similar to that shown in Fig. 2? In the

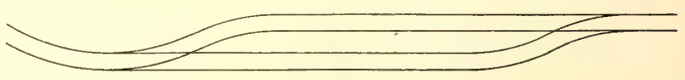


FIG. 4.

former we have six distinct curves, and in the latter but two. Then again, by having the outside track, or one with greater radius, irrespective of whether they pass to right or left, the trolley is not liable to jump at the switch, and we can take the siding at full speed, if desired.

Another instance is at a street corner where we have a reverse curve in order to obtain a greater radius. Here I have seen turnouts located as shown in Fig. 3. Why not use one as shown in Fig. 4, thereby not increasing the curvature any above what we have for single track?

Annual Report of the New York and Brooklyn Bridge Trustees.

The report of the trustees of the New York and Brooklyn Bridge for the year ending December 1, 1893, was submitted last month to the mayors of the cities of New York and Brooklyn. The following is an abstract of the report as relating to the cable railway. The receipts from tolls during the year amount to $1,252,908.04 divided as follows: Railroad, $1,167,497.65; carriageways, $85,410.39. Passengers carried by railroad numbered 42,615,105 and the income derived from this department shows an increase of $22,501.81 over that of the previous year.

The railroad fare is three cents or ten tickets for twenty-five cents.

The travel on the Bridge railway continued to increase until in August last, when for the first time during its operation the travel began to decrease, and has continued to do so up to the present time, but at a diminishing ratio. The number of passengers carried in October was 3,644,053, only 21,037, or about one-half of 1 per cent. greater than the number carried two years before, in October, 1891. The rate of increase and decrease of travel and its fluctuations at different periods of each year, from January 1, 1885, to November 19, 1893, are graphically represented by the diagram on this page, which is a continuation of that printed in the report of 1892. This, it will be noticed, is based upon the average number carried in consecutive periods of four weeks, and exhibits abrupt changes at different seasons, generally the maximum being in May and the minimum in August.

From the opening of the railway to the public use, September 24, 1883, to November 30, 1893, inclusive, a period of ten years and sixty-seven days, 304,875,286 passengers were carried. During any month, the greatest number transported was 4,033,920, in October, 1892, which included the week from the 8th to the 15th of the Columbian festival. The next greatest number was 3,846,493, in May of the current official year, an average of 124,080 per day. In one day of twenty-four hours, the maximum number carried was 223,625, on October 13, 1892, during the Columbian festival; the next greatest number was 166,403, on January 14; and the minimum number during the current official year was 45,280, on August 20.

Since the date of the last report the trains have been run with great regularity and few interruptions. The total time lost by delays, from all causes, was four hours thirty-five and a half minutes, an average of forty-five and a quarter seconds per day of twenty-four hours, or of one minute for 154,668 passengers carried. Of the total time lost by these delays, only 38 per cent. was due to a failure of or a defect in some of the several parts of the cable hauling machinery; the remaining 62 per cent. was due to accidents common in ordinary railroad transportation.

The grip mechanism has been even more reliable and trustworthy during the past year than ever before. Generally, since it was perfected and its operators became accustomed to its application, but little time has been lost in the movement of trains from its failure in any way to perform the service required of it. During the period covered by this report, from such failures altogether there were but seven delays, aggregating one hour and nine minutes, of the total thirty-seven delays from all causes whatever during the 7,300 hours the cable was in active operation.

The railway continues to supply extraordinarily safe transit for its passengers. Referring to this, the following from the preceding report is as true as when then written: "Of the large number carried since its opening to public use, no one in transit has been fatally injured. The principal accidents still are in the form of rear collisions at the stations, caused by an incoming train bringing up against a preceding one not hauled out from the platform in time. As the cars now in use are constructed, when such accidents occur there is little or no damage done to the cars, and the passengers are entirely safe from shock, as well as injury, if they are within the cars and seated."

For switching at the stations the trains hauled by cable, and for hauling the trains over the entire railway generally for the four hours each day, from one to five o'clock A. M., and at other occasional times when from any cause the cable is stopped, locomotives are used, for which until recently there were six, all of one type, each upon two pairs of driving wheels, and weighing when loaded twenty-two tons. These locomotives will haul trains of four cars over the switches and of two cars over the Bridge. They, however, in consequence of the neces sarily long wheel base and their lack of steadiness of movement, rapidly wear the rails and flanges when passing the curves of the switches and main tracks. To reduce in some measure this wear, as well as to provide greater facilities for hauling the trains, a locomotive of an entirely different design was recently procured, with the view, if its operation was found satisfactory, to adopt it as a type of the locomotives hereafter to be used. This locomotive was ordered in August and delivered in November last. It has four driving and four truck wheels, one pair of the latter being pivoted to and placed at each end of the locomotive frame. Its weight when loaded is thirty-four and a half tons. A test, preliminary to putting it in regular service, was made, showing that on dry rails and under favorable conditions, it can haul at cable speed (ten and a third miles per hour) a train of four cars partly loaded or a train of three cars fully loaded with passengers; that is, from eighty-five to 100 tons, this being up the steep grades of the Bridge, the maximum of which is 3¾ per cent., or 175 ft. to the mile. Its hauling capacity, therefore, is more than one-half greater than that of the locomotives previously in the service here.

It was stated in the report for the year ending December 1, 1891, that measures had been taken to double the facilities of the Bridge railway and in like proportion to lessen the discomfort of travel during the hours when the largest number of passengers are to be transported; general plans therefor were prepared, including a new and enlarged station in New York and one in Brooklyn, *an extension of the car storage yard from Concord to Tillary Street, a duplication of the cable driving plant, and other additions necessary to render the whole complete and effective. Of these during the year following the report, the elevated structure for the car storage yard was erected and the extension of the power house and boiler house had been previously finished. During the past year, the cable driving machinery, including a duplicate set of steam boilers has been erected. In obedience to the resolutions passed October 13, 1893, all work on the Brooklyn station has been suspended pending certain modifications in the plans.

It may be proper here to say that annoying and disappointing as are these continued delays in the accomplishment of the purpose of the trustees to as speedily as practicable increase the facilities of the railway, and to relieve its passengers from the crowding and disturbance consequent upon its present limited capacity, it is deemed wise to be certain that whatever may be finally done will best serve their purpose to these ends.

In September last, the attention of the trustees having been called to the ease and efficiency with which the Intramural Elevated Railway

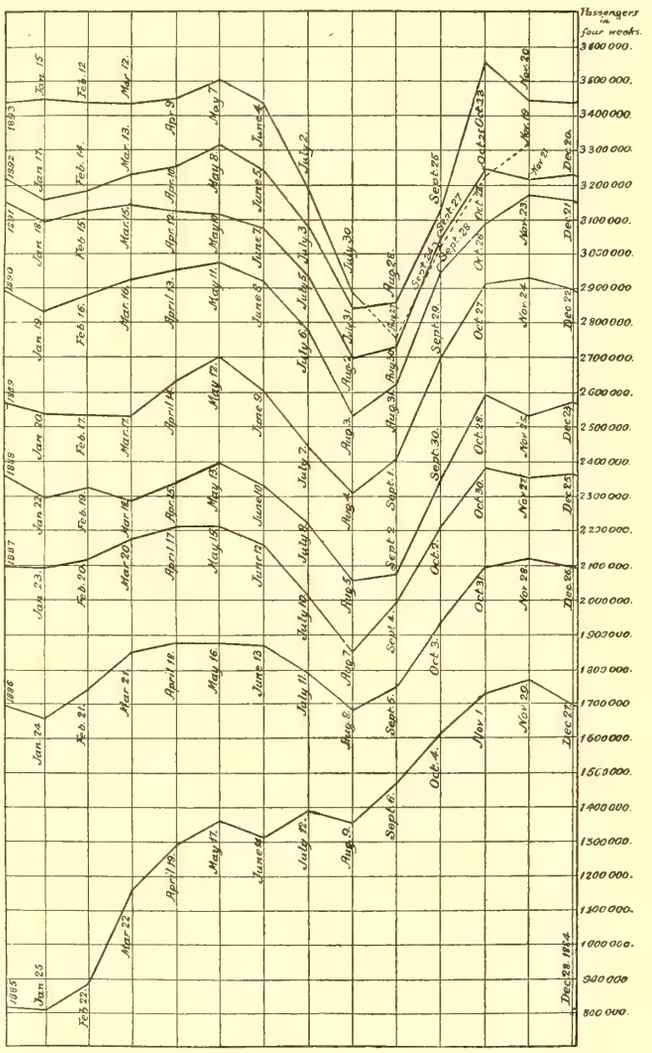


DIAGRAM SHOWING TRAFFIC ON NEW YORK & BROOKLYN BRIDGE CABLE RAILWAY.

on the grounds of the Columbian Exposition, at Chicago, was operated by electric motive power, they directed their engineers to make detailed examination of the same, with a view to determine whether it would be expedient to substitute electric for cable power on the Bridge railway. The report of the engineers has not been formally presented, in consequence of a delay in procuring certain required data as to equipment and cost. It, however, may be here stated that the results of their examination do not, in their opinion, justify at the present time a change, involving necessarily expensive and perhaps doubtful experiment before it will be established that such substitution is safe and economical. Possibly in the future, when the application of electricity to move frequent and heavy trains over steep slopes, under the conditions which govern the operation of the Bridge railway, is elsewhere fully developed, it may be desirable to again consider this matter.

In conclusion, the management desires to again testify to the faithfulness and efficiency with which the several employes have discharged their duties, sometimes at the risk of life and limb, and generally with an earnest desire to fully serve the public to its complete satisfaction and to their best ability.

*These plans were given in the STREET RAILWAY JOURNAL for April, 1893, p. 206 and for May 1893, p. 282.

Annual Report of the West End Street Railway Company.

The annual meeting of the stockholders of the West End Street Railway Company, of Boston, was held November 28. By the vote for directors the next board will be decidedly different from the old one. Six of the old board of fifteen retire. They are Isaac T. Burr, Prentiss Cummings, Joseph S. Fay, Jr., William Powell Mason, Dexter N. Richards and Nathaniel Thayer. The new members of the board are Alfred Bowditch, Francis L. Higginson, William Hooper, B. Rodman Weld and Alfred Winsor, all of Boston, and Samuel Spencer, of Drexel, Morgan & Company, of New York.

The sixth annual report of the company, being that for the twelve months ended September 30, 1893, shows a gain in gross receipts of the usual $1,000 per day with something to spare, the total gain being $375,372, of which but $72,951 was consumed in added expense for operating. The improvement was $302,421, of which $180,077 was required for added taxes, interest and rentals, leaving for dividends $122,344 more than the previous year. The common dividend was reduced from 10 to 8 per cent. in July last, and yet the total dividend payment for the past year is about the same as for the previous year. The balance to surplus account is $122,414 compared with $6,358 a year ago. Operating expenses were a trifle under 68 per cent. of gross receipts, against 70.24 per cent. in 1891–92, and 74.47 in 1890–91.

The balance sheet shows current liabilities of $2,215,010, and offsetting assets of $1,498,200, leaving $716,810 to be met by the balance of bond subscription, say, $500,000, leaving a nominal floating debt. In the liabilities for this reckoning are sundry items accrued, but not due. The track improvement account stands charged in the balance sheet with $192,190 "to be later written off against earnings." This is the balance of track reconstruction account above what the railroad commissioners permit to charge to construction account. Had this been charged against earnings the past year, the dividends would not have been quite earned. The future will, of course, derive benefit from the track improvements of the past year, and it might be contended that it should share in the expenditure. The reduction in the common dividend last July was a conservative step, as shown by analysis of the annual report. A summary is as follows:

Year Sept. 30.	1892–3.	1891–2	Increase.
Earnings	$6,692,578	$6,317,205	$375,372
Expenses	4,550,734	4,477,783	72,951
Net	$2,141,843	$1,839,422	$302,421
Charges and tax	689,778	509,701	180,077
Balance	$1,452,064	$1,329,720	$122,344
Dividends	1,329,650	1,323,362	6,288
Surplus	$ 122,414	$ 6,358	$116,056

ASSETS.

Sept. 30	1893.	1892.
Construction	$6,076,760	$5,920,585
Real estate	7,315,153	7,342,904
General equipment	512,614	556,917
Horses, 2,123 in 1893, 3,754 in 1892	284,482	503,036
Cars, 826 in 1893, 1,226 in 1892	690,448	919,130
Electric cars, 1,346 in 1893, 1,028 in 1892	4,318,988	3,238,227
Electric line equipment	1,276,417	973,437
Electric car house and shop equipment	166,811	99,989
Power station equipment	1,845,853	1,441,041
Malden & Melrose R.R. Co.	214,519	214,519
Somerville Horse R. R. Co.	82,353	82,353
Furniture and fixtures	19,978	24,778
Stocks and bonds	75,100	75,100
Track improvement	192,190	.....
Cash	738,654	355,052
Material and supplies	472,639	554,029
Notes and accounts receivable	255,822	289,354
Insurance, present value	31,114	12,783
Total assets	$24,569,871	$22,603,340

LIABILITIES.

Common stock	$9,085,000	$9,085,000
Preferred stock	6,400,000	6,400,000
Funded debt	6,690,000	4,265,000
Notes payable	1,219,700	1,376,448
Current bills	725,526	923,120
Coupon interest uncalled for	24,472	22,057
Dividends uncalled for	8,925	12,409
Outstanding tickets and checks	11,520	11,136
Accrued interest and rentals not due	96,866	44,783
Accrued pfd. div. to Sept. 30	128,000	128,000
Profit and loss surplus	179,861	336,284
Total	$24,569,871	$22,603,240

The surplus account is credited with $458,699, of which $179,861 is carried forward to the new year, and the balance is charged off as follows: Buildings removed and destroyed, $37,952; loss on decrease of 1,631 horses, $147,051; old track removed and not replaced, $27,524; depreciation of equipment, $66,310. The track mileage September 30 was 268⅓, and the addition during the year was 8½ miles. The miles fully equipped with electricity were 182½ (an increase during the year of 34.48 miles), and 25½ miles were partially equipped. The revenue miles were 18,669,809 against 17,498,660 miles the previous year. Number of revenue passengers 133,863,618, against 126,210,781. Of the number of revenue miles run 76.17 per cent. was electric and 23.83 horse, against 48.63 and 51.37 per cent., respectively, last year. Of the passenger receipts 80.33 per cent. was from the electric lines (against 53.39 last year), and 19.67 from horse lines. The average receipts per passenger were 4.943c., an increase of .001c.

The company owns 524 box horse cars, against 702 last year, and 302 open, against 524 last year; 720 box electrics, against 577 last year; and 624 open, against 451 last year; two motor cars; 2,123 horses, against 3,754 last year; 1,657 electric motors, 83 horse snow plows and 84 electric, 372 snow sleds, and 548 miscellaneous vehicles.

During the year twenty persons were killed and 310 injured on the West End road. Of the killed one was a passenger, two were employes and seventeen other persons. Of the injured 169 were passengers, twenty-three employes and 118 others.

Mr. Prentiss Cummings, vice-president, furnishes the following in connection with the report:

At the close of the year five-sixths of all the mileage, namely, 1,325,000 miles per month, was run by the electric system. It is expected that during the coming year that system will be so extended as to cover most of the important lines.

The board of directors has undiminished confidence in the electric system, and the increased riding, wherever it is introduced, proves clearly that the public consider it a great improvement over horse power. This fact and the comparative cheapness of operation, in the opinion of the directors, justify the large expense involved in the introduction of the system.

To meet this expense and fund a floating debt incurred for construction, the company has authorized the issue during the past year of 5 per cent., ten year bonds to the amount of $3,000,000. All have been sold, and bonds to the amount of $2,500,000 have been delivered and paid for, and the remaining $500,000 are by contract to be delivered and paid for on or before January 1, 1894. The loss on horses, real estate and cars involved in the change, to the amount of $251,313.60, has been charged off during the year either against the surplus or against the earnings, as is detailed more particularly in the auditor's statement hereto annexed. In pursuance of a conservative policy, your directors decided to reduce the semi-annual dividend paid, July 1, from 5 to 4 per cent.

The business of the company has been prosperous during the past year, the average increase of $1,000 a day over the preceding year being more than maintained. Since August 1, however, the effect of the financial difficulties in which the country has been involved has appeared in the receipts, which since that time have been just about equal to last year.

Mr. Henry M. Whitney who had been president of the company since its organization, resigned September 7, 1893, owing to the pressure of business in large interests wherein he is engaged.

An interesting analysis of the earnings and expenses is appended and throws light upon two items much discussed during the year, snow damages and accident damages:

RECEIPTS.

		Increase.
From passengers	$6,616,607	$378,960
Rent of tracks	15,537	2,114
Sales of manure	7,809	*5,111
Rent of real estate	19,380	*2,129
Advertising	31,326	1,936
Miscellaneous income	1,917	*399
Totals	$6,692,578	$375,372

EXPENSES.

For general expenses	$401,192	$37,476
Maintenance of track	281,015	42,224
Maintenance of buildings	66,440	12,890
Maintenance of cars and vehicles	298,068	78,329
Maintenance of horse equipment	51,101	*171,308
Maintenance of electric equipment	343,073	86,151
Road and snow expenses	198,247	64,769
Transportation expenses	2,691,273	*91,429
Injuries and damages	220,322	13,847
Totals	$4,550,734	$72,951
Net earnings	$2,141,843	$302,421

*Decrease.

A Generous Gift.

The Chicago City Railway Company, to help the Columbian Exposition last summer, subscribed for 10,000 shares of Columbian Exposition stock. The board of directors of the company now proposes to donate these shares to the permanent museum now being established in Chicago, provided such action is approved by the stockholders of the railway company. The next meeting of the stockholders is on January 15, when it is expected that a vote will be passed approving the proposed action.

Trinidad Pitch.

FROM A REPORT BY CLIFFORD RICHARDSON TO THE COMMISSIONERS OF THE DISTRICT OF COLUMBIA.

(*Continued from our last issue.*)

LAKE AND LAND PITCH—THEIR PROXIMATE COMPOSITION.

For the purpose of studying the various deposits of pitch, and making a comparison of their properties and value for paving purposes, a large collection of specimens was made from the lake and from the land deposits. These have been carefully examined since my return, and the results are presented here, together with some observations upon commercial specimens collected in this country which have extended over a number of years.

On the lake, specimens were collected at each station on the line of levels, which was run from north to south across it at intervals of 100 ft., and also on an east and west line at intervals of 200 ft., and at the soft and semi-soft spots.

Specimens of land pitch were taken from the several excavations which were visited, from the heaps prepared upon the beach for shipment, and in a few places where the pitch is not worked commercially.

The samples were brought to this country in tin boxes, and although most of them less than a pound in weight, represent, I believe, fairly the deposits from which they were taken. Some of the better class of land pitch deposits had not been opened when I was in Trinidad, but of one or two of these I have since obtained specimens.

When calculated to dry substance the figures become:

	Soft.	Average lake.	Average land.
Inorganic matter	38.00	36 56	37.74
Organic matter not bitumen	9.64	10.57	10.68
Bitumen	52.36	52.87	15.58
	100.00	100.00	100.00

It is apparent, therefore, that in the commercial supply of land pitch which has been carefully selected and from which alteration products and soil have been excluded there is no essential difference in the relative proportions of mineral matter, bitumen and organic matter not bitumen from those in lake pitch. The difference between the two pitches depends, therefore, on some variation in the character of their constituents. The mineral matter and the organic matter not bitumen do not change so as to affect the properties of the pitch, as will be seen when they are described further on. The bitumen in the two pitches must therefore be to some extent unlike, and it is a fact that the original bitumen of the lake pitch has become to a greater or less degree modified in the land deposits. As the soft spots in the lake gradually harden and become like the rest of the surface so this process continues, making the outer portions of the lake harder than the center, and the land deposits harder than any part of the lake. We find evidences of this in the heaps of pitch ready for shipment on the shore. Those of lake pitch rapidly run together and become a homogeneous mass in a short time, while the land pitch, even under the strong tropical sun, still shows the distinct lumps of which it was originally made up, for a longer or shorter time, depending on the quality of the land deposit. With the poorest deposits they remain so loose and friable that it is possible to shovel over such heaps even after weeks.

Their softening and flowing points of the specimens examined reveal the difference, and the results show the greater softness of the lake pitch, and were it not for the difficulty of getting rid of the water in such small samples as were collected of the crude pitch, without losing some of the lighter oils, upon which the flowing point much depends, the relative differences shown in the tables would be greater and more distinctive.

In consequence of this difficulty of removing the water on a small scale from specimens, without decided changes in their character, the comparative study of the bitumen in the two kinds of pitch has been continued with typical specimens of refined pitch, carefully handled on a large scale.

THE DIFFERENCES IN THE CONSTITUENTS OF LAKE AND LAND PITCH.

Refining pitch commercially consists in heating large quantities in stills or boilers to as high a temperature as will drive off the water in the material and melt it without volatilizing the oils to any noticeable degree, the heat being applied, not directly from a fire underneath the vessel, but by conducting the products of combustion around it, beginning at the upper portion of the still. The melted product from which the water has evaporated, the coarser mineral matter subsided, and the lighter organic matter been skimmed is drawn off and is known as refined asphalt, or in Trinidad as epuré. It gives the bitumen of the pitch in a more available form for investigation, and where the process has been carefully conducted, in one representing very closely its nature and character as found in the original pitch.

SOFTENING POINT.

As has been said, the differences in the pitch from the lake and from the land deposits are first revealed by the lower softening point of the former. In commercial refined asphalt this difference is readily recognizable. Determinations accumulated during the past three years with different cargoes have furnished the following extremes:

From a commercial point of view it is not quite possible to tell from the softening point alone the origin of refined asphalt, where refining has been carefully conducted. The figures, however, are representative of characteristics which can be made visible by reducing portions of the refined asphalt to an impalpable powder when cold, and then allowing them to stand in a small heap at ordinary temperatures, seventy to eighty degrees. Under these circumstances the lake material will become caked and tough after twenty-four hours, so that the powdery mass can only be separated with the use of some strength. The best land asphalt adheres somewhat, while the poorer qualities remain in their original condition, and in no wise agglomerated.

	Soft.	Flow.
	°F	°F.
Refined lake asphalt	180—193	189—210
Refined land asphalt	190—237	210—255

If in addition, these preparations are subjected to a temperature approaching or equaling their softening points, they will flow if placed on an incline, and the distance covered may be expressed in percentages of some standard sample, thus giving another expression of the quality of the material.

The softening point of refined asphalts is, of course, modified by the care exercised in refining, and somewhat by the portion of the still from which the sample is drawn when any sedimentation has been allowed or excessive heat applied.

Refined lake asphalt of good quality always softens between 190 degs. F., refined land above that temperature.

CONCLUSIONS IN REGARD TO THE PRESENT POSITION OF THE PITCH INDUSTRY, AND THE RELATIVE VALUE OF LAKE AND LAND PITCH.

In the light of the foregoing investigations and facts the following brief conclusions appear to me to be justified in regard to the present status of the pitch industry:

Land pitch is inferior to lake pitch in cementitious value. Land pitch is better in quality the nearer its source is to the lake. Land pitch can readily be distinguished from lake pitch by certain characteristic differences when examined in the refined state.

Lake pitch is superior for paving purposes, because it contains more bitumen in a viscous or cementitious form and less of the brittle bitumen, which is of smaller value.

The addition of oils to the latter form of bitumen will not produce as desirable cement as that made from lake asphalt. It will not draw out to a long string like lake asphalt cement, but breaks short and is of the same comparative value that cold short is to tough and good iron.

Land pitch requires the addition of more petroleum oil to produce a cement of required consistency than lake pitch.

Land pitch would never be used were lake pitch generally available.

The poorer forms of land pitch are now generally conceded to be unfit for paving, and the question may therefore be asked, where the line or degree is to be drawn as to what is suitable?

The large extent of the lake deposit permits of an unfailing and uniform supply, which can always be depended on and always handled in the same way.

Various deposits of land pitch vary widely and demand great skill in manipulation to produce even the best results attainable with this kind of pitch, although the care used in selection and cutlassing has improved the character of the shipments decidedly.

This element of manipulative skill in handling the materials properly for the production of a good pavement, that is, a thorough understanding of the technique of the industry, in the works and in the street, should, without doubt, have equal consideration with the quality of the materials in use.

A skilled laborer can probably make a better pavement from land pitch than an unskilled one with lake pitch.

With the enormous growth of the industry within a short period of time, the demand for experts has continually exceeded the supply. Every one engaged, from the superintendents and foremen down to laborers, has a decided influence on the character of the finished work. Those who refine and handle the crude asphalt, who make the asphaltic cement and compound the surface mixture, and those who rake and roll the material in the street, according to the degree of their knowledge, experience and skill contribute to the success or failure of the work. The older paving companies certainly control the best labor and brains, having had the longest and most successful experience, and the city of Washington as a pioneer in laying asphalt surfaces has probably at present as able a set of men employed by its contractors as can be found. The character of our street surfaces of all ages attests this fact and it would seem to me to be undesirable, at the height of our success, to enter into any experiments with new and untried conditions and materials.

Should any competitors of the present contractors or methods desire to exhibit their work, there is no reason why they should not be given an opportunity to prove it of superior character, by laying a certain amount at their own expense, where it would be subjected to fair conditions of traffic and wear, in comparison with our own asphalt surfaces.

I should, therefore, in the light of all my experience and knowledge, unless further evidence is adduced or great pecuniary advantages offered, recommend that the District of Columbia provide in its specifications that lake pitch be used in pavements for which it contracts, and that the work shall be done by the most skillful and experienced labor and in the most approved manner.

St. Louis Notes.

Workmen are busy at the works of the Madison Car Company, of Madison, Ill., getting things in shape preparatory to an early resumption of business. This company failed July last.

The Manchester Road Electric Railway Company will begin construction very shortly on the city end of its line. The route within the city lies along Manchester Road from King's Highway to the western city limits. The company is bound by the terms of its ordinance to make a transfer arrangement with one of the city railway systems so as to enable passengers to reach the center, and, in fact, all parts of the city. The road will not be allowed to begin operations until the arrangement is effected. The company must finish the work of construction within two years. The franchise lasts thirty-two years, each of the first five of which the company must pay into the city treasury $1,000, and on each of the remaining years $2,000.

The Midland Electric Railway, which is now in operation on Page Avenue, in St. Louis County, is to extend its road further westward a distance of about ten or twelve miles. The extension will be on private property only.

The efforts of the Smoke Abatement Association, have at last been crowned with great success. A bill was passed through the Municipal Assembly several months ago concerning the unlimited abatement of the smoke nuisance. A large number of citizens took the enforcement of the law in their own hands. As a result, three smoke inspectors have been appointed, in keeping with the provisions of the ordinance, who are to thoroughly canvass the city. If any plant emits black or gray smoke the company owning the same will be required to put in a smoke consumer within thirty days after the time the smoke had been declared a nuisance. Smoke consumers are being rapidly installed, and mostly in the largest manufactories.

There have been several libelous articles published recently in local papers concerning G. W. Baumhoff, general manager of the Lindell Railway Company. He has been charged with compelling all employes of the company to join the politico-religious organization, commonly known as the A. P. A., or receive their discharge. We have the most convincing evidence given us personally by Mr. Baumhoff which utterly puts out of the question the existence of such a state of affairs, and a suit for libel has been brought against the guilty parties. From information elicited from employes of the railway company, everything seems to be working harmoniously between the men and their general manager.

The Missouri Railroad Company has just completed a very neat pavilion in Forest Park, at one of its principal entrances. It is built of white stone and Pompeian buff brick, and cost in the neighborhood of $20,000. The company's Laclede Avenue line now has its western terminus at the pavilion.

The Lindell Railway Company's Compton Heights & Union Depot line commenced operations about the middle of October. The cars are twenty-five in number, forty feet in length, and are each equipped with two twenty-five horse power Westinghouse motors. They were built by the St. Louis Car Company, and are painted a rich red. The new power station of 2,100 H. P. capacity is located at Park and Vista Avenues, where also are located the car sheds. The station was described in the June, 1893, issue of the Street Railway Journal.

The Union Depot Railroad Company, since its acquisition of the Bellefontaine and Mound City railways, possesses the largest street railway system in St. Louis. There are several extensions being made. Sixty twenty-eight foot cars have been ordered from the St. Louis Car Company for these lines. Each will be mounted on Robinson radial trucks, and will be propelled by two General Electric twenty-five horse power motors. The power plant is being increased 2,000 H. P., and will be divided into two units. The generators were built by the General Electric Company, and are to be each direct coupled to a 1,000 H. P. Southwark Foundry & Machine Company's Porter-Allen automatic engine. This company is also supplying the engine equipment for the Lindell Railway's plant. The Union Depot management's new transfer arrangements enable a passenger to ride a distance of about fifteen miles for five cents.

The St. Louis County Street Railway Company has decided to extend its line to Ferguson. The new line will be completed before winter has passed over. S. L.

Notes from England.

(*By Our London Correspondent.*)

Since the last installment of these notes was written, an event has occurred in the British tramway world which may fairly be reckoned as the most important of the year, and indeed of many past years. Messrs. Dick, Kerr & Company, Limited, the engineers and contractors, and the holders of the cable tramway patents for Great Britain, have succeeded in obtaining a lease for twenty-one years on the Edinburgh tramways. It will be remembered that the Edinburgh Corporation bought the lines from the existing company, and asked offers to take them on lease. The success of Messrs. Dick, Kerr & Company is everywhere looked upon as a most significant event in the development of cable traction in this old country. The lessees are to pay 7 per cent. per annum on the purchase price to the Corporation and the latter, after paying interest on the borrowed money, will pocket 4 per cent. per annum. A subsidiary company will work the tramways, and as the capital, which has only to provide cars, horses and tools, will only be £75,000, large dividends are certain, even with horse traction. The Corporation intends almost immediately to set about the building of fourteen miles (seven miles street length) of cable roads, and great success is assured. The lessees will also pay 7 per cent. on the cost of cable construction.

Edinburgh will be the first city here to have a comprehensive system of cable tramways. Things are moving elsewhere also, for in Newcastle-on-Tyne, a syndicate has acquired the control of the local tramway company and is arranging with the Newcastle Corporation for the introduction of the cable system. Things are promising to boom at last. Owing to the Tramways Act little could be done before.

The Thomson-Houston Electric Company is making strong efforts to get the Corporation of Leeds to adopt electric traction. The object lesson of the existing cable road in Edinburgh has converted the people there, and so perhaps will the present electric line in Leeds. The overhead wires are still thought by some a bugbear, but Mr. Graff Baker is trying to enlighten the people as to the benefit of center pole construction.

The Board of Trade has just issued draft regulations for electric tramways, allowing the use of an uninsulated return. Some of these rules are very stringent, and in America would seem grandmotherly. Criticisms have, however, been invited from electrical engineers, and after these have been sent in a working set of regulations will be issued. Tramway companies and electrical engineers will then know exactly what they have to face, and I am strongly convinced that a development is at hand.

Indeed, there is little doubt that great changes are at hand. One hears murmurs from some peculiar people in London against the cable tramway at Brixton, but these are of little consequence. The Board of Trade has itself to thank for the chief cause of complaint, which is the noise caused by the grip cars. The Board refused to allow passengers to be carried on the grip cars, and, consequently, these are of a very light make, with open sides and a flat roof that acts as a sounding board and intensifies tenfold the noise of the wheels on the rails. The evil is easily remedied, and people wherever the cable system has been tried are taking to it hugely.

In the three arbitrations which have taken place—in London, Leeds and Edinburgh—as to the price to be paid under the Tramways Act by corporations buying up tramways, appeals to the courts of law have been intimated by the companies. In each case the arbiter held

that structural value of the tracks, minus depreciations, was what was to be allowed. The companies maintain that rental value ought to be allowed them, and one of them threatens to take the case to the supreme court of appeal, the House of Lords. Should the companies' contention be upheld, purchase will be a very expensive business for corporations, but I am inclined to think the courts will support the view of the arbiters.

That wonderful body, the London County Council, has declined to entertain the notion of buying up the whole of the North Metropolitan Tramway Company's system at present, but will only purchase the nineteen miles which at present fall in under the Tramways Act, leaving the rest to be bought five years hence when it falls in. The County Council has also decided to spend £500 in getting an inquiry carried out by experts as to improving local transit in London, chiefly by means of deep-tunnel electric and cable railways. The Council thinks it can beat private enterprise, because it hopes to persuade Parliament to allow it to put into force the principle of betterment to such an extent to owners of land and houses which are increased in value by the railways will pay most of the cost of construction. Then the Council will be able to give very cheap fares, and the Millennium will be at hand.

Since writing the above, and just before dispatching these notes, I hear of another advance proposed in the way of cable traction. The London Tramways Company intends promoting a bill in the next session of Parliament for the extension of its Brixton cable road three miles further out towards the country. There is no tramway at present on this route, and it is indeed too hilly for a horse line to be easily worked. Should the scheme be carried out, I fancy it ought to be fairly remunerative. The population is not very dense, but it is rapidly increasing, and in the course of a year or two there should be a fairly good traffic. The cable system would show to better advantage if it were extended citywards, but at present there are several obstacles, such as the coming purchase of the existing horse lines, and the attitude of the County Council in seeking to impose restrictions. The three miles (or six, reckoned by single track) will require no new power stations, as the existing one is located so as to be capable of working the extension, and the engines also are ready for the work. The expense will simply be for street work. The chairman of the company is evidently much more enthusiastic about cable traction than he has professed to be at recent meetings of the shareholders. He has expressed there only modified pleasure with the existing cable road, but the action of the directors shows that they know when they have a good thing.

We are promised several additional schemes for underground railways in London. These are to be promoted in the coming session of Parliament, and no doubt the power to be employed will be either the cable or electricity.

Interesting Rail Tests.

In tests conducted at the Watertown arsenal, according to the *Scientific American*, it has been found that old steel rails when submitted to a bending test in which the head of the rail is put in tension and the base in compression, will invariably fracture, making a clean break across the rail, while if the same rail is turned over and the head put in compression it will bend without fracture. Again, if before conducting a test, about one-sixteenth of an inch of metal is planed off the head of the rail, there will be no fracture no matter which part of the rail is in tension. But if, in planing this head, care is not taken to remove one-sixteenth of an inch of metal from the corners as well as the top of the head, the rail will fracture as before. The explanation of the matter is that a thin layer of metal on the head of the rail has been greatly hardened by the contact and pressure of the wheels passing over it, and fractures when put in tension. When once started, the fracture, of course, extends entirely across the rail. If this hard material is removed, the fracture cannot make a start and the head of the rail is as good as the base.

Notes on European Street Railway Practice.

By G. Braet, Engineer to the Minister of the Railway, Postal and Telegraph Departments, Brussels, Belgium.

GAS MOTORS EMPLOYED FOR STREET RAILWAY PURPOSES IN DRESDEN.

We believe that it would be interesting to describe the Lührig system as applied to the operation of street cars by gas in Dresden. The system, as described in the *Moniteur des Chemins de Fer*, operates as follows:

The gas necessary for the operation of the motors, of which there are two for each car, is carried in cylindrical reservoirs 280 millimeters in diameter, and with a capacity of one and a quarter cubic meters, to two and a half cubic meters, where it is stored at a pressure of ninety pounds to the square inch. The storage can take place at any point along the pipe line. Here is established a small station containing a stationary gas motor directly connected to a compressor, which is put in connection with the reservoirs on the car. The consumption of gas by the compressor motor is 8 per cent. of the quantity stored, which is about ten cubic meters per horse power. Naturally, the number of stations for storage varies according to the number of cars in operation. The cost of each of them is from 10,000 to 15,000 francs. The motors for the cars have a power of from fourteen to fifteen horse power, have each two cylinders placed in tandem and disposed lengthwise under the seats. The flywheels are outside of the framework or body of the car behind and along the backs of the seats. The cars are of two types, one for ordinary routes and designed to carry twenty-nine passengers; the other is for steep grades and is designed to carry twenty-two passengers.

The action of the two motors can be either separate or simultaneous. By means of a foot lever, different speeds can be obtained, varying from 150 to 240 revolutions per minute. The first of these speeds is that of the motors turning without load during the stops, it having been found more desirable to have continuous running motors. Stopping and starting are made while the motors are in operation, by means of two hand levers, which throw in and out of contact spur gears by which the power is transmitted. The hand brake permits instant stops to be made. Five reservoirs are carried on the car; four of these are under the platform and one on the roof, where is also located the water reservoir. The pressure of the gas is reduced from thirty to forty millimeters by a Pintsch regulator. The products of combustion pass into an exhaust head, thence into a condenser, by which they pass into the air without noise or odor. The car weighs complete 16,500 lbs. A smaller type has been constructed of 9,900 lbs., useful for steep grades, but only carrying a motor of ten horse power placed under one seat, the reservoirs and exhaust head being located under the seat. The price of the original installation of gas traction, calculated for a line of eight kilometers of single track, is figured at 93,750 francs per kilometer ($11,500 per mile.)

If the gas manufacturing companies agreed to furnish gas at $1.15 per 1,000 cu. ft., gas traction should cost about two and a half cents per car mile.

GAS TRACTION ON THE SWISS RAILWAY FROM NEUFCHATEL TO ST. BLAISE.

The system which will probably be installed on the line running from Neufchatel to St. Blaise, will consist of gas motors with double cylinders, and of eight horse power. The motor will be placed on one of the platforms. The car, when ready for operation, will weigh about 13,200 lbs. The speed will be eleven miles per hour. On a grade of 3½ per cent. the car ought, on full charge, to make a speed of about eight miles per hour. This car will be able to draw one trail car having a weight of 8,800 lbs.

The consumption of gas will be, for a trip of 6.2 miles (round trip), 180 cu. ft. per car when the motor car runs

alone, and 250 cu. ft. for a train of one motor car and one trail car.

NOTE ON ALUMINUM HORSE SHOES.

M. Risler recently reported to the National Agricultural Society of France, on some experiments of M. Jaspy, on shoeing horses with aluminum shoes. The principal conclusions arrived at by M. Jaspy are as follows:

A complete set of aluminum shoes for a horse weighs about one-fourth of that of an iron set. Even when the aluminum was alloyed with about 10 per cent. of another metal to give it greater hardness, the complete set of shoes thus made never weighs more than a single hind shoe of the old style.

Horses thus shod immediately notice the difference in the weight. One becomes convinced of this by shoeing with aluminum a horse with sensitive hoofs that usually dislikes to go unshod. In stepping from the forge with this new protection on his hoofs, the horse seems to have the same misgiving as if he were not shod. He hesitates to plant his hoof on the ground, and it is necessary to urge him in order to give him his usual assurance.

In proportion as the hoof grows all the horseshoes spread a little. At the end of thirty or sixty days they are from two to three kilometers wider between the prongs than when they were put in place. This would indicate that the light pressure exerted by the growth of the hoof makes the metal change its shape on account of its malleability. As this material continues to adapt itself to the natural shape of the hoof, advantage may be taken of this fact to prevent much lameness. There being also less jar when the shoe strikes the ground, it follows that aluminum shoes can render useful service in the treatment of diseases of the hoof.

The average life of a shoe made in this metal, and well put on, varies from forty to sixty days, according to the composition adopted and according to the work done by the animal. It does not afford, however, the most desirable reliability, for the least want of care in the manufacture changes completely the hardness of the shoe. In the trials made at Beaucourt, in the works of M. Jaspy, shoes of the following character were made: No. 1, pure aluminum; No. 2, 85 per cent. aluminum and 15 per cent. tin; No. 3, 94 per cent. aluminum, 6 per cent. copper; No. 4, 90 per cent. aluminum, 10 per cent. German silver (33 per cent. nickel alloy).

Shoes cast directly from these various compositions were very brittle. Those experimented with were, therefore, made in the following manner: The different alloys were drawn or rolled into plates three times thicker than necessary for the horse shoes. The shoes were then cut out with a die, then drop forged to give them the proper thickness, shape, etc.

A trial of strength gave the following results: Alloy No. 1 gave 19.79 kilogrammes per square millimeter cross section (21,850 lbs. per square inch); No. 2, 20.30 kilogrammes per square millimeter cross section (28,890 lbs. per square inch); No. 3, 24.50 kilogrammes per square millimeter cross section (34,850 lbs. per square inch); No. 4, 30.80 kilogrammes (43,800 lbs. per square inch). However, a mistake in temperature in annealing or forging them might diminish their strength from 30 to 40 per cent. Once finished, the shoes are not to be heated.

In case the shape of the shoe does not correspond with that of the hoof, it is necessary to reheat it. This reheating requires great care, for if done badly, it will render the shoe either too soft or too brittle. This ought to be done in a special forge, or, when this is not available, on an iron plate heated to a dull red, on which the shoe can be turned from time to time.

The nails ought to fit completely the holes in the shoe. If they have any play the holes will grow larger, and the nails quickly become loose.

M. Jaspy has also noticed in taking off the shoes from horses, that there exists between the aluminum shoe and the hoof a white material attaining sometimes a millimeter ($\frac{1}{25}$ in.) in thickness, and weighing about two grammes and a half per shoe. This material seemed to be more prevalent when the metal was the purest. Having analyzed this material, it was discovered that it was a salt of aluminum containing about 33 per cent. of organic matter. It remains to be determined whether this salt is produced by the contact of the hoof, by the secretion of the foot or by the manure of the stable. In any case it can be avoided by covering the shoe, when putting it on, with a layer of gutta percha softened in hot water.

In conclusion, according to M. Jaspy, horseshoeing by aluminum is practicable for race horses or fancy horses. It is also useful for the treatment of certain diseases of the hoof, but should be in experienced hands and those knowing how to work the metal.

The alloy of aluminum with German silver, so far as can be seen at present, is preferable. Aluminum shoeing ought to be absolutely rejected for all horses having hard work to do; and it cannot as yet be recommended for hard service, such as exists in the cavalry in time of war.

M. Lavalard, of the Paris Omnibus Company, who has made, on his own account, a number of experiments in this direction condemns the use of aluminum for shoes, on account of its not being economical, owing to its rapid wear and the impossibility of utilizing old shoes.

The question is not yet entirely settled; it is still open, and it is to be hoped that the last word on it has not yet been said, but that better results may be obtained.

HORSE SHOEING WITH BESSEMER STEEL.

Considerable progress seems to have recently been made in the shoeing of horses in France. The Paris Tramway Company has been experimenting for some time with a horseshoe made of Bessemer steel, which is fixed cold in a few moments without the use of a single nail. The "sole" is similar to that of ordinary shoes, but it has at the front a bent arm which extends half way up the front side of the hoof without compressing it. A band of the same (flexible) steel also surrounds the hoof, starting from the two (heel) prongs and reaching to the upper end of the bent arm in front, which latter supports the shoe and consequently prevents it from pressing upon the sides of the hoof in any way. The shoe is provided inside with two small prongs, which penetrate into the horn of the hoof, and prevent the shoe from becoming displaced unless the band has been taken off.

NEW METALLIC PAVEMENT FOR TRAMWAYS.

The Paris Municipal Council has just authorized the test of a new metallic pavement invented by Mr. Perrody, of Lyons.

It is well known that the pavement along the rails wears very rapidly and is soon in ruts, no matter how it is made. The wear and tear of highways in this way is such that the Parisian tramway companies have to pay the city annually some 482,000 francs over and above the expense or track repairs, which amount to about 100,000 francs.

According to *Le Génie Civil*, Mr. Perrody proposes to place on either side of each rail a row of cast iron paving blocks to prevent the occurrence of hollows.

The pavement blocks are 25.0 c. m. (6.35 ins.) long, 17.5 c. m. (4.44 ins.) wide and 15.0 c. m. (3.81 ins.) deep, with rounded cross grooves on the upper and lower surface some three-sixteenths of an inch deep and about an inch "mesh," the edges of the block being also chamfered off. The blocks are hollowed and the hollow is filled with concrete. It is seen from the description that the blocks can be used on both sides and can be turned over when worn out on one face. They are laid alternately lengthwise and crosswise, to break up the continuity of the grooves.

The experiment with this paving is to be made at two points where the traffic of vehicles is particularly active, viz., Boulevard Sébastopol between the streets of Rivoli and of Aubry-le-Boucher, and also on the Rue St. Antoine, in front of the Protestant Church. The section of street experimented upon will be about thirty meters (about ninety-eight feet).

The inventor expects this paving to have almost unlimited durability, and thus make up for its relatively higher cost, which is forty cents per block. He claims that the cross grooving and beveled edge will give a good footing to the horses, and that the blocks will not become polished as they wear.

New Work of the Broadway Cable Company.

The new year will mark several improvements and developments in the service of the Broadway line. In the first place, the original idea of having an auxiliary power house on Front Street to operate the Battery loop, has been abandoned, as the engines of the Houston Street power house have been found to develop sufficient power to operate this section, in addition to that from 35th Street to Bowling Green. When the preparations are all completed the Battery loop will be joined to the main cable, and the whole length operated from the Houston Street station.

The new grips to operate with the automatic tripping device at the power house entrances will be put into use early in the year. This will obviate one of the most fruitful sources of delay due to the failure of the gripmen to throw off at the power houses, and the consequent breaking of the grip and throwing off the cable.

A system of signaling to the power house will probably be soon put into operation over the entire line. This system has been in operation successfully for several months on the stretch of road from 50th to 59th Streets. It consists of signal boxes sunk to the level of the street between the rails at intervals of 500 ft. In order to communicate with the engineer at the power station, it is only necessary to lift the cover and turn a crank like that on a messenger call box. There is a dial underneath which shows the signals, such as "stop," "start," "fire," "block," etc. The engineer reads the signal on a similar dial, and a number designating it is simultaneously struck on a gong. A smaller gong also indicates the location of the box, while a "ticker" records both on a tape. Telephones may also be attached at any of the boxes.

Work was begun December 19 on the Columbus Avenue cable road, one of the new projects of the Metropolitan Traction Company. This line will start at Seventh Avenue, and run through 53d Street under the elevated road to Ninth Avenue, and extend thence north to 110th Street.

There will be a connection through 106th Street to the Amsterdam Avenue line. This will carry people directly to Manhattan Street and Fort Lee Ferry. Continuing from 110th Street and Columbus Avenue, the road will extend through 110 Street, or what is known as Cathedral Parkway, to Lenox Avenue, through Lenox Avenue to the Harlem River. The company has also obtained the right to build the road through Lexington Avenue, connecting with its line on 23d Street, to the Harlem River. A crosstown line will extend through 116th Street.

Vestibules in Cleveland.

At a recent meeting of the Board of Directors, of the Consolidated Street Car Companies, of Cleveland, action was taken towards immediately providing platform screens or vestibules, for all motor cars of the different companies not already so equipped. The Canton platform screen, such as has been in use for some time on one of the cars of the Cedar Street line was adopted as a standard, and all motor cars will be equipped with these screens as soon as possible. The immediate reason for this action was the provision of the Ohio State law, which requires all motor cars to be furnished with vestibules for the protection of motormen.

A Comparison in Mileage and Cars for Two Years.

The subjoined table gives in convenient form the street railway mileage and cars operated by cable, electric and horse power in the different states, for the years ending December 1892 and 1893. The statistics are taken from the directory published in the STREET RAILWAY JOURNAL. The mileage is single track, counting one mile of double track as two of single, and switches as additional length. The number of cars under the heading cable, electric and steam includes trail cars as well as motor cars:

COMPARISON OF THE MILEAGE AND CARS OF STREET RAILWAYS IN THE UNITED STATES FOR THE YEARS ENDING DECEMBER 1892 AND 1893.

States and Territories.	1893. Horse.		Electric.		Cable.		Steam.		Total.		1892. Horse.		Electric.		Cable.		Steam.		Total.	
	Miles	Cars	Miles	Cars	Miles	Cars	Miles	Cars	Miles	Cars	Miles	Cars.	Miles	Cars.	Miles	Cars.	Miles	Cars.	Miles	Cars.
Alabama	36	92	79	144	.....	.....	148	112	263	348	60	157	40	65	.....	.....	150	119	250	341
Arizona	5	4	5	3	.....	.....	.....	.....	10	7	6	4	.....	.....	.....	.....	.....	.....	6	4
Arkansas	38	85	35	95	.....	.....	5	1	78	181	42	90	27	78	.....	.....	5	2	74	170
California	231	706	251	463	156	630	49	79	687	1828	254	587	205	264	157	637	45	69	661	1557
Colorado	7	7	163	347	30	232	15	4	215	570	20	30	152	273	43	300	.....	.....	215	603
Connecticut	107	417	72	158	.....	.....	.....	.....	179	575	103	370	49	111	.....	.....	.....	.....	152	481
Delaware	6	22	13	56	.....	.....	.....	.....	19	72	6	22	13	50	.....	.....	.....	.....	19	72
District Columbia	57	324	56	107	22	389	.....	.....	135	820	54	267	45	87	22	389	.....	.....	121	743
Florida	28	55	5	10	.....	.....	.....	.....	33	65	28	53	5	10	.....	.....	10	5	43	68
Georgia	34	89	213	306	.....	....	28	27	275	422	59	103	160	236	.....	.....	16	11	235	350
Idaho	.....	.....	3	2	.....	.....	.....	.....	3	2	.....	.....	3	2	.....	.....	.....	.....	3	2
Illinois	343	3389	396	805	86	863	4	2	828	5059	365	3193	316	584	85	568	10	10	776	4355
Indiana	92	167	173	402	.....	.....	8	14	273	583	91	172	157	371	.....	.....	8	14	256	557
Iowa	34	56	232	431	7	34	18	19	291	540	54	113	193	421	7	34	14	17	268	585
Kansas	54	111	108	160	.....	.....	11	22	173	293	59	119	68	91	2	4	34	63	163	277
Kentucky	98	280	130	413	.....	.....	.....	.....	228	693	133	333	84	252	.....	.....	.....	.....	217	585
Louisiana	98	334	50	103	.....	.....	9	36	157	473	119	442	5	8	.....	.....	33	36	157	486
Maine	28	52	48	93	.....	.....	.....	.....	76	145	28	75	41	87	.....	.....	.....	.....	69	162
Maryland	59	263	110	247	37	809	2	4	208	743	133	439	67	94	10	35	2	4	212	572
Massachusetts	219	1968	616	2184	.....	.....	6	13	841	4165	267	1729	524	2037	.....	.....	6	10	797	3776
Michigan	51	205	249	637	.....	.....	9	11	309	854	68	380	209	513	.....	.....	15	11	292	904
Minnesota	10	16	319	778	11	80	.....	.....	340	874	10	16	314	710	11	29	.....	.....	335	755
Mississippi	21	54	.....	.....	.....	.....	6	10	27	64	21	54	.....	.....	.....	.....	6	10	27	64
Missouri	43	183	324	1078	108	1114	22	30	482	2405	70	458	321	1040	108	1079	12	20	511	2597
Montana	.....	.....	60	67	2	4	2	5	66	76	.....	.....	60	67	2	4	5	5	67	76
Nebraska	52	91	160	297	6	36	.....	.....	208	424	59	183	150	238	6	22	.....	.....	215	443
New Hampshire	22	50	24	39	.....	.....	.....	.....	46	89	28	70	23	25	.....	.....	.....	.....	51	95
New Jersey	167	669	202	500	1	2	8	15	378	1186	119	436	88	265	3	7	8	20	218	728
New York	629	4275	758	2215	39	408	12	36	1438	6934	848	5895	455	1272	13	73	28	37	1344	7277
North Carolina	5	7	30	53	.....	.....	7	7	42	67	5	7	33	56	.....	.....	4	5	42	68
Ohio	69	157	556	1785	44	322	4	8	673	2272	204	436	538	1566	44	197	4	4	790	2203
Oregon	7	8	91	173	8	23	31	39	137	243	19	39	62	108	13	45	35	43	129	235
Pennsylvania	522	1812	687	1278	70	324	4	6	1284	3420	688	1931	484	923	70	334	.....	.....	1242	3188
Rhode Island	68	353	51	89	3	58	.....	.....	122	500	67	410	51	65	3	14	.....	.....	121	489
South Carolina	34	93	12	6	.....	.....	.....	.....	46	99	38	99	.....	.....	.....	.....	.....	.....	38	99
South Dakota	17	16	9	7	.....	.....	6	2	32	25	17	16	9	7	.....	....	6	2	32	25
Tennessee	23	50	202	332	.....	.....	73	57	298	439	26	56	197	319	.....	.....	71	99	294	464
Texas	99	205	278	365	.....	.....	32	29	409	599	150	263	249	3 7	.....	.....	32	31	431	611
Utah	.....	.....	86	128	.....	.....	15	10	101	138	.....	.....	84	112	.....	.....	16	10	100	122
Vermont	10	19	5	8	.....	.....	.....	.....	15	27	13	20	.....	.....	.....	.....	.....	.....	13	20
Virginia	26	89	120	181	.....	.....	4	4	150	274	30	84	97	138	.....	.....	16	14	143	236
Washington	7	8	221	250	27	77	16	5	271	340	7	8	195	226	29	75	19	7	250	316
West Virginia	13	19	34	85	.....	.....	.....	.....	47	104	21	30	33	51	.....	.....	10	20	64	101
Wisconsin	23	33	230	419	.....	.....	12	9	265	461	66	115	120	286	.....	.....	.....	.....	186	401
Wyoming	5	11	.....	.....	.....	.....	.....	.....	5	11	5	11	.....	.....	.....	.....	.....	.....	5	11
Total	3497	16845	7476	17233	658	4805	566	616	12174	39509	4460	19315	5939	13415	646	3971	620	698	11634	37274

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to
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ANNOUNCEMENT OF REMOVAL.

The Street Railway Journal *has outgrown its present quarters and has secured a new home in the Havemeyer Building, which extends from Cortlandt to Dey Street on Church Street. This building is close to the Cortlandt Street station of the Sixth Avenue Elevated Railroad, near to the Hudson ferries and the downtown business center of New York, and we feel confident will prove very convenient and accessible to our subscribers and friends. Our offices are located on the thirteenth floor, and command an extensive view of New York Bay and the North River front. A special reception room, furnished with files of the* Street Railway Journal *and other technical papers, will be provided to which all interested are welcome. We extend a cordial invitation to all our friends to call and see us in our new home as often as convenient. Those from out of town will be especially welcome, and we trust that they will make our office their headquarters during any visit to New York.*

"American Street Railway Investments," a Supplement of the Street Railway Journal—the announcement of which has been made by private letters and general circulars during the past month—is the most important special work which we have ever undertaken. The plan was first conceived by us nearly two years ago, but for many reasons, chief among which was the intensely narrow market for street railway securities at that time, it was thought best to postpone action. The wisdom of bringing out such a publication at the present time is not, we believe, open to question. During the past two years the street railway industry in this country has pressed forward with leaps and bounds. The great investing public has become favorably disposed toward street railway securities, but is not placing money in this field to any large extent, nor will do so until there is some authoritative source of information concerning individual street railway properties. The great publicity given to steam railway operations in this country, although jealously fought by the managements in years past, is now recognized as of inestimable advantage to their security holders, insuring a wide market for their holdings, not only in direct purchases and sales, but for use as collateral in obtaining loans. If any further proof were needed that greater publicity will directly benefit legitimate street railway enterprises, it is found in the undoubted fact that the street railways in the few Eastern States, which are obliged by law to publish detailed annual reports, are regarded by investors with much greater favor than properties whose reports are published only occasionally if at all The plan of the supplement is broad and comprehensive. Co-operation is invited from all street railways in this country, but no attempt will be made to obtain or print information from those who do not wish to be represented. It is our profound conviction that the time is ripe to broaden the demand for street railway securities, and that the annual publication of this investors' supplement to the Street Railway Journal will be followed by perhaps gradual increase in the interest taken in this field by legitimate investors.

The Valuable Financial Articles by Mr. Higgins, which we commence in this issue, will serve in still another way to broaden the market for legitimate street railway investments, since they will contain the most careful exposition yet made of the fundamental principles which should govern investors in their choice of securities. No such comprehensive treatise as this is possible in the steam railway industry, because of the many and complicated influences which affect passenger and freight traffic on widely ramified railroad systems, although the brilliant essays of Charles Francis Adams, Jr., Arthur T. Hadley and A. B. Stickney are well considered attempts in this direction. The broad lines of the street railway industry, on the contrary, are far simpler and will be easily comprehended by investors who will take the trouble to study the conditions. The territories served are, in all cases, strictly limited in extent—competition is far less a menace to prosperity—rate wars are almost unknown—and the gross business done is under the direct daily inspection of thousands of persons more or less interested in results. That there are failures as well as successes in so large a field goes without saying. We learn in Mr. Higgins' first paper that purely local roads in cities and towns of less than 25,000 inhabitants are often unprofitable to a greater or less extent, although even here careful management has brought about a fair proportion of successes. We shall find in subsequent papers that the conditions for operation in larger cities are much more favorable, and the intrinsic value of street railway investments on the whole will be shown to be as great as, if not greater than, that of most of the large classes of investment which receive the attention of capital.

A Concrete Foundation for street railway tracks, following the English practice, has been employed on certain lines in Montreal, as noted under the head of "Correspondence," in another column, and is apparently giving good satisfaction, notwithstanding the fact that it is located in a very cold climate. As was said editorially in our last issue, we should be glad to see the experiment tried extensively in different localities in our own country, as it is possible that in former experiments there were elements of weakness which can now be eliminated, so that when the cost is not prohibitory we might reap the same

advantage from this method of construction as is enjoyed by the operating companies on the other side of the water.

An Instructive and Interesting Report relative to the operation of a street railway system in Pittsburgh, Pa., will be found in another column of this issue, which has been kindly furnished us by the superintendent. As this report includes the operations on both cable and electric lines, it furnishes a good opportunity for comparing the relative earning power of these two methods of traction, especially as they are operated under the same management, although the conditions are not the same. One having time will be able to work out from the report a good deal of data that will show some striking results; for instance, one power may be substituted for the other with the traffic and conditions of the other. We have more inquiries from street railway managers for this class of matter than for any other, and it is gratifying that our efforts to induce street railway companies to make public their records of operation are meeting with such success. As we have repeatedly said, those who expect to get must give, and where local reasons do not exist for withholding annual reports and reports of operations, the publication of the same will result in great benefit to the street railway business at large.

The Past Year was the most generally unsatisfactory from a business and financial standpoint that the country has experienced for at least twenty years. Whatever the causes were which produced the industrial crisis, its effects were felt in every part of the country. The street railway traffic responds promptly to all changes in the public prosperity, and the receipts on most roads have fallen off considerably during the year. But more seriously than in any other line the national trouble is felt in the direction of new enterprises. These depend largely upon borrowed capital for the means of their construction and upon the ability to float securities, and opportunities in this line during the last nine months have been very much restricted. Still, it is probable that street railways, as a whole, have suffered as little loss as any of the large industries, and as in spite of the depression new roads have been built in different parts of the country, many of the street railway supply companies, as will be seen in another column, report a good business, and in several instances an increase of business during the past year over that of 1892. So far as can be now predicated, the street and electric railway construction in 1894 promises to exceed that of any previous year. Cheap money should be followed by a demand for high grade investment securities in which are classed the standard street railway bonds. If the sale of their bonds can be easily effected, there will be nothing to stand in the way of street railway companies pushing forward their electrical equipment, and we anticipate a rapid growth in electric railway mileage in 1894.

The Amount of Annual Dividend Paid by a street railway company is not always a measure of the manager's ability. It is possible to pay out so much in dividends that nothing is left as a reserve fund with which to make extensions or make repairs. A manager who makes dividend paying his sole aim to the neglect of the traffic and failure to keep the equipment up to a proper standard, may gain the favor of the stockholders for a time, and keep the price of the securities high for a certain period, but in the long run his reputation will suffer, for if the road is in a growing city and it becomes necessary to provide increased trackage and accommodations for increased traffic, the only alternative will be an issue of more stock or an increase of bonded indebtedness, which will displease the original investors, and is not always best or desirable, especially if the first issues were well up to the value of the property. A conservative policy will preferably provide a suitable reserve, which may be estimated by making a careful comparison of the growth of the city and increase of traffic from year to year for a number of preceding years. The principal factors in the problem, which must be carefully studied, include the population of the city for each year, the number of miles of new track laid, number of passengers carried, rides per capita of population, gross receipts, net profits, total car mileage, passengers per car mile, cost per passenger and net profit per passenger. These data should also be compared with like data from as many other cities similarly situated as it is possible to obtain, when it will be easy to judge regarding future growth and the probable outlay that will be required to meet it. There is a science in the street railway business well as in law or medicine, and he is the best manager who works along scientific lines.

A Broad and Liberal Policy on the part of municipal authorities in their treatment of street railway corporations, whether it be in the granting of new franchises or franchises for extensions, will as a general thing, result in a service infinitely more satisfactory to the patrons and property holders than a policy that exacts a compensation for the use of streets, either as a tax on gross receipts, an excessive car license or the paving of the entire street. Transportation systems deal with the lives, customs and living habits of the people, and are more prominent factors in character forming than most people realize. They change tenement house property into business blocks and give increased value to all suburban property, because, by them, laboring men can readily reach the outlying districts, where they can own comfortable homes and live under healthful conditions, comparatively free from the debasing influences of city life. No one who has the good of the common people at heart can advocate the taxing of an industry that is giving value to all property, far in excess of all possible returns that the investors who promoted the enterprise can ever expect to receive. Hence, it is that capital invested in this industry should have liberty to earn the largest possible dividends free from tax upon franchise, dividends, privileges or rights of any kind other than tax upon real estate owned or leased by them, the same as would be required of a private individual. It may be stated as a broad proposition that as burdensome taxes are imposed the service will be crippled to a proportionate extent, and private capital will soon be driven from this field, when the building of street railways must necessarily be relegated to municipal ownership, a policy incompatible with our principles of government. On the other hand, money invested in the transportation lines should be made as secure as possible, so that street railway stocks and bonds would become favorite investments. It is seldom that street railways outside the large cities are built by local

capital, but the securities, sooner or later, find their way to the moneyed centers, and are usually rated, not alone by the amount of business done, as shown by the annual reports, but by the period for which the franchise is granted, the conditions of local taxation and the attitude of the community toward the corporation in which the road is located. If there is a disposition to constantly interfere and change the conditions of the franchise every time the route is to be extended, or a disposition to favor any rival company that may be organized, then investors will decline the securities and invest their money in more stable stocks. There should be no conflicting interests in this matter of transportation. The business from its very nature is of a quasi-public character. The moneyed investor, the patrons, property holders and city authorities should work in harmony, and they will reap no permanent success where any of those interests are ignored. Hence, there should be the largest liberty of action allowed the operating company, which, in return should annually make public all the details of operation, including receipts and expenditures. Much of the so-called dissatisfaction on the part of the taxpayers and labor elements comes from either selfishness or ignorance of the facts in the case, and failure to recognize the benefits which a street railway confers. There are those who seem to think that the street railway business is exceptionally profitable, and that railway corporations exist only for the benefit of the stockholders. This fallacy can best be corrected by means of stated reports and the setting forth of facts, relative to the benefits which the system is conferring on the community in which it exists. These benefits include, not only the increased value to property and the advantage of suburban homes, as noted above, but also by providing ready access to schools, churches and places of amusement, and by giving employment to a large number of men. It is the transportation facilities alone that prevent the cities of our country from becoming like many of the cities of the Old World, where thousands are obliged to live in cellars and garret tenements. Hence, it may be seen that the payment of a few thousand dollars, by a street railway company into a city treasury, is no measure of the benefits which the service confers, but is rather a curtailment of the service to a degree corresponding to the payments made. An acceptable service generally begets a corresponding patronage, so that it is plainly to the interests of every operating company to provide the best possible service, and its efforts to do so should not be crippled by the action of local authorities.

Electric Welding of Rail Joints.

The possibility of employing a continuous rail for street railway purposes, in which we expressed our faith about a year ago, is encouraging, although the experiments in this direction which have been made during the past year at Johnstown, Pa., and on the West End lines, of Boston, Mass., have not until now been entirely satisfactory. In Johnstown about 13,000 ft. of rails, of the Johnson girder type, were electrically welded, and in Boston on a little over six miles of track, constructed with the Providence girder rail, the joints were thus united. The result was a smoother track than it had been possible to obtain by any other means of union. Unfortunately, however, in the Boston experiment, about 10 per cent. of the rails broke, in a few instances at the weld, but generally within a few inches of it, the fractures occurring more frequently in the Providence type of rail than in the ordinary girder rail.

The experiment has proved, beyond question, that a continuous rail, thoroughly protected by the pavement, shows no ill effects from expansion, either of buckling upwards or curving outwards, but whether the rails broke from contraction or from inherent weakness due to the welding, is yet to be demonstrated. It is claimed by the Johnson Company, by whom the welding has been done, that the breaking is due to the pent up expansion strains until now not properly provided for. In the process of welding in the Boston experiment, only a part of the web of the rail was united, and, in some cases, short fishplates were welded in place.

The experiments will be continued, but hereafter the entire end surfaces, including the head, will be united, and care will be exercised not to injure the fibre of the metal or to restrain the expansion due to the heat. These difficulties being overcome, there is little question of ultimate success. The new form of weld embodying these features has been introduced in the last experiments at Boston, and it seems to have entirely overcome all the first defects. The Johnson Company is now satisfied that the process is a success, and it is its intention to order at once several more welders. The experiments are being watched with a great deal of interest, and great credit is due the Johnson Company for its perseverance in this direction.

Next to the welded joints, the best success has been had on the lines of the West End Company by the employment of deep rails united with the Standard girder joint. These joints, of which about 6,000 have been employed on the lines of this company, are about three feet in length, and, we are informed, have required no attention since they were put in service.

Legal Pointers.

By Wm. M. McKinney.

Driver Giving Passenger Incorrect Change.—The case of *Curtis* v. *Louisville City Ry. Co.* (23 S. W. Rep. 363) should serve as a warning to companies running bobtail cars, that change done up in packages and given to drivers should be carefully counted. In this case, a passenger handed the driver a fifty-cent piece, and requested change for it. The driver gave him a package of nickels marked "fifty cents." The passenger immediately, and in the presence of the driver, counted the nickels, and they were short five cents. He called the driver's attention to the shortage, and demanded the correct change. The driver, not denying the shortage, refused to give the correct change, saying that he had received it at the company's office for fifty cents, and that if there was a shortage, the company must correct it. He then requested the passenger to put five cents in the box, and when the car reached the next station the office would correct the mistake. The passenger declined to put the five cents in the box, saying that the driver having refused to give him back the correct change had retained the fare, and that he would not pay it again. Thereupon the driver called a policeman and caused him to eject the passenger from the car. In an action against the passenger to recover damages, the court held that the street railway company was liable, saying: "It seems that the fear of the driver that the company would not make good to him the shortage, and that the loss would fall upon him if he made up the shortage, caused him to prefer that the company should make the correction. It admits of no doubt from the evidence that the package contained a shortage of five cents. Now, as said, the appellee's rules were reasonable, and if a passenger refused to comply with them the appellee would have the right to expel him for non-compliance. But the question is, who was authorized to make change on behalf of the appellee, and for its benefit, as well as that of the appellant, retain a nickel by mistake belonging to him, and then compel him to put the fare, another nickel, in the box, because the rule of the company required the appellant to put his fare in the box? Now, the appellant had placed the nickel in the hands of the driver, and he was authorized, under the rules, to put it in the box. He received the half dollar, and retained five cents too much—the amount of the fare—and he would not give it to the appellant, but required him to

pay his fare in addition. The retention of the five cents was, under the circumstances, a payment of the fare which the driver could have put in the box had he desired. But whether he put it in the box or not did not concern the appellant, because he had paid his fare and was entitled to his ride. The mistake as to the amount that was in the package was that of the appellee, and not that of the appellant, and the court adheres to the rule intimated in *Wisey* v. *R. R. Co.* (83 Ky. 511)—which is sustained by other cases—that if a passenger has paid his fare, and the company fails to furnish him with proper evidence of the fact, he is nevertheless entitled to his ride, because the mistake is that of the company, and the passenger ought not to be prejudiced by it, and that the company is responsible for any damages that the passenger sustains in consequence of being ejected by the company."

DANGER OF THE TROLLEY SYSTEM. In *Louisville Bagging Manufacturing Company* v. *Central Passenger R. R. Co.*, the Court of Appeals, of Kentucky, held that the operation of an electric street railway by the overhead wire system is not so dangerous to those who reside or do business on a public street, as to authorize its restraint by injunction. The court said: "The next ground is that operating an electric railway car upon a public street is dangerous to those who reside or do business thereon. Practical application of electricity as a power to drive machinery or move carriages, as also for illuminating purposes, is of recent date, and it is shown the system best adapted for the purpose, if yet discovered, is by no means a perfect one. The evidence of experts and men having actual experience shows that three different systems for moving railway cars by electricity have been tried in this country, viz: The underground conduit system, the storage battery system, and that of the overhead wire; and it fully appears that the two first are as yet so defective or imperfect that, of several hundred electric railways in operation, there are not a dozen to which either system has been applied, all others being run by the overhead wire or trolley system, the same used by the Central Passenger Railway Company. To apply electrical power in that way requires the erection at the edge of the sidewalk, on each side of a street, of tall poles, about 120 ft. apart, and from the tops of opposite poles are stretched across the street sustaining wires, which hold up the electric wire that is thus suspended over the middle of the railway track, and from which, by means of the trolley pole, the electric current is connected with the motor placed under the car. It will thus be seen that the electric wire is not like telegraph, telephone and electric light wires near to buildings, but suspended over the railway track. It further appears that the electric pressure, measured by volts, required to drive a street railway car is not so great as to destroy or seriously injure a person or animal coming in direct contact with it; injury, where it is produced, resulting only where a broken or detached telephone or telegraph wire falls on it. The evidence in this case, which need not be considered in detail, shows that, although new and not fully perfected, the trolley system of operating street railway cars, when properly adjusted and supervised, is not much, if any, more dangerous than horse power, applied in the same way. Moreover, while street railway cars thus operated go at greater speed, are more comfortable, and must in time become a cheaper mode of travel, they can be more easily controlled than horse cars, and do not really more obstruct the streets, or interfere unreasonably with business transacted thereon. It, therefore, seems to us that in view of the benefit and convenience to the public of electric cars thus operated, and the comparatively little inconvenience or danger they are to individuals, it would be going beyond the province of a court, and contrary to the decided weight of judicial authority, to enjoin or limit their use; especially when a party seeking such remedy so signally, as has the plaintiff in this case, fails to show that he has been unreasonably obstructed or hindered in his business, or that his rights have been illegally interfered with. The judgment dissolving the temporary injunction and dismissing the action is affirmed."

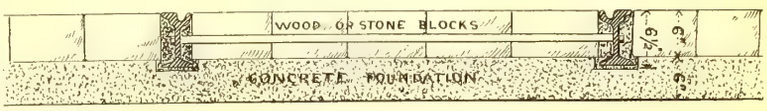
Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Montreal Track Construction.

CITY SURVEYOR'S OFFICE, MONTREAL, December, 1893.
EDITORS STREET RAILWAY JOURNAL:

In reply to your letter of November 22, asking me how the English system of construction for electrical service on a concrete foundation has stood the winter in this climate, I beg to inform you that when the Montreal Street Railway Company, last year, began its construction, I advised it to do away with the wooden ties on streets where there was a concrete foundation underneath the pavement. The construction adopted was as follows: The girder rail being six and a half inches deep on wooden paved and stone block streets upon a concrete foundation, we cut out the concrete to the width of



the flange of the rail, about an inch deep, and placed the rails on oak shims and flooded with a cement grout consisting of one part of cement to one of sand, under the flange of the rail; the rails were tied together with iron rods, and each side of the web of the rail was filled with cement grout mortar of one to one to the width of the rail. We then replaced the wooden or stone block and filled up all intersection with a cement grout of one to one as shown.

This mode of construction stood last winter exposed to a temperature of 20 degs. below zero, and the rail neither contracted in winter nor expanded in the heat of summer, nor did the pavement on either side of the rail move. I think this is very satisfactory. We have continued the same system this year, and have laid about forty-two miles of track in the same manner; the durability of this work depends entirely upon the strength of the concrete foundation. The accompanying sketch will illustrate our method.

Yours truly,
PERCIVAL W. ST. GEORGE,
City Surveyor.

A Letter from Mrs. Reckenzaun.

34 HEMBERTON ROAD, STOCKWELL, S. W.,
November 27, 1893.

EDITORS STREET RAILWAY JOURNAL:

Will you allow me a space in the columns of your journal, which has amongst its readers so many of my late husband's friends, to thank them for sending me, in such numbers, letters of sympathy and condolence.

Their number is far too great for me to reply to them individually, and I hope you will give me this opportunity of expressing to them my warmest thanks, and the gratification it is to me to know how universally my husband was beloved and respected.

Faithfully yours,
E. RECKENZAUN.

The Fire at the Works of the New Castle Car Manufacturing Company.

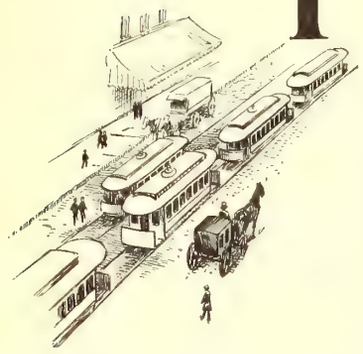
NEW CASTLE, PA., December 26, 1893.
EDITORS STREET RAILWAY JOURNAL:

All the papers have been publishing statements that our factory was totally ruined by fire. I write for publication, if you so wish, that our planing mill together with the machinery was destroyed by fire, but the constructing room, painting department, etc., were undamaged.

We expect to rebuild at once and be ready to run in thirty days. We are in the market for a new engine and all necessary wood working machinery.

Yours truly,
THE NEW CASTLE CAR MANUFACTURING COMPANY.

Starting the Cable Cars on Third Avenue, New York.



THE formal opening of the cable service on a portion of the Third Avenue surface road took place on the afternoon of December 4, when ten of the new cable cars were started from the Harlem station at 130th Street, carrying the officers and directors of the Third Avenue Railroad Company and a large number of invited guests, including the city officials, officers of other New York roads and representatives of the daily and technical press. The cars were in charge of experienced conductors and gripmen in new uniforms of gray material, who had been trained in their duties on the cars of the 125th Street and Tenth Avenue cable lines.

The run was made without a hitch to 6th Street in about an hour, and the avenue for the entire distance presented a holiday appearance, as from many of the principal buildings flags were flying, while the sidewalks, and in some cases the streets even to the line of the track, were thronged with eager sightseers, and from the hundreds of windows of the flats and apartment houses along the route men and women leaned forth to shout their welcome to the handsome new cable cars. At 6th Street the cars were switched to the up track and returned to 65th Street station, where the first car containing the officials of the company was photographed (Fig. 1), when the guests alighted and repaired to the power station, where an elaborate lunch was served, enlivened with music by the military band from the Hebrew Orphan Asylum. After lunch an opportunity was given for all to inspect the driving machinery, some of the auxiliary engines and the overhead electric crane being started up for the pleasure of the company. Two hours were thus spent in social intercourse, and many were the congratulations tendered to the officers of the road and the principal contractors on the completion and success of this important enterprise.

Ten of the cable cars were put in service on December 5, being sandwiched with the horse cars, and the number has been increased from day to day, so that when we go to press forty cars are regularly running, and in a few days more all the horse cars above 6th Street will have been superseded by the cable cars to the number of 180. As soon as the horse cars are out of the way, the ropes will be speeded up to the regulation speed of nine miles per hour, and a headway of three-quarters of a minute will be established. The southern section of the line, from 6th Street to Ann Street near the Post Office, will, it is expected, be in full operation during the present month.

The columns of the Street Railway Journal during the last three years have contained numerous illustrations and descriptive articles of the progress of the work, the machinery and rolling stock of this interesting line, but in this connection it will not be amiss to give a brief review of the work and note the difficulties that have been encountered, that all may fully appreciate the courage, foresight and patience that have been exercised by the officers of the company in inaugurating and bringing to a successful completion the cable enterprise.

ROLLING STOCK.

That portion of the equipment which will be of most interest to the general public, will, of course, be the cars. These consist of a winter and a summer equipment, and are claimed by the managers of the Third Avenue Company to be as good as money can buy. The cars were built by the Laclede Car Company, of St. Louis, Mo., and are finished in the highest style of the car builders' art. The bodies of the closed cars are twenty-two feet long and each car is thirty feet long over all, with the hoods supported by means of pipe posts. The interior finish is of mahogany, with ceilings of birdseye maple, and door panels of the same material. The seat cushions are of dark red plush. The Pintsch gas system of lighting is employed, and there are three domes in the ceilings in which are placed handsome four-burner chandeliers enclosed in glass globes and supported by bronze brackets. The cars are so brilliantly lighted that there is no difficulty in reading a paper in any part. Four oil lamps, for emergencies, complete the interior equipment of the car. The deck lights are in two tiers, the lower or stationary portion being of stained glass composed of small triangular pieces set in lead, while the upper or ventilator portion is glazed with delicately colored cathedral glass. There are seven windows of French plate glass on each side, and shutters of mahogany with basswood slats. The exterior of the car is strikingly handsome, the main panels and dashboards being painted in bright red with silver ornaments and gold lettering, while the lower panel is in white. The hand rails and metal trimmings are of bronze, while the iron platform gates are of the folding type, and painted red.

The grips and brakes are operated by straight levers from either end of the car. The life guards consist of V shaped fenders faced with rubber, with a wire screen on both sides of the trucks. The trucks were designed and manufactured by the Baltimore Car Wheel Works, and have the Third Avenue standard, oiltight axle boxes.

The open cars are forty feet over all, with a four foot platform at each end, and have a seating capacity for forty-eight persons. These are mounted on double trucks of the McGuire type. The open car has a center aisle and twenty-four reversible seats, with rattan coverings, of the Hale & Kilburn type. The ceilings are of birdseye maple, and the deck lights are of stained glass, and all the interior mountings are of bronze. The exterior is painted red, with silver ornamentation and gold lettering. In addition to the regular storm curtains, adjustable awnings extend the entire length of the car, which may be let down to shield the passengers from the sun's rays.

The grips on the closed cars are mounted on the trucks beneath the center of the car, and are connected, by means of rods, with the platform levers (Fig. 2). The grip, which is of the movable lower jaw type, takes the rope on either side, and is of the same pattern as used on the 125th Street and Tenth Avenue line, which was designed by Mr. Robertson, the superintendent, but differs from them by having a triangularly shaped trip on on each end in place of the vertical spools formerly employed. It is claimed that a grip with a movable lower jaw is easier on the rope, and in case of a defective rope, is less liable to foul with the grip. It is possible also, when necessary, to lessen the hold on the rope on the curves, since the upper jaw takes the side strain against the curve guard. The new grips are also provided with a tripping device which was designed by the superintendent of the company, and is employed as a protection against cutting the rope. This device consists of a joint or clutch which devides the connecting rod leading from the grip to the lever, and which is operated by means of a lever chain and a depending trip or finger and a connecting chain (Fig. 3). The trip is sprung by coming in contact with a toe or projection coming up through a surface plate beside the slot rail. The toe is supported by a rocking lever placed diagonally under the surface, and provided at its outer end with a projection beside the track rail in position to be depressed by the tongue of the wheel flange, which raises the other end and lifts the operating toe above the surface. In case the gripman fails to release the rope on approaching a crossing or other points where it is necessary to trip the rope, the finger springs the trip which allows the rod to part, when the lower jaw falls by its own weight, releasing its hold on the rope. At the next pick-up it is necessary for the gripman to stop and readjust the trip, which is done through a trap door in the floor. In case the rope has been released by



J. H. ROBERTSON, SUPERINTENDENT



HENRY HART, VICE-PRESIDENT



ALBERT J. ELIAS, PRESIDENT.



JOHN BEAVER, TREASURER.



ALFRED LAZARUS, SECRETARY.

Executive Officers of the Third Avenue Railroad Company.

the gripman, the connecting chain is slack and does not operate the joint.

STREET CONSTRUCTION.

The Third Avenue line extends from Ann Street, near the Post Office, along Park Row, the Bowery and Third Avenue to 130th Street, near the Harlem River, a distance of nearly eight miles, and while there are no corners turned there are twenty-eight deflections in the line where it was necessary to employ curve pulleys, the principal one being a compound curve, 500 ft. in length, at Chatham Square, with radii varying from 280 to 500 ft. The lower end of the line terminates in two balloon loops,one beside the main line encircling the Franklin Statue at Printing House Square, and the other at Ann Street, which has a radius of forty-one feet, the entrance and exit radius being fifty-one and forty-one feet, respectively. The rope is carried around the loop by sixty-two horizontal pulleys thirty-three and five-eighths inches in diameter. At the Harlem terminal the loop turns into 129th Street, where it divides into twenty-six parallel tracks which lead over pits in the car barn and emerge at 130 Street, where they converge and return to Third Avenue. The cables do not round the barn loops, but pass around the terminal sheaves in the vault just north of 130th Street, and a Connelly gas motor is employed at this loop for hauling the cars to and from the barn. There are no less than thirty-five separate track crossings on the line, the one at 125th Street being a cable crossing (Fig. 4), and there are eight points where the other roads switch off from the Third Avenue line, and nine crossover switches. The switches are so constructed that the cable cars continue on the main track and ride over the switches, while the horse cars of other lines switch off as required. At the cable crossings where it is necessary to drop the rope, and at the power stations, automatic lifting devices are employed, which bring the rope into position to be taken by the grips. These are also supplemented by hand lifts in the event of the others failing.

The street construction of this, in some respects, the most important cable ever built, has many peculiar features. In the first place, it is operated by a duplicate, and in one division by a triplicate set of ropes. The two ropes are so mounted that they can be operated together or singly, and either one may be stopped or started at the will of the engineer. The line is operated in three divisions requiring seven ropes, having an aggregate length of 193,295 ft. The Harlem division extends from 130th Street to the main power station at 65th Street and the ropes on this division are 36,600 ft. in length. The second division extends from 65th Street to 6th Street near the Cooper Union, and on these two divisions the ropes are operated from the 65th Street station, at a speed of nine miles per hour. The City Hall, or southern division, extends from 6th Street to the Post Office terminal. There are three ropes which are operated from the Bayard Street station. Two of them are mounted in the conduit in the ordinary manner, and are run at a speed of seven miles per hour, while the third has a speed of only five miles, but which is taken up south of Bayard Street, on the down trip, and carries the cars down through Chatham Square, Park Row and around the loop, back to the *Times* Building; then one of the fast speed ropes is taken up and employed to 6th Street (Fig. 5). One of the fast ropes down to the terminal vault at the loop, and the slow rope from the *Times* Building up to Bayard Street are carried in a blind conduit outside of the fast ropes.

The object of the slow speed is to avoid slipping the rope on the up grade on Park Row on account of the traffic at that point going slow speed, and also to avoid accidents on the loop. Neither of the ropes, however, is led around the second loop at Printing House Square. This is to be used only in case of a blockade, when the cars will be transferred by horse power.

The conduit on the tangent construction is twenty-four inches deep and fifteen inches wide, while the slot rails are arched and have an unusual spread at the base, the object being to allow the grip jaws to ride well up to the surface of the street, and thus avoid the necessity of a deep conduit which would interfere with a greater num-



W. L. ELKINS, JR.,
PRESIDENT PENNSYLVANIA IRON WORKS COMPANY.



B. W. GRIST,
GENERAL MANAGER.

DESIGNERS AND BUILDERS OF THE POWER EQUIPMENT FOR THE THIRD AVENUE RAILROAD.



E. A. MOORE,
CONSTRUCTING ENGINEER.

ber of gas and water mains. Two styles of yokes are employed, weighing, respectively, 475 lbs. on the tangents and 500 lbs. on the curves. The tangent yokes on that portion of the line constructed by the first contractor rest on concrete piers 12 × 12 ins. and five feet in length, the base extending forty-six inches below the surface of the



R. P. TOMASSECK,
CHIEF ENGINEER.

street; but on the later construction a continuous bed of concrete, six inches in depth, was employed, and in this the yokes rest, being spaced five feet apart. The track rails and slot rails are firmly bolted to the yokes with broken joints, the joints of the track rails being suspended and those of the slot rails supported by the yoke. Both rails are braced at the yokes and intermediately by peculiarly formed steel tie rods with double bolts through



JOHN BROLLES,
ASSISTANT SECRETARY.

the slot rails, the object being to prevent any possibility of the rail tilting. The slot rails are slightly adjustable, a small space between the rail and the base being filled with a bituminous concrete, which can be melted out when it is necessary to open the slot, in case it should be closed by frost pressure or surface traffic. No bolts or nuts were allowed to project into the conduit.

The track rails are of the semi grooved type, weighing eighty pounds per yard, and are seven inches in depth, this type of rail being required by the Railroad Commissioners of the State. The joints are connected by heavy, six-bolt fishplates, with nut lock washers, and the draining of the rail groove is provided for by the employment of drainage plates connected to the nearest manhole at the foot of each grade. The total weight of the metal per lineal foot of single tangent track on the tangents, is 210 lbs., but on the curves and at the crossovers a much greater weight is employed per foot.

The conduit walls are eight inches in thickness on the sides and ten inches at the bottom, and are composed of concrete made from the best Burnham and Gillham Portland cement, the entire quantity of cement consumed being 46,000 bbls. The details of construction, as followed by the first contractor, included a steam crusher mounted on a car and operated by a portable engine, which was run along ahead of the work on the old tracks, and in which a part of the old paving blocks, which consisted principally of trap rock formation, were crushed, and employed as material for the concrete; a mechanical concrete mixture was also employed. On the later construction, however, the broken stone was purchased and delivered at the cross streets, where the materials were mixed on platforms by hand and delivered to the trench



C. G BLISS,
MECHANICAL ENGINEER.

by carts and wheelbarrows, when it was tamped in place, wooden forms being provided to shape the conduit, and also for manhole foundations. The pulley vaults are spaced thirty-five feet apart, and are constructed of brick and cement. Where the tracks are close together a single vault connects both conduits, with a manhole between the tracks. The double pulley vaults are five feet two and a half inches deep, four feet wide, and the manhole covers are 2 ft. 6 ins. × 2 ft. 6 ins. Where the tracks are separated, as on a portion of the Bowery between 6th Street and Grand Street, each track is provided with pulley vaults, and the manholes are located outside the rails. The carrying pulleys are sixteen inches in diameter, and are mounted in bracket frames bolted to the yokes. The curve pulleys are thirty-three and five-eighths inches in diameter, and are placed four feet three inches apart, and are of the spiral groove type, similar to those employed on the old lines of the company. These, as well as the deflecting pulleys, are mounted in gimbal bearings, which permit of adjustment in any direction. By means of the spiral groove pulleys, the two ropes are carried around the same curves without interfering with each other. A brick subway, four feet wide and five feet eleven inches in depth, is provided at the inside of the curves, which provides a passageway for the inspection of the curve pulleys. This subway is supported by I beams and T rails, above which the paving and manhole covers are placed. A pipe subway is also located between

the conduits for the entire length of the line, in which the conductors for the electric signals are placed, there being a complete signaling system, with signal boxes located opposite the manhole covers at every second block, which can be opened by keys carried by the conductors, so that communication can be had with the power station, in case it becomes necessary to stop the ropes.

The surface of the street is paved with granite blocks, resting on a concrete foundation, the vertical joints of which, between the rails and track, are grouted with concrete which was applied in a liquid form, while the balance of the surface is grouted with gravel and asphalt cement. Some idea of the excessive street traffic to which the construction is subjected can be formed from the fact that the granite paving on some portions of the Bowery was nearly worn out before the cars were running.

POWER STATIONS.

There are two brick power stations from which the seven ropes are driven; one is located at 65th Street and Third Avenue and the other on the west side of the Bowery corner of Bayard Street, and both were designed by Architect Albert Wagner, of New York. The site of the principal station is the rear portion of the old 65th Street depot before it was torn down to make room for the new power. The building is bounded by Second Avenue on the east and by 65th and 66th Streets. The ground plan containing the boiler and engine rooms is 200 × 285 ft., and the smoke stack is 200 ft. high. The engine room is open to the roof, which is of glass, eighty-four feet eight inches above the floor, and is supported by a clear span 137 ft. 10 ins., composed of seven arched steel girders, making what is, doubtless, the largest and brightest cable power station in the world. After the rope is in full operation it is proposed to remove the remaining portion of the old station and extend the new building through to Third Avenue, which will provide car storage, and rooms for repair shops and offices.

The Bayard Street station is designed to be nine stories in height, of brick and granite. The upper floors are designed for business purposes and will be served by six elevators and lighted by electricity. Only one story, however, has as yet been completed, and this has been roofed over for the protection of the machinery, but will probably be completed in the near future.

The power equipment of the main station consists of thirty-two tubular boilers of 125 H. P. each, arranged in four batteries, two on each side of the passageway, which opens on 65th and 66th Streets. The base of the smoke-stack is located between the two batteries on the east side, and two large iron flues lead into it from the two opposite batteries. The coal bunkers, which have a capacity of 8,000 tons, are located on the floors over the boiler rooms, and the coal is delivered at each furnace door by means of chutes, in which it is automatically weighed. There are four feedwaters of 1,000 H. P. each, and two duplex pumps. The water and steam connections of the four batteries and boilers are so arranged that they can be worked independently or together, so that either battery will supply steam to any of the four engines. The engines are four in number and of 1,500 H. P. each, and are of the Corliss type. Two of these are coupled to the ends of the main shaft by a crank disk, and have flywheels twenty-two feet in diameter. The two others are coupled to auxiliary shafts, which are on the same line, in the rear of the main shaft, fifty-six feet distant, to which the power of each is transmitted by means of twenty-two cotton ropes working over a pair of grooved pulleys twenty-two feet in diameter.



FIG. 1.—FIRST CABLE CAR RUN ON THIRD AVENUE RAILROAD.

The main shaft is 154 ft. in length and twenty inches in diameter in swell, with bearings 18 × 30 ins., and is divided by five plate couplings. There are four nine-foot rope pinions mounted loose on the main shaft, each having twenty-two grooves, and these are provided with plate clutches of the Walker type by means of which they are coupled to the main shaft, the clutches being operated by means of a lever provided with a hand wheel and operated by a rack and pinion. The power is transmitted from the pinions by means of cotton ropes to corresponding pulleys thirty-two feet in diameter, each mounted on the same shaft with the first winding drum in each pair, the shaft being fifty feet distant from the main shaft, and which is coupled to the shaft of the second drum by a train of cut gear, so that both winding drums are driven. The winding drums are fifteen feet in diameter, mounted overhanging, and have solid, removable rims, so that,

with the engines running at seventy-five revolutions, the cables are driven at a speed of nine miles an hour. The tension runs are 255 ft. in length, and, being located between the winding drums and the street, the rope, after being led over the sheave of the tension carriage, returns to a twenty foot stationary sheave located in front of the winders, from which it is led out to the main vault. In addition to the power described, there is a pair of small vertical engines for driving each of the four pairs of winding drums at slow speed for rope inspection or when it is necessary to turn down the grooves. These are located in front of the drums, on each side of the building, and communicate their power by a train of gears meshing with the coupling gears.

All the bearings for the winding machinery rest on heavy cast iron bed frames, which in turn are securely anchored to the foundations which, as well as the foundations for the engines, are built of brick laid in the best Portland cement. The engine room is provided with the traveling electric crane built by Wm. Sellers & Company, 134 ft. 9 ins. in length, and of thirty tons capacity. The crane, as well as the lighting circuit is supplied with current from an isolated plant.

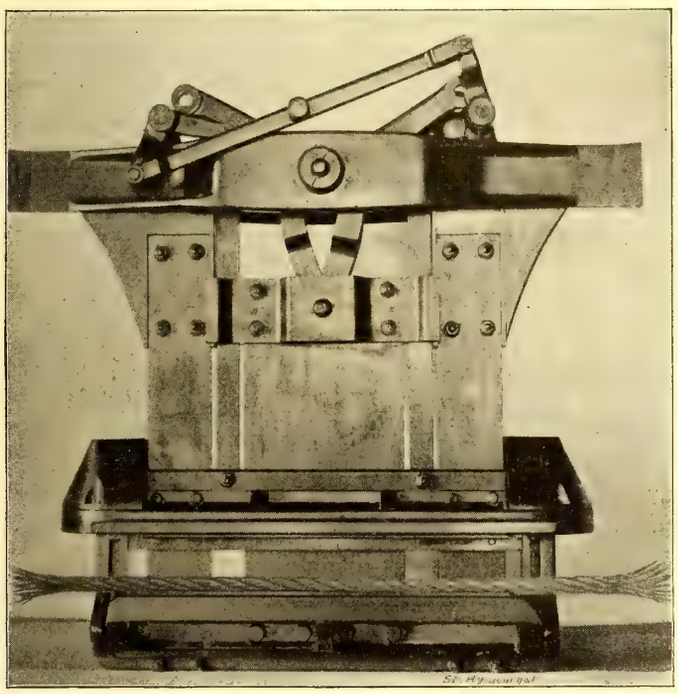


FIG. 2.—GRIP EMPLOYED ON THIRD AVENUE RAILROAD.

The power equipment of the Bayard Street station consists of sixteen boilers and two engines, and winding drums for three ropes, like parts in each case being duplicates of those employed in the 65th Street station, and described above.

The tension runs, however, are located between the winders, thus avoiding the necessity of an extra guide pulley, which is employed in the other stations. The engines and winding machinery are located on the west side of the basement, which is thirty-six feet below the surface of the street, and the coal bunkers and tension run are on the west side of the same floor. The boilers, however, are located on the first floor on the Elizabeth Street side, and a portion of this floor will be occupied as the repair shop. The engine equipment of both stations aggregates 9,000 H.P.

OBSTRUCTIONS MET WITH.

The work, as a whole, challenges the admiration of engineers and mechanics, and is a monument to the skill, ingenuity and courage of nearly all who have had a hand in its construction, but that portion of the work which has most taxed the ingenuity of the superintendent, engineers and contractors, but which does not show on the surface, has been the removing of the substructures in the street, renewing foundations to a number of elevated railway posts, and excavating for power house foundations in treacherous quicksand formation, also the placing of temporary tracks and providing for street traffic and the traffic on their car lines.



FIG. 3.—GRIP TRIPS, OPEN AND CLOSED—THIRD AVENUE RAILROAD.

Although the conduit, as before noted, is only twenty-four inches deep, it was necessary to excavate for the entire width of both tracks, in most cases to a depth of forty-one inches, and at pulley vaults, which are five feet ten inches deep, a still deeper excavation was necessary. The pulley vaults are spaced thirty-five feet apart, with a manhole between the tracks where the tracks run near together, but where the tracks are spread to a considerable distance, manholes are provided for each track. The pulley vaults are drained by eight inch pipes, and are trapped where connections are made with the sewer. On some parts of the line both tracks were constructed at the same time, all the dirt from the excavation being carted into the side streets. In some sections it was necessary to blast a channel through solid rock. Besides the cross mains of gas and water pipes frequently met with, there were encountered at the curve on the Bowery, near 5th Street, a nest of five large gas and water mains, which crossed the line diagonally and continued parallel to it for several hundred feet. These all had to be lowered, the gas mains renewed and the water mains placed in a brick subway with I beam support, and of sufficient size to allow of access to the mains for the entire distance. Below this point, on the Bowery, a large number of sewer manholes, which are about 125 ft. apart, and which came directly in the line of the west track, had to be changed. This work consists in removing the brickwork of the old shaft down to the line of the sewer, a distance of about twelve feet, and building arched transverse chambers of brick of sufficient length to bring the manhole outside of the tracks, and then rebuilding the shaft, it being necessary

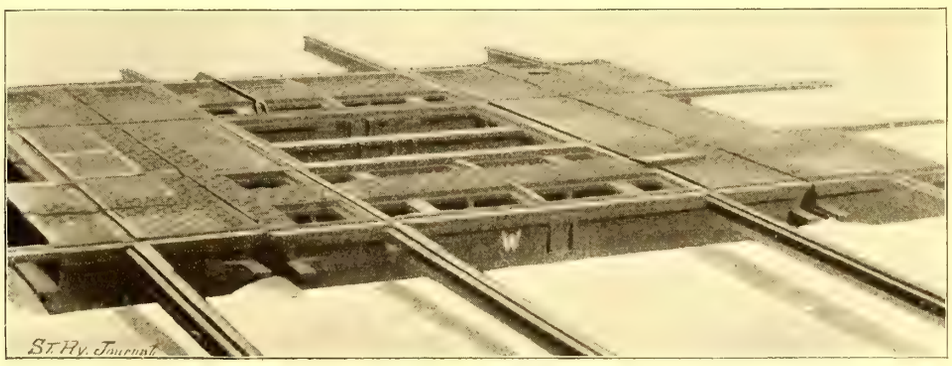


FIG. 4.—125TH STREET CABLE CROSSING.

to shore up the sides of the excavation as the formation for most of the way was sand. The terminal and interior vaults are five in number, and each required special construction. The vault for the northern terminal at 130th Street, is sunk below the level of high water in the Harlem River, and is divided by a large sewer which had to be preserved intact. The pulley vault in front of the 65th Street station is 146 × 60 ft. and 20 ft. in depth, and in it are mounted eight fifteen foot deflecting sheaves. There are also two secondary vaults near by for the elevating sheaves. In excavating for this vault a thirty inch water main was encountered, which it was necessary to sink twelve feet below its original level for a distance of 450 ft., and enclose it in a special tunnel, so that it can be inspected. New brick foundations to the depth of twenty-four feet had to be placed under six of the elevated posts, and on the west side these foundations are arched over a trunk sewer. It was also necessary to construct a special sewer along 65th Street, for a distance of about two blocks, in order to provide drainage for the vault. In excavating for the 6th Street pit, where are located the terminal sheaves, between the two lower sections, three of the foundations of elevated posts were increased to a depth of fourteen feet, it being necessary, of course, to shore up the structure while the new foundations were being placed.

In excavating for the pit or vault on the Bowery, in front of the Bayard Street station, five sixteen inch, two twelve inch and one eight inch gas mains were encountered, also a twenty inch water main, an electric subway, several six inch pneumatic tubes and a large sewer, all of which had to be changed without interfering with the gas or water service in the neighboring buildings. Besides this, the foundations of three of the elevated posts were renewed with brick to the depth of forty-five feet, the foundation being ten feet below water line, the formation being quicksand. The excavation for the Bayard Street station, however, was one of the most interesting and most expensive features of the entire cable construction. This excavation, which was in quicksand, was made to the depth of forty-two feet, and, being below the water line, it was necessary to pump out the seepage water and shore up the banks with heavy timbers to protect the walls of neighboring buildings and the lines of the neighboring streets.

Novel methods were adopted by the contractors for conducting the work on lower Park Row, in order to interfere as little as possible with the street traffic. This street is comparatively narrow from Chatham Square to the Bridge terminal, and is traveled by numerous lines of street cars and numberless trucks and wagons. An attempt was made to divert the traffic into Centre Street, but this street soon became congested, and frequent blockades occurred, so that the traffic returned to Park Row, which necessitated the bridging over of the trench with planking, on which new tracks were placed, while the excavation and placing of the yokes and concrete was carried on underneath the temporary bridge which was only a few inches above the street level. The same method was adopted in constructing the loop and the terminal pit near the Post Office, and in the case of the pit, air for the support of the workmen was forced into the excavation by means of fan blowers operated by hand power. These efforts of the contractors to prevent the blockade of street traffic are commendable, and the methods adopted reflect credit upon the engineers in charge of the work.

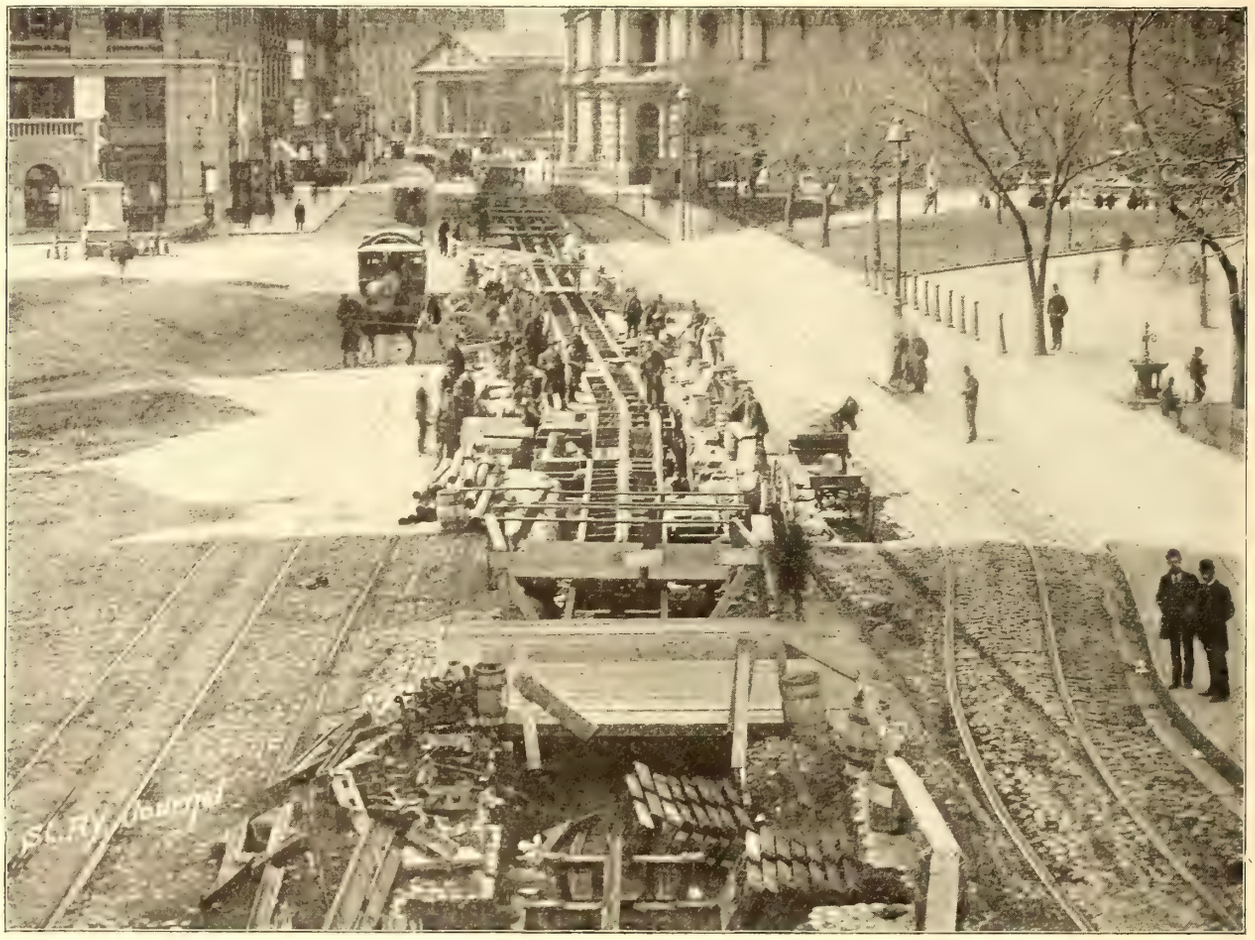


FIG 5.—CABLE CONSTRUCTION—THIRD AVENUE RAILROAD, NEAR CITY HALL AND POST OFFICE.

HISTORY.

On July 3, 1853, the first horse car was run on the Third Avenue Railroad. This road then consisted of a double track line extending from 23d and Chatham Streets, opposite Tryon Row, north as far as 61st Street. Shortly after this date, the road was extended to 86th Street, and on July 4, 1859, it was extended as a double track to 69th Street, and a single track line opened through to Harlem. A second track was, however, soon after laid on the Harlem section. At the time of the ex-

tension of the line there were very few buildings above 61st Street. The 125th Street branch was opened on October 15, 1870, and was operated by one horse cars, and on August 31, 1885, the Tenth Avenue cable line was opened to the public, and afterwards, December 1, 1886, cable power superseded the horses on the 125th Street line.

As early as September 12, 1887, two years after the completion of the cable construction on 125th Street and Tenth Avenue, the directors of the Third Avenue Railroad Company decided to cable the main line. The credit for bringing about this action is largely due to the late Lewis Lyon, then president of the company, who was an enthusiastic believer in cable traction. Steps were at once taken to get the consent of the property owners along the route, and no opposition was met with on the part of the property holders to the enterprise. The company, claiming that its franchise allowed of the employment of mechanical traction, did not make application to the Board of Aldermen for permission to install the cable system, but did apply to the State Railway Commissioners and to the Street Commissioner of the city, for permission to tear up the streets and proceed with the construction. The consent of the Railroad Commissioners was obtained on October 2, 1889, but the Street Commissioner refused the application, when a mandamus was asked for from one of the city courts compelling the commissioner to accede to the request. The court having rendered an adverse decision, the case was taken to the Court of Appeals, at Albany, and on June 17, 1890, a decision was rendered in favor of the company, and soon after an order issued requiring the commissioner to grant the necessary permit, which he did on June 24, 1890. Following this action a chief engineer was engaged and the preliminary work was begun. Before any of the contracts were let, however, the president of the road, in company with a number of directors composing an inspection committee, made a tour of the principal cable cities for the purpose of selecting the best methods of construction. After much deliberation the American or duplicate system, which is practically the same as that employed on the 125th Street and Tenth Avenue lines, was decided upon, and a number of manufacturers of engines and machinery were invited to submit for approval plans and specifications for the full equipment of the two power stations. Finally, in October, 1890, contracts were placed with Wm. Wharton, Jr., & Company, Philadelphia, for the entire construction of the line outside the power stations, including the ropes, for the sum of $1,600,000 or about $100,000 per mile of single track. The contract was also closed with the Pennsylvania Iron Works Company, of Philadelphia, for the complete equipment of the power stations after designs made by the manager of the contracting company. The actual work of reconstruction began about 4 P. M., on March 30, 1891, when the first paving block was removed from its bed near the intersection of 124th Street and Third Avenue, and this block has been carefully preserved as a memento of the occasion. The work was pushed vigorously from this time to December, 1891, about five and a half miles of regular construction being completed, when the contractors for certain reasons abandoned the contract, after which the work was divided up, and separate contracts were made for the iron and steel, excavating, castings, etc. The street construction was undertaken by Thomas E. Crimmins, for a percentage on the actual expenditures. Work was renewed by the new contractor in February, 1892, and pushed to a successful completion, as noted above, but the cost per mile has doubtless exceeded the original estimate to a considerable extent.

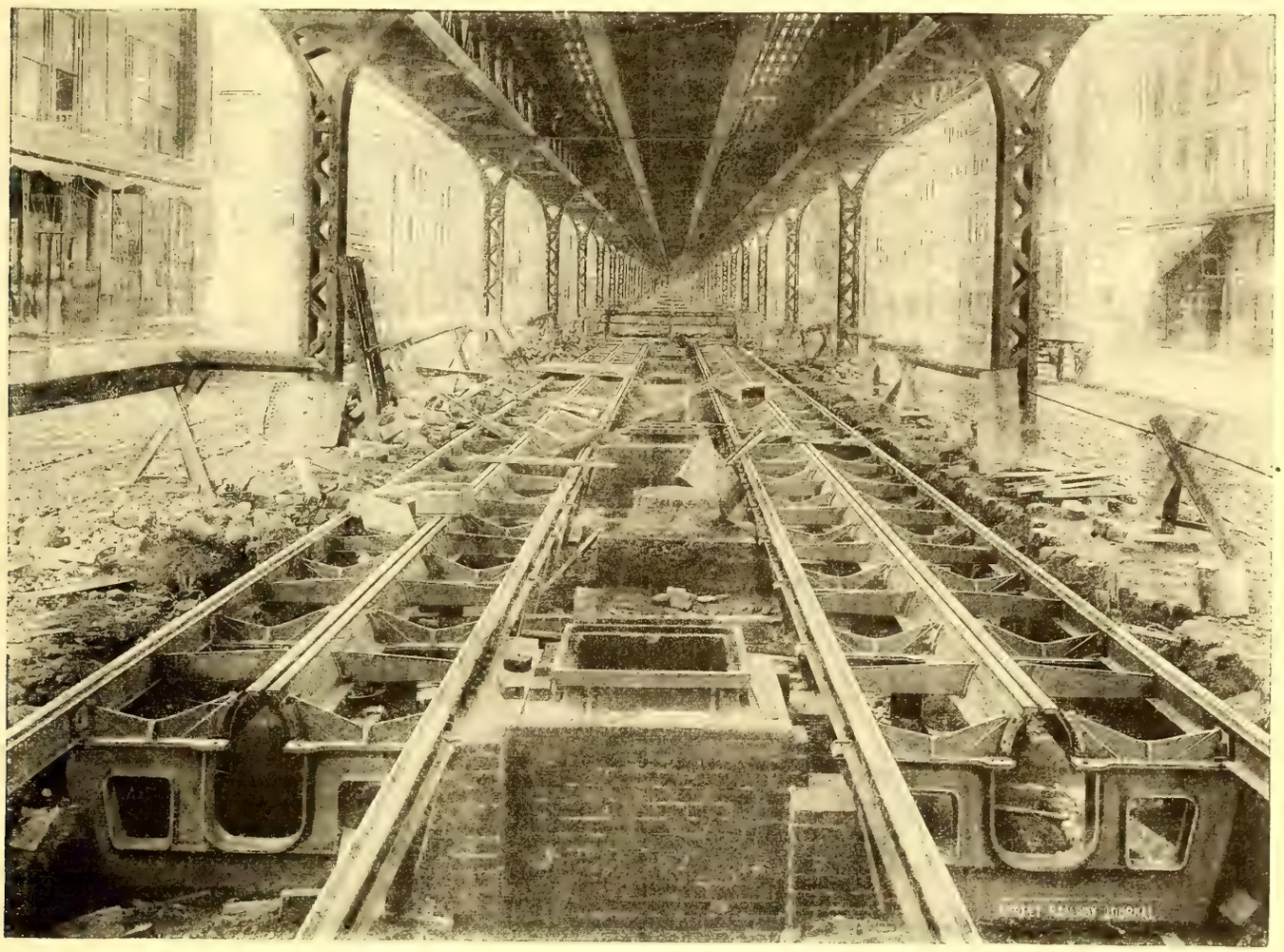


FIG. 6.—VIEW OF THIRD AVENUE CONDUIT AT 100TH STREET DURING COURSE OF CONSTRUCTION.

The official staff of the Third Avenue Railroad Company, whose portraits are given in this connection, from photographs taken especially for the STREET RAILWAY JOURNAL by Ehrlich, of New York, is composed as fol-

lows: Albert J. Elias, president; Henry Hart, vice-president; Alfred Lazarus, secretary; John Beaver, treasurer; John H. Robertson, superintendent; Edward Lauterbach, attorney, with R. P. Tomasseck as chief engineer of construction; C. G. Bliss, mechanical engineer, and John Brolles, assistant secretary.

The board of directors is composed as follows: Henry Hart, William Remsen, Silvanus S. Riker, Robert George Remsen, Robert W. Tailer, John E. Parsons, Edward Lauterbach, Albert S. Rosenbaum, Simon M. Ehrlich, Abraham Ayres, William H. Webb, Emanuel Lehmann and Albert J. Elias.

Mr Elias succeeded to the presidency after the death of Mr. Lewis Lyon, October 29, 1891, under whose administration the cable scheme was inaugurated. Having previously held the office of vice-president, Mr. Elias was already familiar with the details of the business, and has been the mainspring of the executive organization which has brought the enterprise so near to a successful completion.

To the vice-president, Henry Hart, however, is due the principal credit for having backed the undertaking with the funds with which the expenses of the reconstruction have been met, and, although the cost has largely exceeded the original estimates, his faith in the ultimate success of the line as a business venture has emboldened him to invest his money freely, and thus prominently identify himself with the history of the road.

The secretary and treasurer, Messrs. Lazarus and Beaver, although they have been excessively burdened by the increased labors and responsibilities incident to the reconstruction of the line, have zealously and ably performed the duties, and justly take great pride in their share of the work. Both these gentlemen have long been identified with the affairs of the Third Avenue Railroad Company, the former having served in the present capacity since 1884, and the latter since 1864, at which time he was appointed a receiver, and served in that capacity until 1884 when he was appointed to the position of treasurer which he now holds.

Upon the superintendent, John H. Robertson, has rested the principal burden of personal responsility for the success of the enterprise. His duties have included, not only the details of keeping the line in operation under the most unfavorable circumstances, but also the details of reconstruction, as he has served virtually as consulting engineer, and necessarily passed upon all the designs, including the plans for the power houses and their equipment, the cars, grips and street construction. He also originated many of the devices employed for facilitating the labors of construction, and patented a number of the safety devices adopted by the company, including the grip trips, tilting sheaves and car trucks. When the multitudinous duties he has been called upon to perform are considered, it is a wonder he has held up so well; nor could he had it not been for his vigorous constitution and the confidence and support freely accorded him and his superior officers, and by the fidelity of his assistants and employes. Mr. Robertson has been identified with the Third Avenue Railroad Company since 1867, and was made master mechanic and superintendent of the repair shop in 1874, and seven years later assumed the position of superintendent of the entire system. He is regarded by all who know him as one of the best all around railroad men in the country, and his many friends hope that on the completion of the cable lines his duties may be less arduous, and that he may long continue in the supervision of the operating affairs of the company as a reward to his devotion and loyalty during the trying period now, fortunately, nearly closed.

We have spoken above of the difficulties encountered in the early history of the cable scheme, in obtaining consent from the city authorities to substitute mechanical traction on the Third Avenue line. The details included suits in a number of courts, and finally the Court of Appeals, the outcome of which reflects great credit upon the legal ability and perseverance of Edward Lauterbach, counsel for the company. Many other legal problems have also been encountered as the work has progressed, all of which have been ably solved by the counsellor, who is also a member of the board of directors. The chief engineer, R. P. Tomasseck, succeeded to the position in August last, on the resignation of A. H. Lighthall, the former incumbent. Mr. Tomasseck had previously held the position of first assistant engineer and chief of the drafting room and hence was familiar with all the details of construction. He has ably performed the work of redesigning and constructing some of the principal crossings and crossovers.

C. G. Bliss has charge of the three power stations from which the cable lines are operated, and has also assisted in placing the machinery in the new plants. He has had considerable experience in cable railway work, having previously been employed on the lines of the West Chicago Railway Company and those of the Cleveland City Cable Railway.

PRINCIPAL CONTRACTORS.

As noted above, Thomas E. Crimmins succeeded Wm. Wharton, Jr. & Company, as contractor for the street construction, and under his supervision the work has been successfully prosecuted, notwithstanding the unforeseen difficulties met with. Great credit is due to the contractor for the methods employed, which resulted in little obstruction to public traffic.

The Pennsylvania Iron Works Company, of which W. L. Elkins, Jr., is president and B. W. Grist, general manager, were the contractors for the entire power equipment of both stations. The original designs were produced by Mr. Grist, and the machinery has been erected by E. A. Moore, constructing superintendent of the company. The successful completion and operation of these enormous plants reflect great credit upon the builders, and will stand as a monument to the genius and energy of the individuals composing the company. (See portraits on another page.)

The Jonson Engineering & Foundry Company, of New York, has also done a large amount of work in connection with the street construction and in designing and building some of the operating mechanism. Following the failure of the first contractors, a number of the large sections of the unfinished work were awarded to this firm, and all the special and difficult work, including the double cable crossing at 125th Street (Fig. 4) with the accompanying rope release and pick-up mechanism and the large summit and depression sheaves; also the 6th Street vault work and a number of street railway crossings on the Bowery. The works which are located at 118th Street and Harlem River, are virtually the repair shops of the Third Avenue Railway Company, and to them come a great deal of the detail work, such as building and repair of grips, manufacture of the grip trips above described, fitting pulley frames, bearings and brackets and an endless amount of small work. This firm were the principal contractors for the construction of the Tenth Avenue cable line, and sole contractors for the 125th Street cable road, which they built within eight months. The entire period during which they have been patronized by the Third Avenue Railway is an evidence of the confidence that the excellence of the work has inspired.

The cars were built by the Laclede Car Company, of St. Louis.

Albert Wagner, of New York, was architect of the buildings for the power stations.

The buildings were erected by Isaac A. Hopper, contractor and builder, of New York.

The excavation for the power stations was conducted by the contracting firm of D. E. Genovese & Towle, of New York, in connection with which the work of shoring up the banks and the walls of the old 65th Street station was done by T. P. Galligan & Son.

The ropes were all purchased from the John A. Roebling's Sons Company, of Trenton, N. J.

It is reported that a bill will be shortly introduced in the Maryland Legislature, for the protection of motormen and gripmen on rapid transit cars from the inclement winter weather, by compelling the adoption of vestibules.

The "Imperial" Steel Truck.

The accompanying engravings show a new steel truck, the "Imperial," recently put upon the market by the Fulton Truck & Foundry Company, of Cleveland, the new name of the Fulton Foundry Company, of that city.

In bringing before the street railway managers this new truck, the company does not wish to convey the idea that it has discontinued the manufacture of its wooden truck. The managers of the company still believe in the merits of their wooden truck, and are ready to fill orders for it when their customers so desire, but the manufacture of the steel trucks is done with a view to putting the company in a position to furnish its customers anything they may desire. The success with which the company has met in truck building has been very encouraging, and has driven its owners to the necessity of erecting one of the largest factories for this purpose in the country.

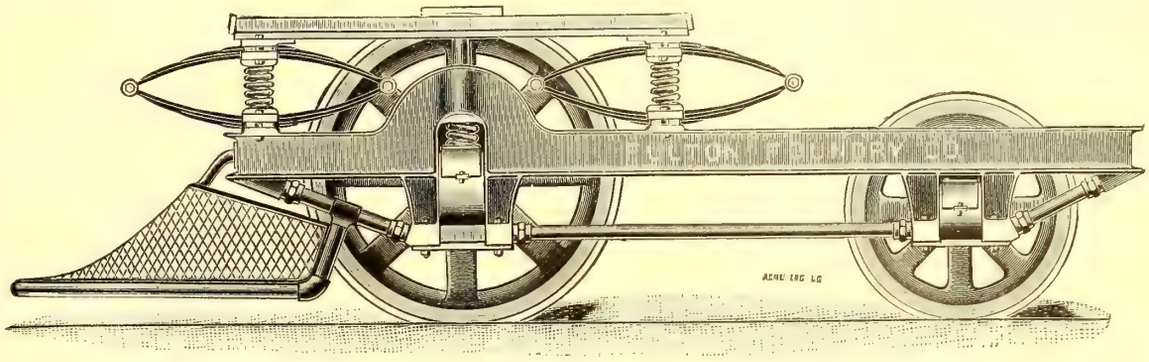


FIG. 2.—DOUBLE "IMPERIAL" STEEL TRUCK.

The "Imperial" trucks are designed by W. E. Haycox, who has had thirteen years' practical experience in street railway work, and who thoroughly understands the requirements of street railway companies. The single steel truck "Imperial," it is claimed, has many advantages over trucks of other makes, a few of which advantages are herewith presented the readers of the STREET RAILWAY JOURNAL. The main frame is made of cast steel in the form of an I beam and extends from end to end and around on the cross section about ten inches, and the two frames are joined together with a rolled steel I beam and fishplates similar to those used in track construction, thereby making a very rigid frame and with no joints at the corners, thus preventing the truck from getting out of line. The pockets to receive the springs are cast on to the frame, and also the lugs for the under truss, therefore requiring no bolts or rivets to fasten them to the main frame. The spring over the journal box is kept in position by the pockets in the journal box and in the main frame, and needs no other fastenings. On the end of the truck is a new combination coil and elliptic spring. The great advantage gained by this construction is that it prevents the elliptic spring from breaking should too heavy a strain be brought upon it. The coil spring will bear the greater portion of the strain when the elliptic spring is compressed past its normal position, and assists the elliptic in resuming its proper position. The company has a steady pin running from the subsill through the main frame over the journal box, which prevents the oscillation of the car and keeps the springs in perfect line. The success had with former Fulton Foundry trucks has been due in large part to the fact that this steady pin has been used, which prevents any oscillation even where thirty-two foot cars are used.

These trucks are also equipped with the company's new life guard, which is constructed of gas pipe running as near to the rail as is practical, and having a brace in the center as a support, running from the cross section of the truck to the center of the frame of the life guard. This frame is covered with a wire netting, and is so designed as to pick up any obstruction rather than run over it. The company believes that this style of life guard is as near perfect as a life saving device as anything can be made. At the same time, it does not require any attention or sufficient presence of mind on the part of the motorneer to operate a life saving device. It is also said to be lighter than any life guard which has yet been put on the market. This truck is equipped with an equalizing brake which is very powerful, and does not require any adjustment as the brake shoes become worn. The subsills are made of channel iron, and the spring connections are riveted on to the same, and after this is done a piece of hard wood is used to fill out the channel iron to receive the car body, thereby giving a support to the car sill the entire length of the truck. There is also a perfect oiltight and dustproof box, and a three and a half inch journal is used as a standard, unless otherwise specified.

The trucks are also equipped with the company's patent double tread wheel, with an independent brake rim, if so desired. These wheels are coming into general use very rapidly and proving the theory that the brake shoe takes from the life of an ordinary wheel from 60 to 75 per cent. Therefore, by placing the brake shoe on an independent rim, it is thought this 60 or 75 per cent. additional life will be gained in addition to having a clean braking surface the year round.

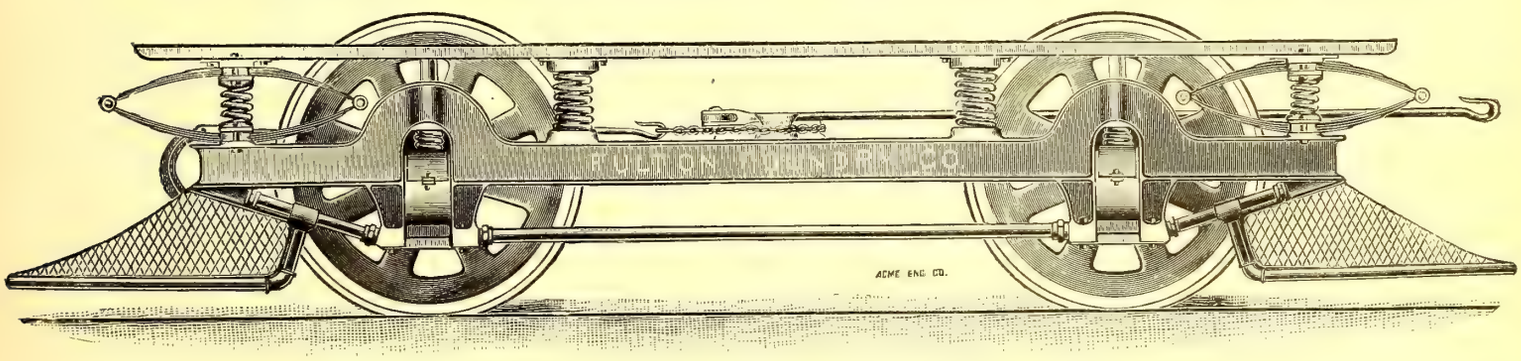


FIG. 1.—SINGLE "IMPERIAL" STEEL TRUCK

Fig. 2 shows the double steel truck "Imperial," which possesses all the good qualities of the single truck. The main frame is made in the same manner, but is made to use a large driving wheel and small trailers. Four patent combination coil and elliptic springs are employed on the double truck, and the weight of the car body is equally distributed over the driving wheels. The steady pin is connected to the subsill and a king bolt driven directly over the axles of the driving wheels, thereby giving the maximum traction to the drivers. This truck is also equipped with the patent life guard, the same as

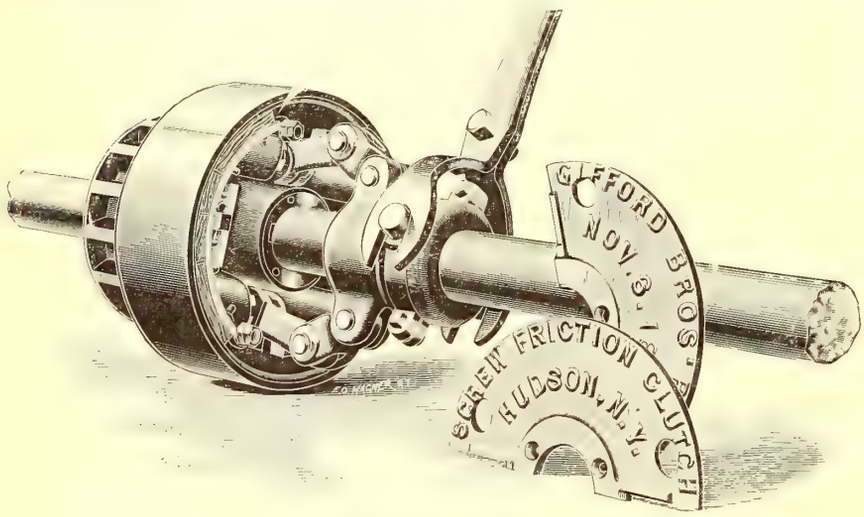
used on the single truck. Another great advantage claimed for the use of these trucks is the convenience of removing wheels and axles when necessary to do so for repairs. The removal of one bolt in the jaw of the main frame and the loosening of another on either side of the truck is all that is necessary to remove the wheels and axles. There are very few bolts employed in the construction of these trucks and those are equipped with lock washers.

The company invites correspondence from the street railway managers, and writes us that it is ready to fill orders promptly, and will guarantee the material and workmanship to be second to none in the country.

Patent Screw Friction Clutch.

Power users will be interested in the accompanying engraving which shows a patent screw friction clutch, manufactured by Gifford Brothers, of Hudson, N. Y., and which has given excellent results in practice.

The power of a screw is employed for creating pressure and this, together with the powerful leverage used to rotate the screw, enables it to weld, so to speak, the face of the driving segments to the interior face of the driven drum. The screw and lever arm are in one piece and, with their nuts, are of aluminum bronze. Wooden lags of hard maple are employed to obtain the best frictional results. It is said that the wear on them is practically imperceptible, and, granting that they might wear, they can be replaced easily and at very slight expense.



SCREW FRICTION CLUTCH.

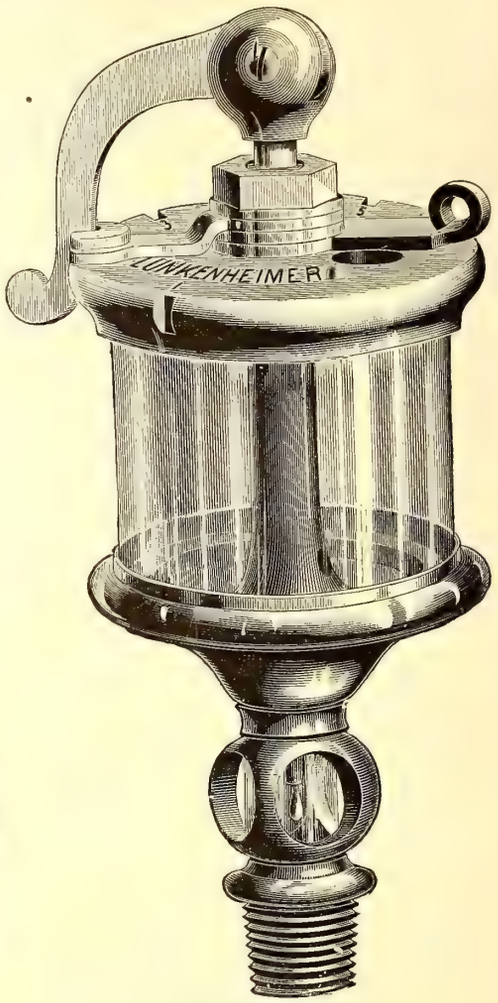
The clutch is compact and requires but little space on the shaft, and the adjustment, when necessary, is readily made. The manufacturers have contracted with the Suburban Electric Company, Elizabeth, N. J., for the installation of countershafting, clutch pulleys, quills, cut-off couplings, etc., in its model electric light and power plant now being constructed.

Next spring the Brussels Tramway Company will make an experiment with electric traction on the Uccle line, on the North and South Brussels line. The trolley system will be used. The management of the Suburban Petite-Espinette Railway is completing at its stables, at Cureghem (Brussels), the construction of an electric power house for introducing the same system (trolley) on its lines, about 6.5 miles in length. Certain grades on this line are as high as 6.3 per cent. The first tests will occur shortly.

Milan, one of the first cities of Europe to install a large central station for lighting purposes, incorporated on November 1, 1893, a double track trolley electric road. This line is nearly two miles in length. The motors are of the General Electric W. P. type. Half of the engine equipment was built by the Armington & Sims Company, and the other half was of Italian make.

New Glass Oil Cup for Dynamos and General Engine Bearings.

The accompanying engraving shows the new Lunkenheimer "Crown" index, sight feed, glass oil cup, manufactured by the Lunkenheimer Company, of Cincinnati. This cup is provided with an "index" device for regulating the flow of oil, and an indicator arm turning on the lid to mark the notch, giving the desired feed. When desired, the feed can be instantly turned off and on again by replacing the index lever in the notch of the indicator arm. When the index arm is closed the lever can be left to stand up out of the notch, thus acting as an indicator to show from a distance that the feed is shut off.



NEW GLASS OIL CUP.

It is often the case that a number of cups require different feeds, especially before starting the engine, when an extra amount of oil is wanted. This can easily be accomplished with the "Crown" without losing the original feed, by simply moving the indicator arm a few notches to the right, and when the established feed is again required it is only necessary to replace it in the index slide which marks the established feed. These cups are all made of cast brass, handsomely finished and are heavy and durable. The oil will not leak out between the brass and the glass parts, as is the case with all ordinary spun brass cups. Wherever the "Crown" has been put in use it is giving the very best of satisfaction. They are made in eight sizes, holding all the way from five-eighths to eighteen ounces of oil.

Besides the "Crown," this company makes seven other styles for various purposes.

The size of the electric generators to be supplied by the Westinghouse Electric Manufacturing Company to the Niagara Falls Power Company, it is said, is 5,000 H. P. each.

Triple Expansion Engines in Central Stations.

Of the many problems of interest to the central station managers, one of the most important is, how far they can go in the direction of multicylinder engines, and by so doing effect a saving in fuel commensurate with the greater cost of installing this class of engines.

An increase in the number of cylinders narrows the limits of economical working, and the more variable the load, the less is the saving which can be effected by their use. The question is: When do they pay? In the largest cities, in stations for incandescent lighting, it has been found that triple expansion engines are perfectly feasible and effect a large saving. This work, of course, is of a very favorable nature, enabling the units to be always kept well loaded. In smaller cities, however, and where

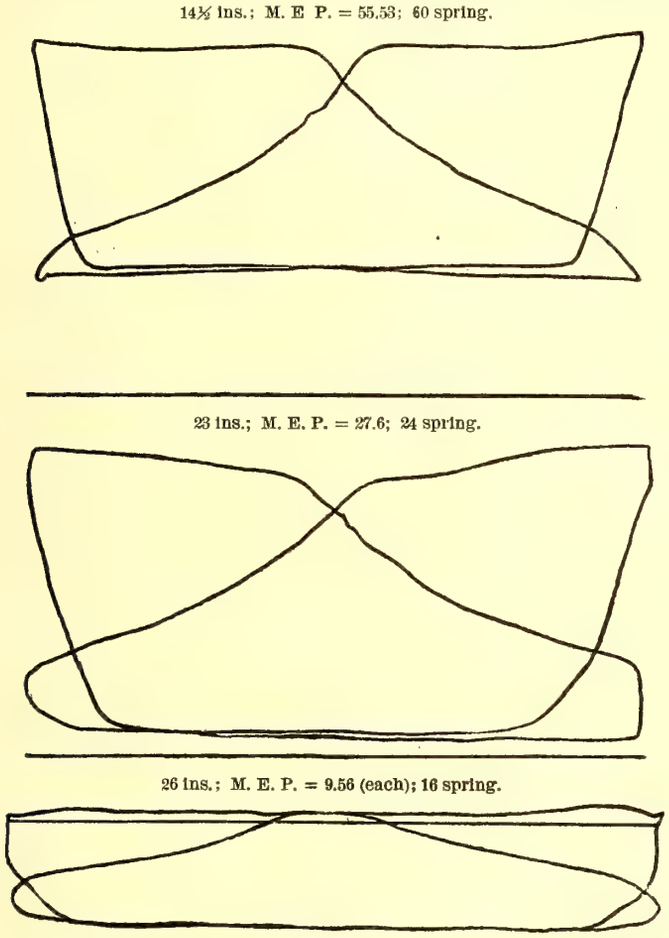


FIG. 1.—MAXIMUM STATION LOAD—INDICATOR CARD FROM TRIPLE EXPANSION ENGINE.

the work is of a varied kind, such as arc, incandescent and motor work in combination, there has not been much done in this line, and it has been considered by most engineers that the efficacy of using triple expansion engines as a means of saving coal is somewhat problematical on account of the variations in the load.

We illustrate herewith some indicator cards taken from a triple expansion engine in the station of the Elmira Illuminating Company, of Elmira, N. Y., which has shown very good results in the line of fuel economy. This station was described in a recent issue. The engine was built by McIntosh, Seymour & Company, of Auburn, N. Y., and is of the vertical, four cylinder, triple expansion type, of a nominal capacity of 500 H. P. In this station the day load consists of motor and electric railroad circuits only, which are run from separate, horizontal, compound engines. The 500 H. P., triple expansion engine is started when the lighting comes on, and runs until midnight. From midnight until morning a smaller horizontal, triple expansion engine carries the lighter load, which is nearly constant, consisting largely of arc lights. The cards taken from the large engine show the minimum and maximum loads under which it runs, the light cards giving the Sunday evening load, when lightest, and the heavy cards being taken slightly before six o'clock, when both store and house lights are on, and the load is heaviest. It can be readily seen that in both of these extreme cases the engine is working under favorable conditions as regards economy of fuel. The lateness of the cut-offs which occur in triple expansion engines impose a very difficult duty on the governor, much more so than is common in single cylinder and compound engines, by reason of the greater range through which it has to act. Upon this engine, at full cut-off, which is at eight-tenths, the speed falls off only about 2 per cent. from no load and condensing, which is a remarkable result. It will be noted that by having the cut-off valves operated by the governor the receiver pressures and the drop of temperature in the cyl-

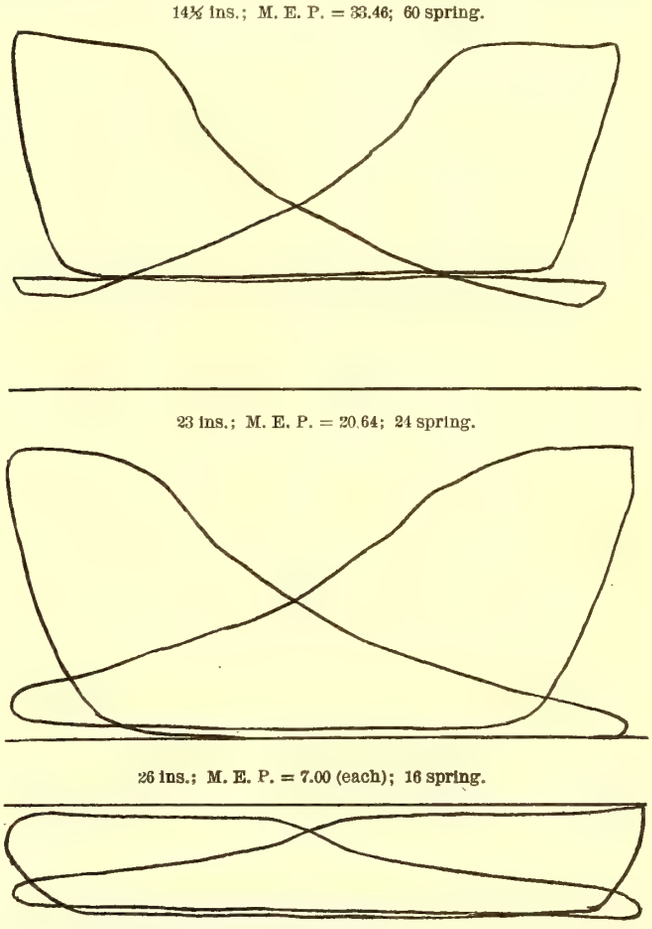


FIG. 2.—MINIMUM STATION LOAD—INDICATOR CARD FROM TRIPLE EXPANSION ENGINE.

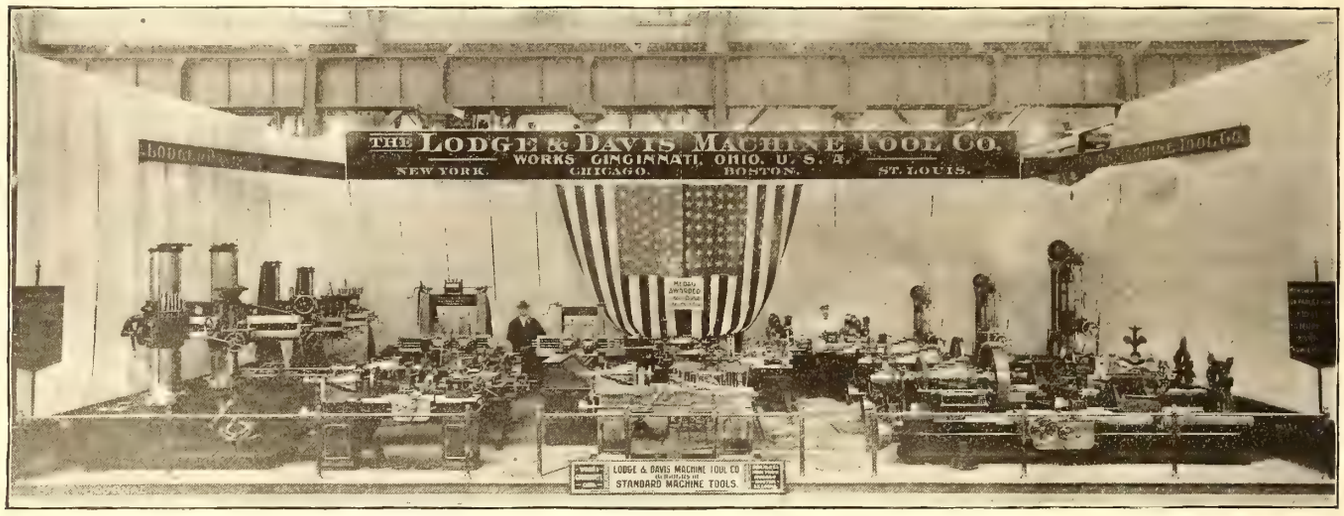
inders is kept practically constant, and the economy of the engine is always the best obtainable for the conditions under which it is running, without any hand adjustment of the valves being required.

As to practical results, comparing the percentage of the coal bill to the gross receipts of the company from business shows a saving in fuel of 61 per cent. as compared with results obtained in the old station, comparison being made between the results obtained during the months of November this year and last, which should give as fair a test as is possible.

MESSRS. AHEARN & SOPER, of Ottawa, have recently supplied the Canadian Government with three electric mail cars for use in Ottawa. The car bodies were manufactured by the Ottawa Car Manufacturing Company, are mounted on Brill trucks and are equipped with thirty horse power Westinghouse motors. Doors are provided in the sides for loading and unloading the mails, and the interior is arranged to afford every convenience for handling the mails.

The Lodge & Davis Machine Tool Company's World's Fair Exhibit.

The Lodge & Davis Machine Tool Company, of Cincinnati, O., made a most interesting exhibit at the World's Fair. A good idea of the appliances shown is given by the engraving on this page. The exhibit was made up of some twenty-five engine lathes, planers, drill presses, screw machines, milling machines, turret lathes, etc. An interesting feature was the operation of a large radial drill and an improved tool room lathe, both of the Lodge & Davis manufacture, by direct connected electric motors.



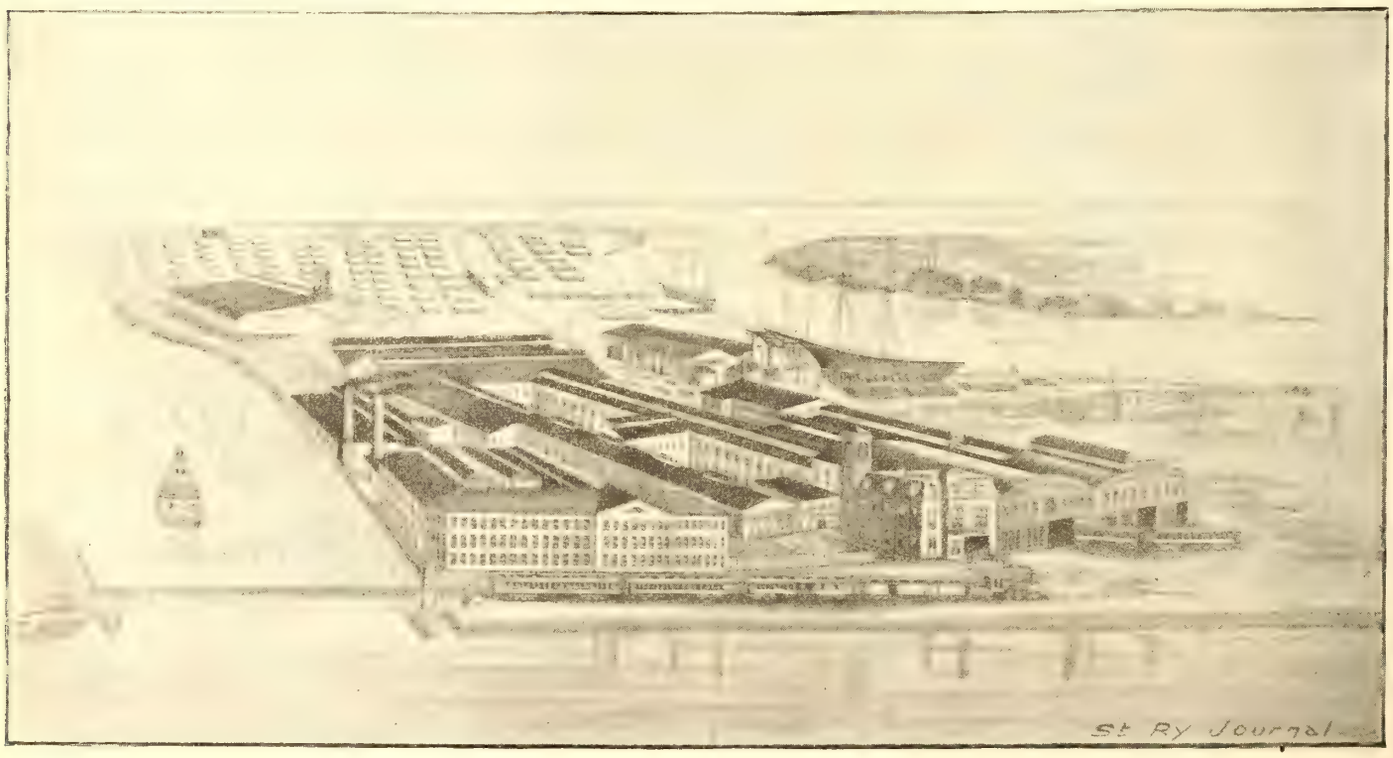
THE LODGE & DAVIS MACHINE TOOL CO.'S WORLD'S FAIR EXHIBIT.

One of the finest pieces of work in Machinery Hall was one of the company's tool room lathes, entirely finished in gold and silver plate. This lathe cost some $3,000 and took six months to complete. The company's exhibit was in charge of some of its most capable and experienced men, including the company's foreign representative, who is conversant in nine different languages.

As a proof of the excellence of the exhibit, the company received the highest award for the finest exhibit of machine tools in Machinery Hall.

A New Departure For a Long Established Company.

The Jackson & Sharp Company, of Wilmington, Del., who for the past thirty years has been renowned as a manufacturer of railroad cars, is about to start actively in the building of street railway cars of all patterns. This is not an entirely new step, for many years ago, when the street railway industry was still in its infancy, this company built a large number of the old fashioned, small, light cars, many of which are still in service. The great advance in steam railway construction led the company, shortly after, to turn its attention entirely to this line which it has followed exclusively until just recently, when the growing market and demand for street railway cars of superior workmanship and finish has led it to enter the field again.



WORKS OF THE JACKSON & SHARP CO.

This firm was started in the business of car building in a small way by Job H. Jackson and Jacob F. Sharp, in 1863. Owing to honest dealing and industry the business has increased to its present dimensions.

Our illustration shows a view of the company's pres-

ent works, situated at the junction of Brandywine Creek and the Christiana River. These works cover twelve acres of ground, and have all facilities for turning out work up to the company's acknowledged standard. The company's lumber yard has a capacity of 7,000,000 ft., and its sheds, of 2,000,000 ft. more. The erecting and paint shops have a capacity of 75 steam, or perhaps 250 street, cars, and the storage rooms, of 75 to 100 more, so that large orders may be easily handled without delay.

Handsome Cars.

The two cars, engravings of which accompany this article, represent two types, opened and closed, manufactured by the New Castle Car Manufacturing Company,

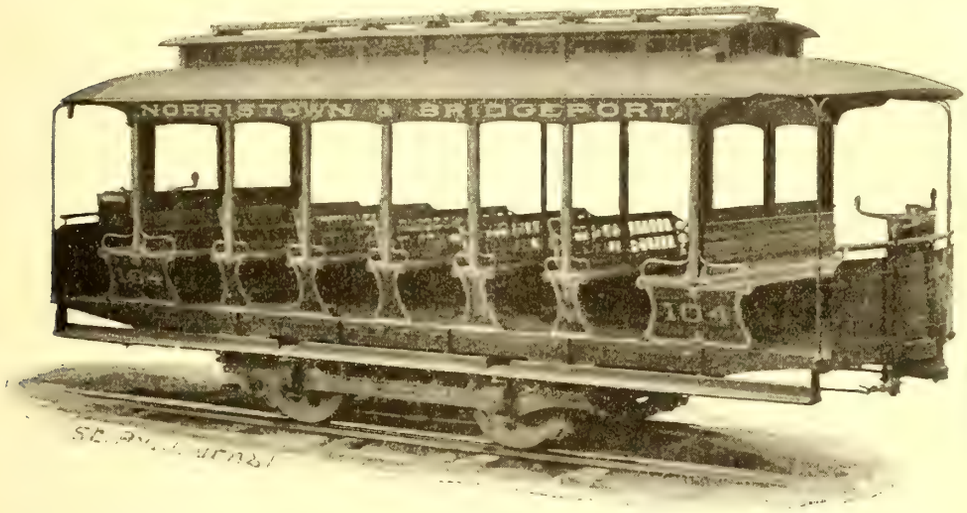


FIG. 1.—OPEN CAR FOR THE NORRISTOWN & BRIDGEPORT RAILWAY.

of New Castle, Pa. The former contains nine benches and was built for the Norristown & Bridgeport Railway. The latter, which is shown without supporting truck, is of the vestibule type and is part of an order filled by this company for the Bridgeport, Bellaire & Martin's Ferry Railway, which was described in a recent issue of the STREET RAILWAY JOURNAL. The managers of this company recently had a fire at their works which destroyed the planing mill. This accident was exaggerated by a number of the daily papers, which reported that the entire works of the New Castle Company had been burned to



FIG. 2.—CLOSED CAR FOR THE BRIDGEPORT & BELLAIRE RAILWAY.

the ground. The company, as mentioned elsewhere in this issue, will rebuild at once and be ready to run its mill about the latter part of January.

THE Milwaukee Electric Railway was formally turned over to the control of the Milwaukee Street Railway Company, on December 1, having been purchased by the latter company, as we have before noted. A part of the road has been abandoned, and the cars are being operated from the central power station, and the old station is being utilized for lighting purposes.

The Pfingst Fender.

We show herewith two views of one of the cars of the Brooklyn City Railroad, showing the application of the Pfingst fender recently adopted by that road for all its lines. Of the two cuts, Fig. 1 shows the front platform with the fender extended for use, and Fig. 2 the rear platform with the fender pushed back under the car out of the way.

This fender, which was illustrated and described in the STREET RAILWAY JOURNAL for May, 1893, is the invention of Louis Pfingst, late master mechanic of the West End Street Railway Company, of Boston. The fender itself is in the form of a table or platform of wrought iron, with a floor of latticed strips. This table is mounted



FIG. 1.—PFINGST FENDER READY FOR USE.

under the car, so that it may be extended parallel to the ground or pushed back under the car when not in use. It may also be used when a trail car is used, making it perfectly safe to pass from one car to the other. In action the fender strikes an object below its center of gravity, causing it to fall upon the platform. It is also high



FIG. 2.—PFINGST FENDER PUSHED UNDER PLATFORM

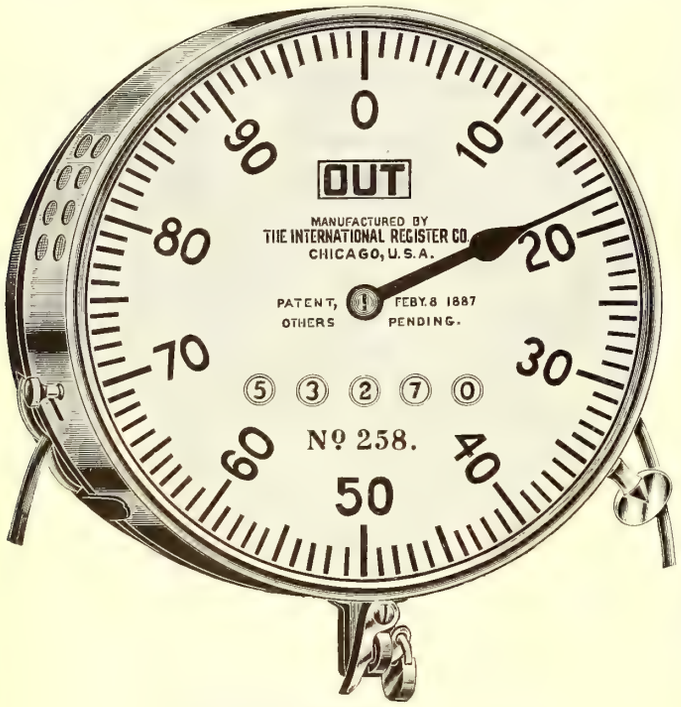
enough from the ground to clear all fixed obstructions that cause derailment. This fender can be applied to any car without interfering with the drawbar, brake, attachments, controller spindle, etc. It has also been adopted by the West End Street Railway Company, of Boston.

THE Street Car Brotherhood, of Indianapolis, an organization of the street railway employes of that city, has disbanded. At one time the Brotherhood was in a very flourishing condition and successfully engineered several strikes against the company.

"The Aluminum" Stationary Register.

"The Aluminum" is the name given the new stationary fare register illustrated below and manufactured by the International Register Company, 300 Dearborn Street, Chicago, which has just placed it on the market. There are a good many new and novel features in this register which ought to recommend it to the practical street railway man. In the building of this machine it has been the aim of the manufacturer to produce a register that is simple, strong, durable and accurate, as well as one of tasty and artistic design. How well the company has succeeded in its efforts is best determined by an examination of the machine. The register is of the double clock-face design, having a tally or permanent register with a capacity of 100,000 fares, and a trip register, indicated by the pointer, which is capable of being returned to zero.

In the construction of the tally or permanent register, the manufacturer claims to have evolved an entirely new idea. It is made entirely of cut gears, without any



AN ALUMINUM STATIONARY REGISTER.

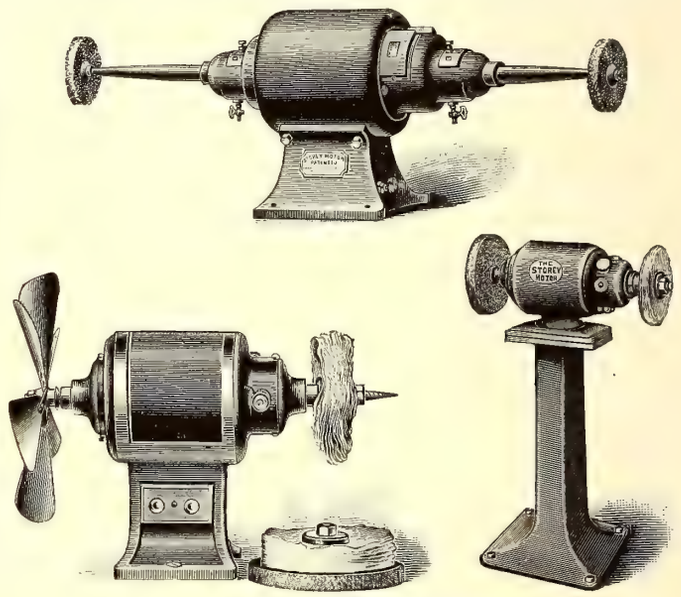
springs or pawls whatever, and is, therefore, not liable to get out of order. It cannot possibly be moved (backward or forward), except by pulling the cord and actuating the entire mechanism. This, as will be seen, is a very valuable feature. It will effectually prevent any tampering with the total record, even though the glass should be broken. The makers go so far as to claim that the total record cannot be changed, even though the case, glass, dials and all are removed, except by pulling the cord as described.

To overcome the inevitable result of cracking and peeling of enameled dials, pure aluminum is used for dials throughout this register, and the satin finished surface presents a strikingly handsome appearance. The advantage in using this material is that it will always retain its color and lustre, making the register look new at all times. Another very valuable feature in this device is the length of the stroke, which is seven and a half inches. The object of this is to overcome the practice of ringing up a number of fares in such quick succession as to make it almost impossible to count the vibrations of the bell. With a long and easy stroke the conductor is obliged to ring each fare distinctly. It will also prevent passengers from ringing up fares when meaning to signal the conductor, as the register will not operate with a short quick jerk. The register is of the standard twelve inch size, and is finished in full nickel, presenting a remarkably fine appearance. It is operated either with cords and pulleys, or by a rod running lengthwise of the car.

The Storey Electric Lathes and Motors.

One of the most interesting developments in the electrical field is the increasing use of small, isolated, self contained motors which can be run directly from the lighting circuits, and are adaptable to a multiplicity of uses in shops, factories, hotels, etc. Among the handiest and most adaptable of these machines are the motors and lathes manufactured by the Storey Motor & Tool Company, of 120 Liberty Street, New York. This company makes a line of standard slow speed motors, ranging in size from ¼ H. P. to 100 H. P., which are adapted to run any kind of machines or machine tools, either by direct connection, or belts or gears; and also a line of six sizes of electric grinding and buffing lathes which are rapidly coming into use and giving great satisfaction wherever operated. Our illustrations show views of several of these machines.

These motors, as may be seen, are entirely self contained, the armatures, coils, brushes, etc., being covered and enclosed by the field magnet case which protects them from injury, dust, dirt and dampness. The motor is a plain cylindrical machine having end projections for the boxes and commutator. The field magnets present



TYPES OF STOREY MOTORS.

four poles so arranged that while the center of the machine is of one polarity the ends are of the opposite, and as this is a four pole machine it has eight distinct magnetic circuits, thus giving magnetic circuits of very low resistance and, therefore, maximum efficiency for a minimum quantity of wire. The coils are held in position by the pole pieces. The armature is of the drum type toothed. The end caps act as supports for the bearings, and also serve as oil reservoirs. The bearings are either self oiling or graphite, and so constructed as to work perfectly in any position. From this description it may be seen that this motor, by reason of its dust and dampproof construction, is capable of many uses from which other motors are debarred, such as in breweries, mines, basements, sugar houses, and for blowers, ventilating fans, in wood working shops, etc. The brushes last indefinitely, and can be changed in a moment by anyone.

The double end buffing lathe has given great satisfaction in a number of the larger hotels in New York where they have been used for cleaning silver and plated ware, knives, etc. All who have used this machine speak of the finish given to the articles cleaned as being fully equal to that of new work, and a vast improvement on hand work. The feature of attaching the buffing or grinding wheels directly to the armature shaft is a good one in that it saves the space occupied by countershafts, belting, etc. A portable motor is being furnished by this company, to which a flexible shaft, with a buff at the end, is attached for polishing brass fittings around the engine room or other places where current is accessible.

The Works of the J. W. Fowler Car Company.

The new factory which has been erected by the J. W. Fowler Car Company, at Elizabethport, N. J., presented a scene of much activity on the occasion of a recent visit of a representative of the STREET RAILWAY JOURNAL. These works, which, it is well known, have been built during the last year, are equipped with the latest and most approved appliances for the manufacture of street railway cars and all necessary parts for the complete rolling stock of a street railway company, including in this catagory snow plows and snow sweepers, as well as every variety of passenger car. The works were erected under the supervision of, and are operated and managed by, persons of long experience in just this class of work, and represent the most approved ideas for securing the best of work, together with the greatest facilities for manufacture.

The factory comprises eleven brick buildings, with a total of 100,000 sq. ft. of floor space. The buildings are arranged somewhat in the form of the letter U, a covered passageway being provided between two wings, as shown in the engraving on this page. The arrangement is such that the movement of the material used in the construction of the cars is constantly in one direction, reducing to the minimum all necessary transportation, the receipt of lumber being at the north-western end of the works, and the shipment of the cars at the eastern end, as shown.

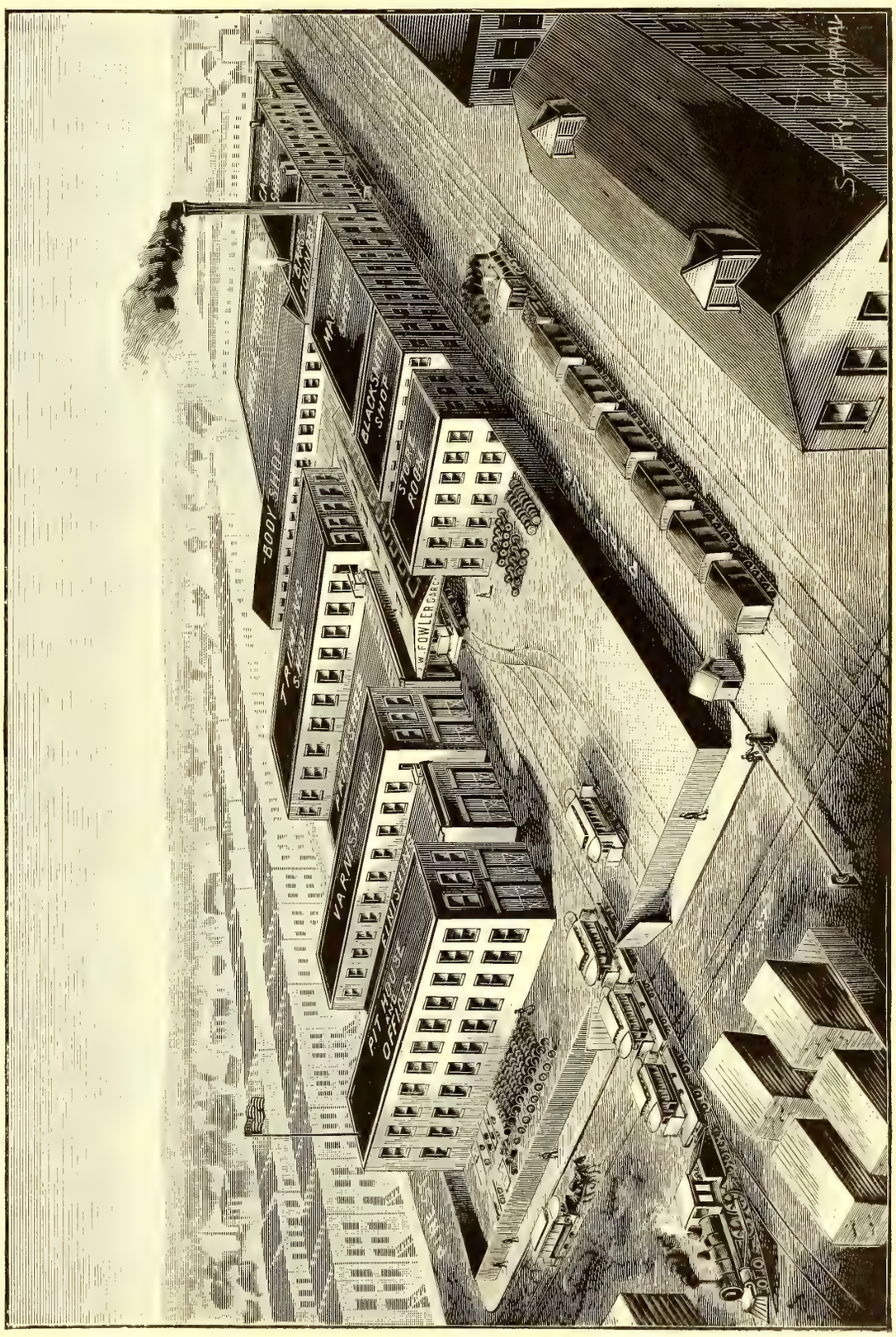


FIG. 1.—THE WORKS OF THE J. W. FOWLER CAR CO.

Following the raw material as it is handled at this factory, we enter, first, the kiln-dry rooms. These are two in number, with concrete floors, and have a total capacity of 60,000 ft. of lumber each. The process of drying and seasoning is aided by a draft of hot air supplied by a Sturtevant blower fan which keeps a continuous current of hot air passing through the rooms. Adjoining the kiln-dry rooms is a lumber shed, with a capacity of 500,000 ft. of kiln-dried lumber, and opening into this is a third building containing, on the ground floor, the mill, and on the second floor, the cabinet shop. Both of these are furnished with a great variety of woodworking machinery, of the latest pattern, necessary for performing the varied work pertaining to the manufacture of street cars.

Continuing in the direction which the material takes, the visitor next enters the body shop, where the different parts, when finished in the mill and cabinet shop, are taken to be fitted together. A spur from the railroad tracks enters into this room through the covered passageway already mentioned, which is thirty-two feet wide and is lighted by skylights. This enables the company to load the bodies of the cars and the trucks directly on to the platform cars for shipment.

On each side of this passageway are located the rest

of the buildings comprising the factory of the J. W. Fowler Car Company. The order of their arrangement can be seen from the engraving. Each building is two stories in height and entirely distinct from those on each side, though connected by passageways on each floor, so that easy access is allowed from one to the other. These different shops include the body room, trimming room, varnish shop, machine shop, brass foundry, engine room, register and stove departments, etc. Particular attention is paid by the J. W. Fowler Car Company to the manufacture of snow sweepers and snow plows. We present, in Figs. 2 and 3, engravings of two of the many sweepers built by the company this season for service during the winter on different roads. One is a sweeper manufactured for the Scranton Traction Company of Scranton, Pa., and the other one for the Atlantic Avenue Railway Company of Brooklyn, N. Y.

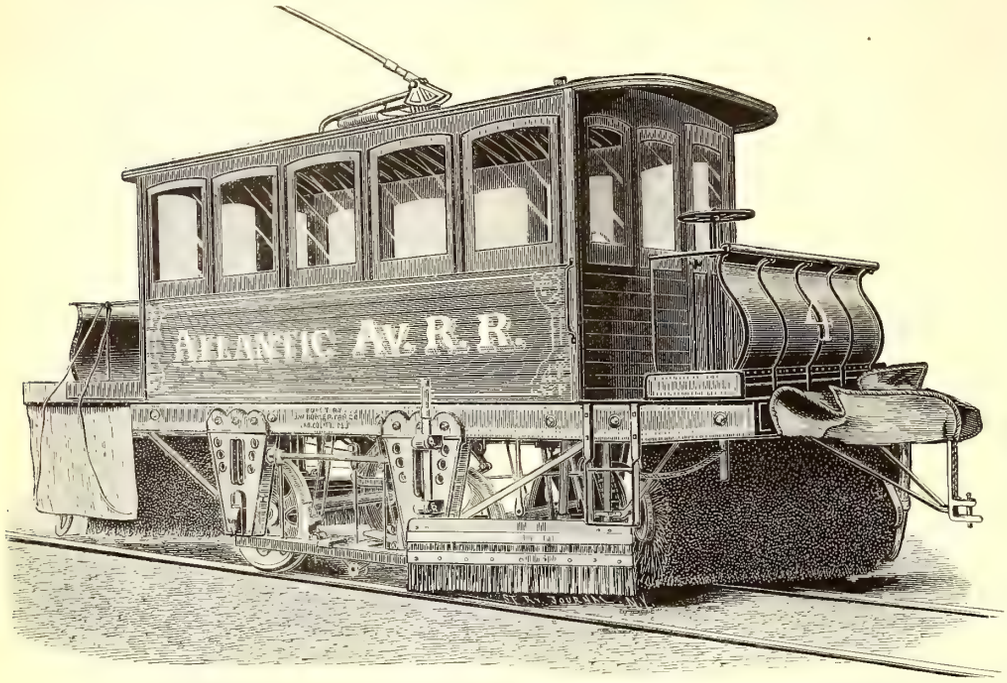


FIG. 2.—ELECTRIC SNOW SWEEPER BUILT FOR THE ATLANTIC AVENUE RAILWAY CO., BY THE J. W. FOWLER CAR CO.

The Scranton sweeper is built with a heavy oak frame, and, as will be seen, has a cab extending its entire length, effectually protecting the operators, motors, wires, switches, etc., from the weather. The cab of the Atlantic Avenue sweeper is much shorter, the motorman standing on the outside. The cabs are furnished with windows at the sides and ends, affording plenty of light and permitting inspection of the street and roadway by the operators. Doors are located at each end of the cab. To permit of easy access to the motors and brooms, one-half of one side of the cab is made detachable. This side can be removed in a short space of time, and can be put in place again just as rapidly.

The revolving brooms, which are of rattan, are thirty-seven inches in diameter and are driven by special motors, so that their speed is entirely independent of the speed of the sweeper. In this way, in case a heavy drift is encountered, the brooms can be operated at full speed, while the sweeper advances slowly. Connection between the broom shaft and motor shafts is made by sprocket chains manufactured by the Link Belt Engineering Company, of Philadelphia. In addition to the revolving brooms, the mould boards of the sweeper are also equipped with rattan brooms to clear the tracks of snow. The motors employed are of the Westinghouse type, but any type of motor can be used.

Every part of the sweeper is made with special care to provide sufficient strength for the necessarily arduous work imposed upon a sweeper, and extra strong knuckle joint brakes form part of the equipment.

Turning from these necessary parts of the storm equipment of a street railway, the reader can see in Fig. 4 a specimen of one of the passenger cars manufac tured at these works. The car shown was the first car turned out from the works, and is a production of which the managers of the J. W. Fowler Car Company are deservedly proud. It was built for the Lake Roland Elevated Railroad Company, of Baltimore, Md. In point of finish and general tastefulness of design the car leaves nothing to be desired, while in regard to durability and comfort, neither the most captious street railway company on the one hand, nor the passengers on the other, could have ground for dissatisfaction. The bodies of these cars are eighteen feet in length and provided with six high windows on each side. The platforms are four feet wide, furnished with steel steps and folding gates. The roof is of the Monitor type with bonnets supported by posts from the dashes. The inside finish of the car is of solid mahogany with bronze trimmings throughout. Veneer seats are used, and seats and backs are covered with Wilton carpet. The windows are curtained with Burrowes roller shades and each end of the car is furnished with beveled glass mirrors. The ceiling is of quartered oak veneer, handsomely decorated. Illumination is provided by center lamps. DeWitt sand boxes and steel foot gongs are used. The doors are double and self-acting, providing easy ingress and egress. The drawbars are of the

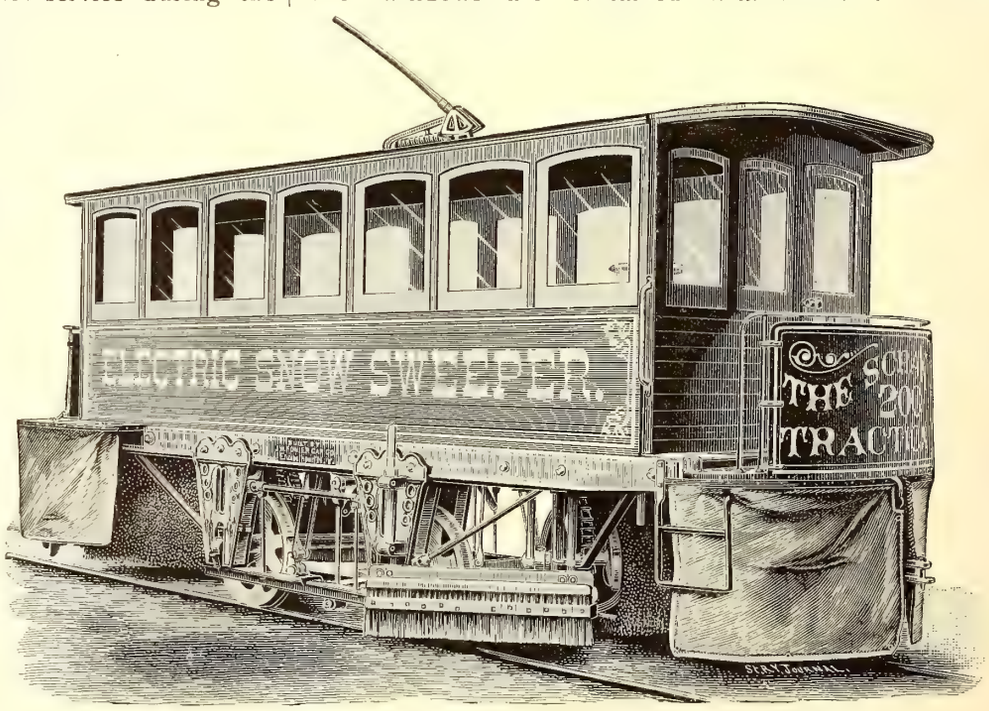


FIG. 3.—ELECTRIC SWEEPER BUILT FOR THE SCRANTON TRACTION CO., BY THE J. W. FOWLER CAR CO.

radiating type and provided with draw and recoil springs.

The personnel of the J. W. Fowler Car Company is a strong one, and includes the following well known names: President, John W. Fowler; treasurer, John W. Cooper; secretary, R. C. Swan; superintendent of construction, John Hutton; superintendent of supply department, John England; superintendent of machine department, James Grady. In the sales department of the company is George S. Whipp.



J. W. FOWLER,
PRESIDENT J. W. FOWLER CAR CO.



J. W. COOPER,
TREASURER J. W. FOWLER CAR CO.

The president of the company, John W. Fowler, whose portrait we present on this page, is well known in the street railway fraternity. The development of a high standard of street car construction is due in large measure to Mr. Fowler, who has always insisted that the products of his works should be of the best, both in material and workmanship.

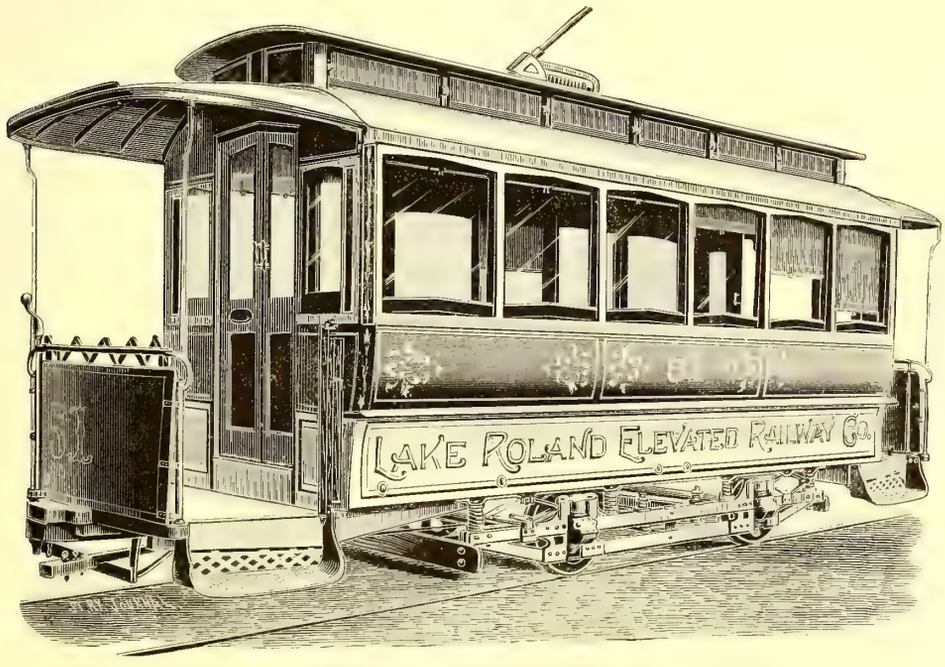


FIG. 4.—FIRST CAR OF THE J. W. FOWLER CAR CO.

Mr. Fowler started in the manufacture of street railway appliances in 1877, when the first car register of the firm of Lewis & Fowler, which has since become so well and popularly known, was put upon the market. Mr. Fowler was previous to this time, and had been for a number of years, in the mechanical department of the Brooklyn City Railway Company. The success from the start achieved by this register led to an extension of the manufacturing business of the firm with which Mr. Fowler was then connected, to other street railway appliances, and on December 1, 1883, the firm was merged into the Lewis & Fowler Manufacturing Company, Mr. Fowler being elected president of the company. The business of the company was continued at the same place, No. 8 Columbia Heights, Brooklyn, until April, 1886, when owing to the large increase of business, the factory was moved to larger quarters on Walworth Street, where Mr. Fowler remained president and manager until November, 1892, when he resigned his position and sold out his interest in the company, having served nine consecutive years as its president. In March, 1893, the J. W. Fowler Car Company was organized. Work was immediately commenced on the Elizabethport factory of the new company, which was put in operation September 6, 1893.

Mr. Fowler was born on Long Island, in 1848, and is now a resident of Brooklyn. He is also the owner of a beautiful country residence at Northport, L. I.

Mr. Fowler is ably assisted in his present work by John W. Cooper, treasurer of the company, and a life long friend of Mr. Fowler. Mr. Cooper was born in the City of Brooklyn in 1845. At the age of fourteen years, he entered upon his business career, which has so far been a very satisfactory one, both to himself and to his immediate social and business acquaintances.

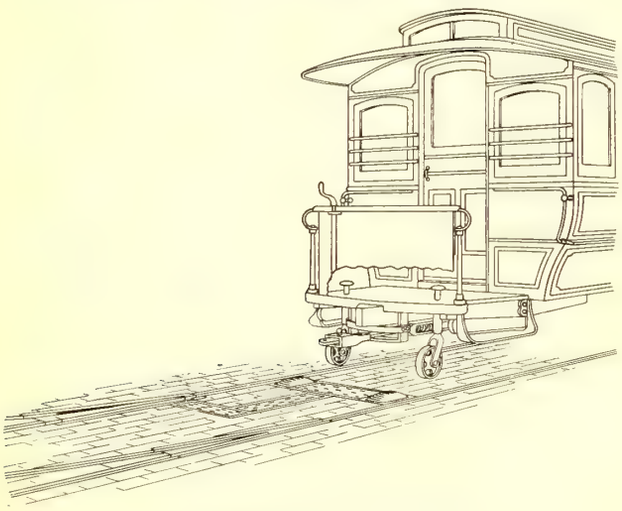
His first employers were Metcalf & Duncan, ship-brokers, whose office was at 23 South Street. A more promising position was offered him by Davis, Morris & Company, drug brokers, then at 87 Wall Street, but now (under the firm name of Davis, Wolt & Company) 58 Pine

Street. Finally, he became connected with Mr. Thompson in the South American trade, where he engaged his time as chief clerk and confidential man for six years. He was with Mr. Thompson for eight years, the last two of which he had a special interest in the business welfare of this house. About 1870, Mr. Cooper established himself at No. 259 Front Street, but has since removed his office and warerooms, to Nos. 36 and 38 Dover Street.

A Pressure Plate Switch.

The plate switch manufactured by the Pressure Plate Switch Company, of Brooklyn, N. Y., illustrated in our last issue has been giving good results in Syracuse and elsewhere where tried. We present herewith another view of the device showing the latest form in use by the manufacturers. This switch, as will be remembered, is operated by rollers mounted underneath the front platform of the car. These rollers are normally held about seven inches above the roadway, by springs placed inside the sleeves of the supports. The pressure plates, by which the switch is operated, are placed in the roadway some five feet or more in front of the switch, so the motorman can see the operation of the switch before the car passes over it. The plates themselves are slightly convex with a corrugated surface.

When it is desired to operate the switch, the motorman presses down one of the foot plates, which brings the roller into contact with the plate. These rollers and the rods holding them can be used with any style of fender. The People's Railway Company, of Syracuse, has recently put in one of these switches at the corner of



A PRESSURE PLATE SWITCH.

Court and Salina Streets, and the company's electrical engineer, H. S. Newton, reports that it has worked in a most satisfactory manner and is a great convenience to the motorman, the tongue moving freely on the application of a light pressure.

A New Fender.

The Euphrat life saving car fender is about to be placed on the market, a company having been organized recently, under the laws of Montana, bearing that name. This fender is the invention of Theophile Euphrat, of Darien, Conn. It is carried under the platforms of the car, out of the way of possible damage from collisions, etc., and consists of a scoop running close to the ground.

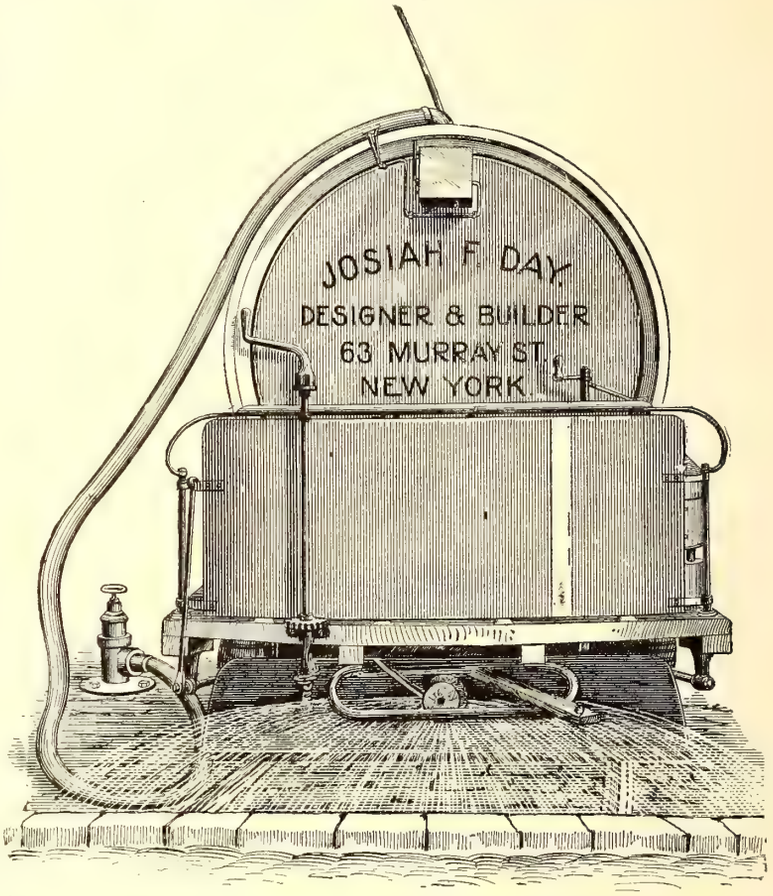
There are two styles of this fender; in one, the lower part is down all the time, clearing the ground by about three inches. When an object strikes the fender it springs down and almost touches the pavement, the weight being carried on small wheels or rollers. This gives the effect of a fender running very close to the pavement, without striking when the car rocks.

The other style is hinged at the back, and the lower half is carried in a raised position close under the platform. This is let down for use either by a treadle within reach of the motorman or by the person or object striking a strip connected with the releasing mechanism and running around the lower edge of the dash. The main office of the company will be at 45 Broadway, New York City, and it has a representative traveling through the West, bringing this fender to the attention of street railway managers.

Electric and Cable Car Street Sprinkler.

We present herewith an engraving showing view of an electric car sprinkler manufactured by Josiah F. Day, of New York, in connection with the Miller-Knobloch Wagon Company, and claimed to be the only downward spray sprinkler made for electric and cable railways.

This sprinkler is adjusted to spread water from eight to twenty-five feet, and the output is under perfect control, spreading the same amount when running fifteen miles per hour as when running four miles per hour.



ELECTRIC AND CABLE CAR STREET SPRINKLER.

Water can be thrown to the center of a double track, and outside to the curb from eighteen to twenty feet. The tanks hold from 2,000 to 2,500 gals., and when spreading from eight to nine feet will be fifty to sixty minutes in emptying, laying the dust completely. For electric roads the sprinkler is of great value, keeping, as it does, the dust out of the machinery, the rails clean and wet, thus improving traction, and reducing the resistance of the return circuit.

The sprinkler shown is equipped with motors and trolley. A car sprinkler adapted to cable railways is also manufactured by Mr. Day.

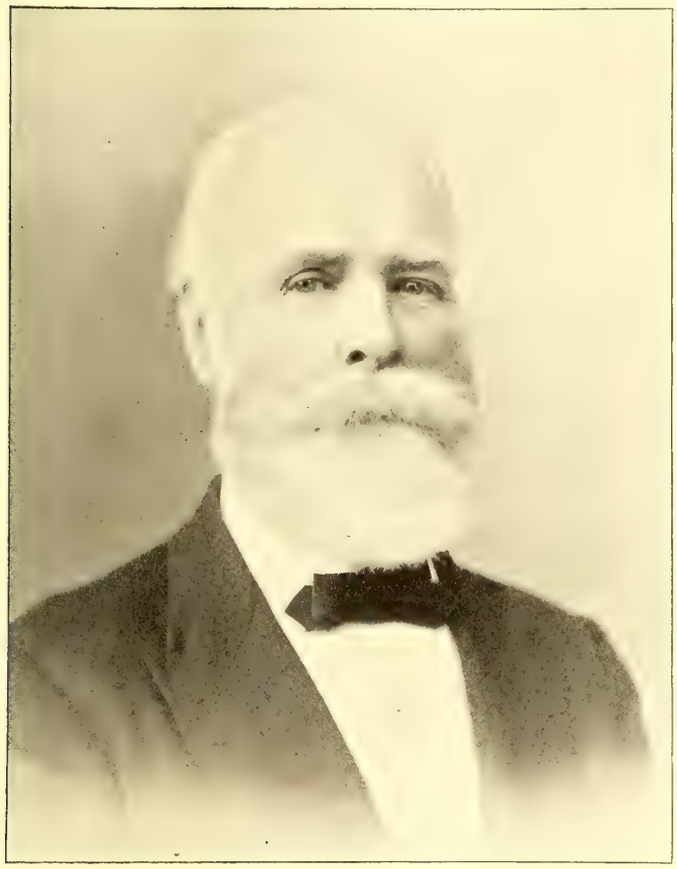
Removal of the Offices of the Metropolitan Traction Company.

The main executive offices of the Broadway Cable Road have been removed from the uptown station at 51st Street and Seventh Avenue to the cable road building and station at Houston Street and Broadway.

Death of William Richardson.

We are pained to record the death, on December 31, of William Richardson, late president of the Atlantic Avenue Railway Company, of Brooklyn, N. Y. Mr. Richardson has not only been prominently identified with the street railway interests of New York and Brooklyn for the last thirty years, but he has taken a leading part in the meetings of the American Street Railway Association and of the New York State Street Railway Association, of which he was a regular attendant. His death occurred at his home, No. 125 South Oxford Street, Brooklyn. He had been ill for a week and suffered from pneumonia and heart trouble, following congestion of the brain and diabetes.

Mr. Richardson was born at Berkhampstead, Hertfordshire, England, on December 8, 1822, and, consequently,



THE LATE WM. RICHARDSON.

at the time of his death was seventy-one years of age. When twelve years old he came, with his father, to this country, and the family settled at Gambier, O. When the Republican party was formed he joined it and became a member of its first State Committee. In 1857 he was elected clerk of the Assembly, and he served in 1858, 1859 and 1860. In 1861 President Lincoln appointed him an additional paymaster in the army. After the war he came to New York, and was made superintendent of the Dry Dock, East Broadway & Battery Railroad Company. In three weeks he became a director and president. This position he held for two and a half years, during which time the income of the road increased from $600 to over $2,000 a day.

In 1867 he resigned, and leased the Brooklyn & Jamaica Railroad for forty years. In 1872 a mortgage upon the property of the company was foreclosed, and Mr. Richardson bought the property. He then organized the Atlantic Avenue Company and became its president. He gradually extended its lines and built up the property until it was sold for a large sum to the Brooklyn Traction Company last year.

During Mr. Richardson's presidency his road had its share of labor troubles, and at one time the road was tied up for six days. But he successfully managed the affairs of the company and did not accede to the demands of the men.

Mr. Richardson was popularly known as the "Deacon," but as a matter of fact had never held that office in any church. He married in 1844, and had already made preparations to celebrate his golden wedding next September. He had seven children, of whom three sons and a daughter survive. Wm. J. Richardson, secretary of the American Street Railway Association, is a son.

$50,000 For the Best Street Car Motor.

The Metropolitan Traction Company sent a letter to the Board of Railroad Commissioners last month offering a prize of $50,000 for the invention of a system of street railroad propulsion superior to the cable and the trolley. In this letter the officers of the company say:

"On streets where the lines are straight and the business is heavy, the cable system is the most economical yet invented. For general use in a city, winding about through the streets following the routes of travel which the public wish to pursue, it is impracticable. You require straight routes for cable roads. We have, in addition to the lines upon which the cable will be laid, over eighty miles of street railroads now operated with horses all below the Central Park. It is to these lines in particular that we now desire to direct your attention.

"Up to the present time the only system whose practicability has been demonstrated is the overhead trolley. We are well aware, however, that its application in the streets of New York would not meet with the approval of the community. What we most desire now is to hasten the development and perfection of a better system. We therefore submit the following proposition:

"*First:*—We will set aside the sum of $50,000 to be awarded as a prize to any person who shall, before March 1, 1894, submit to your honorable Board an actual working system of motive power for street railway cars demonstrated to be superior or equal to the overhead trolley.

"*Second:*—The qualities necessary to meet this requirement shall be left to your decision; but with the present state of the art, a system to win the award must necessarily approximate the trolley as a standard of economy in operation, but should be without the features objectionable to the public that are in it.

"*Third:*—We shall exact no rights in the invention in return for the $50,000, and shall have nothing whatever to do with the making of the award further than to pay any expenses which your honorable Board may deem it necessary or wise to incur, either in the employment of experts, the giving of hearings, or the conduct of experiments—this in order that no effort may be spared to achieve the desired result."

The reply of the Railroad Commissioners is dated December 11. They say they cannot act as arbiters upon the merits of inventions. Competitive efforts should be addressed to railroad companies, and not to officials who try to hold railroads to a proper discharge of duty.

"Your effort is prompted," the letter concludes," by considerations of such public importance, and your spirit in making it is at once so practical and munificent, that its failure or abandonment would be greatly regretted by all who are interested in solving the problem of rapid transit in New York City. If, therefore, the Board can co-operate with your company within practicable lines such as have been set forth in part, it will do so."

Quick Construction of a Sweeper.

The J. W. Fowler Car Company recently built a snow sweeper for the Meriden Horse Railroad Company, of Meriden, Conn., completing the order and shipping the sweeper within fifty-two and a half hours after receiving the order. This company since commencing work at its new factory, September 6, has built an average of more than one sweeper a week, besides carrying on a large amount of car construction. The sweepers have gone to the Baltimore Traction Company, Scranton Traction Company, Hartford & Wethersfield Railway Company and the Atlantic Avenue Railroad Company, as well as other purchasers.

Change in the New York Offices of the General Electric Company.

It is reported that at a meeting of the executive committee of the General Electric Company, held December 29, it was voted to remove the executive and engineering offices of the company from New York to Schenectady, N. Y. The change will be made, it is said, February 1.

THE electric railway at Remscheid, Germany, which we described in our December issue, was installed by the Union Electricitäts Gesellschaft, of Berlin, and not by the Allgemeine Electricitäts Gesellschaft of that city.

The Requirements of Safety Appliances For Street Railways.

By R. A. Crawford.

The frequency of accidents from rapid transit street railways, and an earnest desire for their abatement by the mutual interests of the public and railway companies, has created a demand for safety contrivances that American ingenuity has responded to; in fact, railway

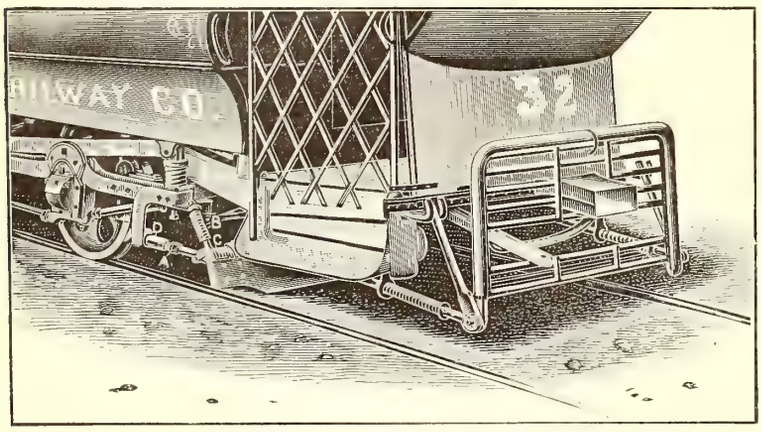


FIG. 1.—CAR WITH FENDER RAISED

officials have been overwhelmed by numerous divergent schemes which have been of educational advantage, if not always of practical utility.

Inventors and railway men coincide in working upon two standard ideas for a safety device, viz.: First, a wheel guard fender board placed in front of the wheels underneath the car; second, a projecting platform fender in front of the car.

Regarding the first standard idea, the present type of rigid fender boards now in use is crude and inflexible, affording no protection whatever, owing to the imperative height carried to avoid irregularities of the roadbed. Even at the present unsafe height of four and a half, five and six inches, they are continually being destroyed or having their ends broken by unevenness of road, sunken rails, plunging of truck and immovable obstructions.

Railway men demand a safety appliance possessing all of the following qualifications: Lightness, neatness, simplicity, safety, durability, and to be at the same time inexpensive, automatic, yielding, needing no attention, capable of being carried exceedingly close to and conforming with the roadbed, capable of passing over immovable obstructions and unevenness of road, quickly removable and adaptable to any car. A wheel guard fender board to meet the foregoing specifications

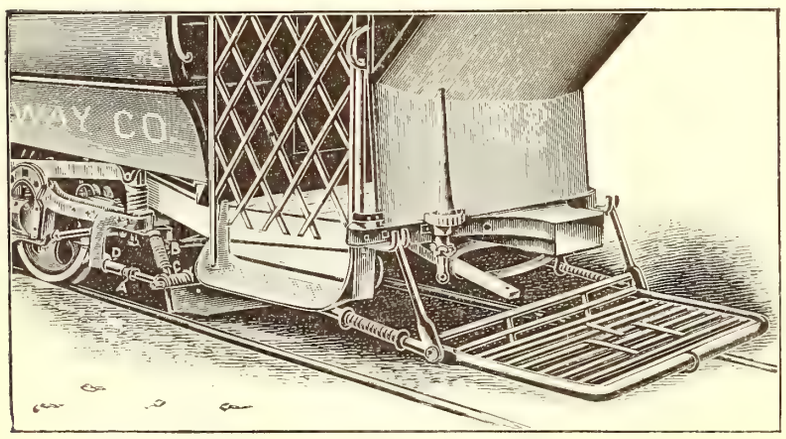


FIG. 2.—CAR WITH FENDER LOWERED.

must be held in place by three types of springs, each having different degrees of strength. There should also be three movements to the fender board, downward, a turning under and upward. In this way, when in contact with a movable object, the minimum power spring yields to its limiting check and allows the fender board to go downward, causing it to rub the ground. Then the next powerful spring resists, and the object is pushed ahead or aside by the car in motion.

When an immovable object strikes the fender board, the minimum power (C) yields to the limiting check, and the fender board is on the ground. Then as the obstacle does not move, the next two springs (A and B) yield and the fender board turns under, then upward and passes over the obstruction. Then the three springs return the fender board to its normal position. This method permits of a very simple form of construction, adaptable to any car and carrying a fender board exceedingly close to the roadbed.

Statistics show that people are seldom seriously injured by the blow of the car, but are crushed and killed by getting under the wheels, motors or high rigid fenders, and as accidents often occur by persons falling from the rear platform and getting under the wheels of the trail car, the value of a wheel guard fender such as described is very evident.

Regarding the second idea of a projecting platform fender, many railway managers assert that a majority of inventors have been working more to secure public approval, than from a practicable conception of what is needed.

The materials of such a fender should be as nearly indestructible as possible to avoid expensive repairs. For this reason pneumatic tubes, many forms of rubber, ropes, canvass and such substances, being destructible by weather, exposure and friction with the roadbed, etc., are objectionable. We should have, therefore, a projecting platform fender constructed entirely of iron or steel. This should be automatic and have a backward, down yielding movement to the roadbed, which action in contact with a person would lessen the impact and cause the one struck to fall into the fender, instead of throwing him forward, as with a rigid device.

A projecting platform fender should be constructed so as to fold up over the drawbar and bumper, and not interfere with the radiating action of the drawbar when coupled to another car, and in going around curves the fender should be entirely automatic and independent of the motorman, who has sufficient duties to perform without the additional one of caring for a fender; besides, accidents are not anticipated soon enough for any motorman to operate a fender and stop the car simultaneously.

As either of these described safety appliances is adaptable to any car on any street railway, the manager's preference and practical knowledge of the cause of accidents must govern his decision in adopting either one or both devices for a car.



THE WORKS OF THE C. & C. ELECTRIC CO.

The Works of the C. & C. Electric Company.

The C. & C. Electric Company, whose small electric motors for miscellaneous stationary work are well known, has recently been reorganized, and has secured large works, at Garwood, N. J. The company's object in taking these works is to extend its business to include a line of direct connected and multipolar generators, and, probably, also, of street railway apparatus. A general idea of the extent of the works will be obtained from the cut herewith.

The office seen at the extreme left of the buildings, and which is only 150 ft. from the railroad station, is an attractive, light building, two stories high and separated from the buildings comprising the works. Upon the ground floor are the offices of the chief engineer and assistants, cost and accounting departments and purchasing agent, while upon the second is a large and light draughting room with necessary blue print and photographic rooms.

The buildings comprising the works are generally upon the plan of a letter "E," in which the main stem comprises a building, 500 ft. × 80 ft., in which are located the main machine shop, the light machine shop, the winding shop and the erecting and assembling shop. A ten ton electric traveling crane of an approved make operates in this building, in which the various tools and processes are so arranged that from the time the raw materials are delivered under the crane, until the finished dynamo or motor is delivered into the testing room, the work never takes a backward movement.

The three buildings which form the lines at right angles to the main building, are used for the following purposes: One building, 72 × 110 ft., for stock room of raw material, one building, 72 × 110 ft.,

for light winding and testing room, and one building, 50 × 96 ft., for storage and shipping.

In addition to these buildings there is a boiler room containing three boilers with a capacity of 300 H. P. complete, with steam pumps, etc., an engine room with an engine of 150 H. P., with feedwater heater, etc., to be shortly supplemented by a second engine direct connected to multipolar dynamos of 150 H. P. capacity; a pattern shop, 30 × 48 ft., blacksmith shop, 30 × 48 ft., a polishing shop, 25 × 50 ft., and a lavatory of ample size to accommodate 500 hands. Side tracks are so arranged that cars containing raw materials can be set in, and those containing shipments taken out independently, while an industrial railroad runs into all departments to enable the expeditious handling of light materials, without interfering with the use of the crane for the transfer of heavy materials. The arrangement of the buildings permits of the location of the superintendent's office in a position to command the workmen in all departments. Capacious drying ovens are provided for properly drying such articles as require this process to insure high insulation.

All of the shafting and machinery is driven by motors which are supplied with current from dynamos in the engine room. Much care has been exercised in the grouping of tools and machinery, in order to show the great advantages to be gained from electrical power transmission, with a maximum efficiency with minimum investment. To this end, such large tools as are in constant use, are supplied with individual motors of sufficient capacity to operate them, while the smaller tools which require a varying amount of power, are grouped together upon short lengths of line shafting with a motor sufficiently large to meet all requirements made upon it, but without the heavy investment in motors necessary if individual motors were provided for each tool, with a sufficient capacity to operate each one at full load. A casual inspection of this feature of these works, shows that the company has taken advantage of the experience gained in the past, in the numerous applications of its motors to driving all classes of machinery.

These works have a floor surface of about 62,000 sq. ft., and throughout show a careful consideration of the advantages to be gained by concentration of departments, and at the same time an arrangement permitting of growth of these departments without interfering with the most economical conduct of the work. The company is to be congratulated upon its new works, and a prosperity that warrants its moving into them.

Prize Tickets.

The Oakland Consolidated Street Railway Company, of Oakland, Cal., issued some time ago a circular containing the offer given below. The secretary of the road writes us that the plan was very popular, and that the traffic soon increased 15 per cent. and at the time of writing was still constantly increasing:

"To encourage school children, young ladies and enterprising young men, the Oakland Consolidated Street Railway Company will, on and after November 1, 1893, issue prize tickets to patrons of its roads. Each passenger when he or she pays a fare will receive from the conductor a prize ticket duly canceled with the bell punch, in his or her presence. The passenger should, in all cases, accept this ticket, and if he or she does not wish to use it, should give it to some friend who intends to compete for a prize. The prizes will be awarded every two months. The first award will be made January 2, 1894. There will be ten prizes in all, as follows:

"First prize $60, second prize $40, third prize $30, fourth prize $20, fifth prize, $15, sixth prize $10, seventh prize $9, eighth prize $7, ninth prize, $5, tenth prize, $4, in all $200 in coin.

"The first prize will be given to the person collecting the largest number of canceled tickets; the second prize to the person collecting the next largest number, and so on through the list. The awards will be made by a committee consisting of representatives from the *Times*, *Tribune* and *Enquirer*.

"Organize districts, see all your friends, ask them to ride on the Oakland Consolidated Street Railway Company's cars and to save the prize tickets which they receive. Persons feeling that they cannot accomplish this work alone, may associate two or more of their friends with them and form a club, and increase their chances for winning a prize. The conductors on the cars will not be allowed to compete; neither will they be permitted to solicit them for their friends, so that everybody will have a clear field.

"Instructions to competitors.—As fast as the tickets are collected, put them up in packages of 100, and lay them away. On or before ten o'clock P. M., January 1, 1894, make one package of all the tickets, and place in this package a card with name, address and the number of tickets. Take or send the package to the secretary of the Oakland Consolidated Street Railway Company, at 47th and Grove Streets, Oakland. Be careful to correctly count the tickets as an error might result in the loss of a prize."

A. K. GRIM, Secretary.

A Neat Paper Weight.

The Electric Railway Equipment Company, of Cincinnati, O., has sent us with its "compliments of the season," one of the products of its foundry in the shape of a souvenir paper weight, which is extremely tasteful in design and which has already proved itself very useful.

Report of Citizens' Traction Company, Pittsburgh, Pa.,

FOR YEAR ENDING OCTOBER 31ST, 1893.

PASSENGERS, TRIPS AND MILES.

Total number of passengers in cable cars	12,999,478
" " " electric cars	1,848,373
Total	14,847,851
Total trips run by cable cars	241,605
" " electric cars	75,366
Total	316,971
Total miles run by cable cars	2,037,262
" " " electric cars	459,223
Total	2,496,485

EARNINGS AND EXPENSES.

Total receipts from cable cars	$627,558.27
" " " electric cars	80,437.07
Total earnings from cars	$707,995.34
Total operating expenses of cable cars	$332,644.48
" " " electric cars	57,189.33
Total expense of operating	$389,833.81

Note:—In operating expenses, all expense is included except interest, taxes, damages and dividends.

PER CENT OF RECEIPTS FOR OPERATING..

Cable cars	53. per cent.
Electric cars	71.1 "
Average	55.1 per cent.

DAILY EXPENSE OF OPERATING CABLE POWER HOUSE, 725 H. P.

Oil, Grease and Waste	$2.31
Fuel	28.74
Water	3.60
Labor	27.16
Total	$61.81
Cost per H. P., 20 hours	8.5 cents.
Cost per H. P., 1 hour	.42 cent.

DAILY EXPENSE OF OPERATING ELECTRIC POWER HOUSE 22 HOURS PER DAY, AND 216 H. P.

Oil, Grease and Waste	$ .56
Fuel	9.47
Water	.98
Labor	8.96
Total	$19.97
Cost per H. P., per day	9.20 cents.
Cost per H, P., per day	.41 cent.

DETAIL OF COST OF MOTIVE POWER PER CAR MILE.

Coal	8.45 lbs. Cable.	Cost.	.51 cent.
Oil, Waste and Water	"	"	.10 cent.
Labor	"	"	.49 cent.
Total cost			1.10 cents.
Coal	11.36 lbs. Electric,	Cost.	.80 cent.
Oil, Waste and Water	"	"	.10 cent.
Labor	"	"	.70 cent.
Total cost			1.60 cents.

CABLE ROAD.

Miles run. 2,037,262	
Receipts per mile	30.80 cents.
Expenses per mile	16.33 cents.
Profit per mile	14.47 cents.
Profit for the year	$294,913.79

ELECTRIC ROAD.

Miles run 459,223.	
Receipts per mile	17.51 cents.
Expense per mile	12.45 cents.
Profit per mile	5.06 cents.
Profit for the year	$23,247.74

TAXES PAID.

State	$32,471.31
County	53.10
City	7,192.88
Total	$39,717.29
Increase over last year	$14,497.82
Paid on account of accidents and damage	$ 3,644.45

Repairs to cable cars, .75 cent per mile run.
Repairs to electric cars .35 cent per mile run.

Legal.

Street Railway Service—Injury to Passenger—Contributory Negligence—Question for Jury—Note.

1. Where a passenger was injured by being thrown from defendant's car by a sudden jerk of the car, while preparing to get off (while car is in motion), after having given conductor a signal to stop, the question of plaintiff's contributory negligence is for the jury to determine.

2. In the absence of evidence to show, or tending to show, the cause of the injury to the passenger, and no affirmative testimony that the company neglected any duty to the plaintiff, *held*, that the submission of the question of defendant's negligence to the jury was erroneous. Judgment for plaintiff reversed.

Bradley v. *Ft. Wayne, etc., St. Ry.*, Mich. S. C., December 22, 1892.

Note: Preparation to alight while car is in motion has been a fruitful cause of injury and subsequent litigation. It is the duty of the company's servants in charge of a car to stop it at street crossings or other regular stopping places, when so requested, to permit passengers to leave the car, and those who wish to alight have the right to rely upon the performance of that duty. And while a passenger has a right to remain in his seat until the car comes to a full stop, it is generally a mutual saving of time to both carrier and passenger for the passenger to leave his or her seat and make preparation to alight while the car is still in motion. Hence custom, supported by numerous decisions, uphold the rule that, when a passenger has signaled the conductor to stop the car, it is not negligence *per se* to proceed to the rear platform (or side of an open car) while the car is slowing up, and wait there until he can safely alight. But in doing so he assumes the risk of all the ordinary movements of such a car properly managed, but if, while proceeding to the rear platform or footboard, or while waiting there to alight, he is thrown to the ground and injured, by a sudden jerk of the car caused by the negligence of the company's servants, the fact that he left his seat while the car was in motion, and prepared to alight will not defeat a recovery. See, Medler *v.* St. Ry. Co., 12 N. Y. Supp. 930; Ganley *v.* St. Ry. Co. 7 N. Y. Supp. 854; Bowie *v.* St. Ry. Co., 10 So. Rep. 574; Nichols *v.* St. Ry. Co., 38 N. Y. 131; St. Ry. Co. *v.* Findley, 76 Ga. 311; Harmon *v.* St. Ry. Co., 17 Wash. Law. Rep. 426; St. Ry. Co. *v.* Calderwood, 89 Ala. 247; Ridenour *v.* St. Ry. Co., 102 Mo. 270 and 14 So. W. Rep. 760.

It has been regarded as a reasonable safeguard against accidents to forbid departure from a car while it is in motion, but a passenger does not violate this regulation or necessarily preclude a recovery against the company for the latter's negligence, by walking while the car is in motion, toward the rear end (or side) for the purpose of descending to the lower platform of a double decked car. See St. Ry. Co. *v.* Leonhart, 66 Md. 70; or 5 Alt. Rep. 346. See also, Booth's Law of Street Railways, 470.

Street Railway Companies—Liability for Injury to Pedestrians—Swung Around a Corner. This action was brought to recover damages from the defendant company for personal injuries. The testimony showed that plaintiff was standing near the side of the track, waiting for a car to go by. She testified that she saw the car; that she was looking north at some teams, while the car was coming from the south; that she saw the front of the car go by her, and thought she was far enough from the track to be safe, but was struck by the rear end of the car as it was swung around the corner at a turn.

Held, that in the absence of any claim or proof of defect in the car or its equipment or in the track, or of testimony of anything unusual or improper in the management of the car, that there was no evidence of negligence on the part of defendant, no recovery could be had.

Widmer v. *West End Street Railway Co.*, Mass. S. J. C., January 6, 1893.

Rapid Transit Plans in New York.

The Rapid Transit Commissioners have at last decided upon a plan upon which to invite bids. The new plan provides for a West Side line, beginning at the Battery and running up West Street, West 11th Street, Seventh Avenue, Broadway, the Boulevard, Eleventh Avenue and Kingsbridge Road to the city line. The East Side line has two branches, one starting from the Battery and running up South, James, Centre and Marion Streets, Lafayette Place and Fourth Avenue, and the other starting from the City Hall and running up Centre, Canal and Wooster Streets and University Place to 14th Street. A connecting line is also provided through 14th Street from Fourth to Seventh Avenues.

These lines must all be operated by electricity or some power not requiring combustion on the road, and must be independent of the Manhattan Elevated Railway.

Interesting Legal Decision in Cleveland, O.

An interesting case was recently decided against the Brooklyn Street Railroad Company and the New York, Chicago & St. Louis Railroad Company, joint defendants, in favor of the estate of Isabella Mooney, deceased, in the Ohio Court of Common Pleas. It was charged that the plaintiff came to her death through a complication of diseases induced by nervous shock caused by a collision between a train of the former and a locomotive of the latter company, on September 6 last.

The damages claimed were $10,000, the maximum amount claimable, but the Ohio State law provides that in case of death from such a cause, the corporation or person causing the same is liable for the actual pecuniary loss sustained by the survivers of the deceased up to a maximum amount of $10,000. In this case the deceased left three sons, all of age, and the question of the pecuniary loss to these sons, aside from all feeling of sentiment, was charged minutely to the jury. The verdict was for only $400 each against the companies. The case has been taken to the Circuit Court on errors.

Automatic Cable Signaling Device.

A method of automatically signaling the power station in a cable system, in case the grip of the car cannot be unfastened from the cable, has recently been patented by J. Sachs, of New York. The system consists of a number of small and simple electric signal boxes located in the cable conduit at every wheel pit. The hook or arm that actuates the signal projects into the conduit. On the grip of the car and below the slot is an arm or projection which, although normally in such position as to be safe from and not strike the arm of the signal box, its position can be immediately changed by pulling a suitable lever, at either end of the car. In this way a moving car will strike the signal arm and move it, thereby actuating the signal box and transmitting the signal to the station. If the gripman notices that his car is unmanageable, he simply pulls this hook or lever on the platform of the car, and thereby operates the next signal box in the conduit. By always setting the lever on stopping the car, the signal will be transmitted automatically if the grip should become caught in a strand of the cable.

Rapid Transit Wins in Cincinnati.

The Cincinnati Street Railway Company, after a long fight, was recently granted, by the Board of Administration, the franchises desired for its proposed extensions, and the right to equip its lines electrically.

The franchises granted provide that all old tracks where electric motor cars are to be used be replaced by girder rails of satisfactory weight and pattern, and all pavements disturbed in construction be replaced to the satisfaction of the Board of Administration. The company is also obliged to use iron poles throughout, and no wires to be less than twenty feet above the street, except where required by overhead bridges, etc. The Board of Administration reserves the right to require, when it may be deemed expedient, all feeder wires and mains, except the necessary connecting and supply wires, to be placed in suitable underground conduits. This is to be done as soon as a successful underground system is in operation in any city of the United States.

The company is also required to maintain in good order all streets and pavements disturbed in construction for a period of two years, and also to make good all damage to pavements caused by the yielding of its tracks. Open cars must be run in summer and closed cars heated in winter. Cars shall leave the starting points of all lines up to 12:30 A. M. A full system of transfers on a five cent fare is also provided for.

As to license fees, the company must pay to the city a license fee of $4 per foot length of body, inside measurement, on each car per year, account to be kept and submitted of all extra cars in emergency service, and also the sum of 5 per cent. on the entire gross earnings of all lines owned and operated. All the extensions authorized must be commenced within three months and completed and in operation within one year from the date of the granting of the franchises.

The franchises granted expire with the existing franchises of the lines to be extended, and as the shortest of these has eighteen years to run, the new franchises are practically for eighteen years from date,

A RETROSPECT OF THE PAST YEAR'S BUSINESS: THE PROSPECTS FOR 1894.

The past year has been one of great activity in street railway construction. During the first six months all the manufacturers of street railway supplies had their facilities taxed to the uttermost to supply the large demand made upon them, and though the last six months have been a period of general depression throughout the business world, the demand for equipment does not seem to have slackened to a very large extent. To lay before our readers what was thought of the past year's business, and what is expected in 1894 by the dealers in street railway appliances, we addressed a circular letter to the prominent manufacturers, asking for an opinion on this subject for publication. The following are some of the replies received:

AMERICAN CAR COMPANY.

ST. LOUIS, MO., December 14, 1893.

GENTLEMEN:—We have no reason to complain of the past year, having built in the neighborhood of 1,000 cars, and increased our capacity so as to largely exceed that output during the year 1894. We have no reason to believe these expectations will not be fulfilled.

Respectfully,
AMERICAN CAR COMPANY.
E. ALEXANDER, Secretary.

SAMSON CORDAGE WORKS.

BOSTON, MASS., December 14, 1893.

GENTLEMEN:—We are increasing our sales of trolley cord considerably, sending our special Samson Spot cord for this purpose largely. We look for an increased business in this line next year.

Yours very truly,
HERBERT G. PRATT.

THE LUNKENHEIMER COMPANY.

CINCINNATI, O., December 16, 1893.

GENTLEMEN:—The volume of our business for this year compares very well with last year, taking all things into consideration, and has only fallen behind about 15 per cent. in sales for the entire year. Collections have been very good with us for the last sixty days, and trade has opened up somewhat, and we expect very large sales for 1894. We hope we shall not be disappointed.

Yours truly,
THE LUNKENHEIMER COMPANY.

PRATT & WHITNEY COMPANY.

HARTFORD, CONN., December 14, 1893.

GENTLEMEN:—The volume of our business for 1893 up to July 1 was 15 per cent. greater than for the same period in 1892, but since that date it has fallen off so much that the business for the year is 20 per cent. less than for 1892. We have known times when business was very much lighter than now, and do not look for an important increase in business before 1895, unless we shall be fortunate enough to obtain some contracts of a special character, which we hope to do.

The milling, drilling, brass finishing, automatic screw making and automatic weighing machines exhibited at the Columbian Exposition attracted universal attention, and the exhibition has already resulted in some business.

Very truly yours,
PRATT & WHITNEY COMPANY.
R. F. BLODGETT, Secretary.

THE WADDELL-ENTZ COMPANY.

NEW YORK, December 13, 1893.

GENTLEMEN:—Our batteries during the last year have been giving good satisfaction where used, and have proved their desirability for street railway service. The most extensive plant of this kind which we have installed is that on the Second Avenue line in New York City, familiar to your readers through the able description published in the December number of the STREET RAILWAY JOURNAL. You will be interested to learn that this battery has been adopted for traction purposes by the Accumulatoren Fabrik Aktiengesellschaft for introduction in Switzerland, Austria and Germany.

The showing made on Second Avenue has attracted careful attention of the street railway men from all parts of the world, and the outlook for the season of 1894 is very promising.

Yours very truly,
THE WADDELL-ENTZ COMPANY,
J. A. MACHADO, Secretary.

THE DORNER & DUTTON MANUFACTURING COMPANY.

CLEVELAND, O., December 19, 1893.

GENTLEMEN:—In reference to comparison of business done this year with last year, we find that in most of our branches, we have done a greater business than we did in 1892. We have considerably increased our plant this year, and anticipate a much larger trade next year, especially in the truck line.

Very truly yours,
THE DORNER & DUTTON MANUFACTURING COMPANY,
W. A. DUTTON.

WM. B. MERRILL & COMPANY,

SOLE MANUFACTURERS OF
THE TRIPP METALLIC PACKING COMPANY.

BOSTON, MASS., December 15, 1893.

GENTLEMEN:—Our business for 1893 has shown an increase over any previous year, far ahead of anything we had anticipated. A generous share of our orders is for packings required for engines designed for street railway service.

Yours very truly,
WM. B. MERRILL & COMPANY.

H. J. WIGHTMAN & COMPANY.

SCRANTON, PA., December 20, 1893.

GENTLEMEN:—As for the outlook the coming year, while perhaps not as promising as the opening of the present year, we think there is every reason for looking for a continuation of the improvement in the business outlook, which has certainly commenced.

Yours very truly,
H. J. WIGHTMAN & COMPANY,
H. J. WIGHTMAN.

J. M. JONES' SONS.

TROY, N. Y. December 30, 1893.

GENTLEMEN:—We are well satisfied with the amount of business done in the past year, and look forward to 1894 as being a good year.

Yours truly,
J. M. JONES' SONS.

IMPERIAL PINE PRODUCT COMPANY.

NEW YORK, December 20, 1893.

GENTLEMEN:—Our "Imperial Cable Coating" is growing in favor, and is being widely adopted. It seems to really fill a long felt want for a perfect and satisfactory coating for cables for railroads and for collieries.

Yours very truly,
C. W. KIRBY, JR., Treasurer.

BROWN & SHARPE MANUFACTURING COMPANY.

PROVIDENCE, R. I., December 15, 1893.

GENTLEMEN:—We find that for the first six months of this year our business, in comparison with that of 1892, was considerably larger, as shown by the amount of sales. During August the demand for machine tools almost ceased, but during October and November the sales were greater than anticipated, so that the total for the first eleven months of the year was but slightly below that for the same part of 1892. We anticipate a gradual revival of business, and, on the whole, satisfactory results before the end of 1894.

Yours truly,
BROWN & SHARPE MANUFACTURING COMPANY.

PHILADELPHIA ENGINEERING WORKS, LTD.

PHILADELPHIA, PA., December 21, 1893.

DEAR SIRS:—We have just completed a 22 × 48 in. Corliss engine at the works of the Delaware County Construction Company, this engine being used for driving electric railway generators. Also a 1,000 H. P. cross compound, condensing engine for the Hudson Electric Light Company, Hoboken, N. J., this engine being used for railway work. During the first months of this year, we were fortunate enough to secure sufficient orders to keep us busy night and day until June. Since then orders have been falling off very markedly, this being due to the general depression in business throughout the country.

At the present time we have quite a number of inquiries, and from appearances we have every reason to believe that our business next year will increase in volume at low prices.

During the last few months we have made quite a number of improvements in our shop tools and fixtures, by means of which we hope to more efficiently and economically produce our machinery.

Yours truly,
PHILADELPHIA ENGINEERING WORKS, LTD.,
VICTOR O. STROTEL, Secretary and Treasurer.

HILLES & JONES COMPANY.

Wilmington, Del., December 14, 1893.

Gentlemen:—As you are aware, business in our special line of building machine tools is extremely quiet, and it is not worth while to explain what we think is the cause, further than to say that it is fear of tariff reductions which the present Congress seems determined to enforce.

Yours truly,
Hilles & Jones Company.

L. P. & D. TRANSMITTER COMPANY.

Montpelier, Vt., December, 13, 1893.

Gentlemen:—Notwithstanding the very bad year for business, the demand for our transmitters has exceeded 1892 thus far by 25 per cent. The great trouble has been in getting paid for machinery sold. As for the other branches of our business, they have been practically dead this year.

Yours truly,
L. P. &. D. Transmitter Company.

HINE & ROBERTSON.

New York, December 14, 1893.

Gentlemen:—Had the depression in business not occurred, we have every reason to believe our business this year would have far exceeded that of last year. We do very little with street railways, because contracts for the plants are let to certain contractors. We cultivate their acquaintance, and in that way get what business we have in that particular line.

Wishing you continued success, we remain,

Yours very truly,
Hine & Robertson.

HARRINGTON, ROBINSON & COMPANY.

Boston, Mass., December 16, 1893.

Gentlemen:—Our business of the first half of 1893 was very satisfactory. It is perhaps needless to add however, that the last half has been decidedly the reverse. We think, however, taking the year as a whole, the amount of business done will not be far behind that of the year 1892.

It seems to us that the present outlook for business in 1894, is very good, but we would be chary of positively assuring ourselves of this result.

Very truly,
Harrington, Robinson & Company.

MILLERS FALLS COMPANY.

New York, December 14, 1893.

Gentlemen:—Our business for the eleven months of 1893 fell short 2 per cent. from last year, but was larger than in any former year. The home trade fell off very much, but export demand increased in about the same ratio. We are always bringing out new tools, and have added such new machinery as was needed for the new goods.

For some reason the track drills, which we advertised in your paper are having a good run, regardless of the hard times. In regard to the future we have not very high hopes. We would sooner risk the old time policy of government.

Truly yours,
Millers Falls Company,
H. L. Pratt, President.

CROCKER-WHEELER COMPANY.

New York, December 11, 1893.

Gentlemen:—We have not as yet extended the manufacture of our special types of apparatus into the direct street railway line, our apparatus being supplied with power, in many instances, however, throughout the country, from street railway circuits. We are however, at this time just commencing the manufacture of the larger dynamos, using the Bradley type of bar wound armature construction, the patents on which type are solely owned by this company. The peculiar non-burn-out type of these armatures, we are very sure, will readily commend them to railway managers, and we shall therefore hope a year hence to be able to report to you a considerable output of this type of machine.

Yours very truly,
Crocker-Wheeler Electric Company.
H. L. Lufkin, Manager.

THE BALL & WOOD COMPANY.

New York, December 15, 1893.

Dear Sirs:—The business conditions which have existed for the past six months have so affected every branch of industry that few establishments, if any, we think, will be able to report any increase over 1892. While we are no exception to this rule, yet orders have been received which have kept our factory busy, and rendered unnecessary either the shutting down of the works, the discharge of our men, or the reduction of wages.

As regards the outlook for 1894, with the Silver and Tariff questions settled, we see no reason why, with the opening of spring, conditions should not be favorable to active business in all directions. As long, however, as either of these questions remains in abeyance and the subject of Congressional action we believe, by just so long, we can expect lack of confidence and a continuance of existing depression.

Yours truly,
The Ball & Wood Company,
Thos. C. Wood, President.

WILLIAM WHARTON JR. & COMPANY, INCORPORATED.

Philadelphia, Pa., December 13, 1893.

Gentlemen:—During 1893, we have been extremely busy in all our departments, many of them running double turn the entire year, the demand for our "Integral" special work being constantly increasing and taxing our efforts to keep up with it. The closing year will show an output nearly 100 per cent. greater than any prior year, and the only disagreeable factor is that prices have been cut to such low figures that the profits of the business are not such as are warranted by its intricacies and destruction of brain tissue. In regard to the prospect for business during 1894, we do not care to express an opinion.

Yours truly,
Wm. Wharton Jr. & Company, Incorporated.

JAMES A. TRIMBLE.

New York, December 15, 1893.

Gentlemen:—My business during the year 1893 has been a gain on the previous one, notwithstanding the fact that it was somewhat retarded by building an addition to my factory of two extra stories, which now gives a capacity of twenty-five to thirty cars per month. I am now finishing some cars for Steinway Railway Company, of Long Island, also a lot of work for Brooklyn, Jersey City and others, and am in good shape for next year's trade. I do not pretend to compete against cheap builders, as I only do a high grade of work, as proved by the continuance of my customers during the past fifteen years.

Respectfully yours,
James A. Trimble.

ROBINSON ELECTRIC TRUCK & SUPPLY COMPANY.

Boston, Mass., December 19, 1893.

Dear Sirs:—Our business during the last year has been considerably larger than ever before, and the prospects for 1894 are excellent.

One significant fact shows the estimation in which the Robinson radial truck is held by users, and that is, that we have repeatedly received second, third, fourth, and even fifth and sixth, orders from the same companies for these trucks, together with endorsements of the highest character as to efficiency, economy in power and maintenance and satisfaction given.

Yours very truly,
Robinson Electric Truck & Supply Company,
Wm. Robinson, General Manager.

ELI B. HALLOWELL & COMPANY.

Philadelphia, Pa., December 15, 1893.

Gentlemen:—Our business for this year, as compared with last, has been more satisfactory, inasmuch that, while the volume has not been as large, the net results are about equal. We dont look for any boom next year, but still think that a fair amount of trade will be done. The most promising outlook to us is in the electric railroad line. We hear of new roads almost every day. As a matter of course a great many will not be built, but there will be enough done to keep a good many busy. We have made arrangements to handle a good many octagon poles and also sawn ties, and will be pleased to name prices at any time. Wishing you a prosperous new year, we are,

Yours very truly,
Eli B. Hallowell & Company.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY.

Cincinnati, O., December 19, 1893.

Gentlemen:—During the last year we have enjoyed a fair run of business, considering the dullness and stringency of the times. Our sales for November and December show that quite a revival has taken place in the electric equipment of roads. We have this year brought out quite a number of novelties for use in overhead construction, and have enjoyed an exceptionally large sale of our patent joint, wrought iron and steel, tubular poles, having received orders for nearly 6,000 within the last four weeks.

The outlook for the coming season looks as if there would be a considerable amount of business, if nothing happens to upset the financial condition of the country, and we look for large business next year if things continue to improve as they seem to have done the last month or two.

Yours respectfully,
The Electric Railway Equipment Conpany.

GRAHAM EQUIPMENT COMPANY.

Boston, Mass., December 15, 1893.

Gentlemen:—We have met with unexpected success in our business during the year drawing to a close. We have trucks running today and giving satisfaction in Milwaukee, Pittsburgh, Philadelphia, Providence, South Braintree, Bath, New Haven and Hazleton, Pa., and we have orders ahead for spring delivery. We have opened an office and established a plant in the city of Philadelphia so that we can give our customers prompt delivery in Southern and Southeastern States. At the same time we are in a central point, and quite able to compete with any truck makers in that section. We are arranging for an entire new plant in Boston. The plans are all ready, and special machinery is being designed. Taking everything into consideration, we anticipate a heavy business in 1894, and we are getting ready for it. If the volume of business is equal to our expectation, we feel confident of our ability to satisfy all our customers.

Respectfully,
Graham Equipment Company.

HEINE SAFETY BOILER COMPANY.

ST. LOUIS, MO., December 11, 1893.

GENTLEMEN:—We are glad to be able to state that business is rapidly reviving with us, and we have very little complaint to offer in that respect. We are encouraged to believe that the business of 1894 will go far to make up for the shortage which everyone has experienced in the 1893 business.

HEINE SAFETY BOILER COMPANY,
S. D. MERTON, Secretary.

THE DELAWARE HARD FIBRE COMPANY.

WILMINGTON, DEL., December 13, 1893.

GENTLEMEN:—The only item of interest which we can report just now is that we have opened a store at 15 Long Lane, London, E. C., where we have shipped a large stock of our product, and from which all of our European business will hereafter be conducted.

DELAWARE HARD FIBRE COMPANY,
C. G. RUPERT, Manager.

WADHAMS OIL & GREASE COMPANY.

MILWAUKEE, December 16, 1893.

GENTLEMEN:—The first four months of this year were marked with the most satisfactory business ever done by this company in the same period of time. The general depression during the summer and fall was very noticeable in our line of trade, and on the whole our business will probably fall short of that of last year by about 15 per cent. In some special lines, such as Wadhams graphite curve grease and Badger motor lubricants, our sales ran far in advance of 1892.

We look forward to a good, healthy state of affairs for the new year. Collections are decidedly improved, and a much easier feeling seems to prevail. Wishing you the compliments of the season, we remain, Yours truly,

WADHAMS OIL & GREASE COMPANY.

CENTRAL ELECTRIC HEATING COMPANY.

NEW YORK, December 19, 1893.

GENTLEMEN:—So far as the railway department of the Central Electric Heating Railway Company's business is concerned, the year just drawing to a close has been a most successful one.

This company has now acquired all of the most valuable patents on electric heating, and after many careful tests of heaters in actual use, has decided on a form which is believed to be both economical and efficient in use for street railway purposes, and it has so proved itself in the fact that it has been adopted on a very large number of street railways throught the country. The outlook for business for 1894 is most encouraging, and we predict that there will be hardly an electric car in the United States but will be equipped with electric heaters.

Yours very truly,
CENTRAL ELECTRIC HEATING COMPANY,
Per EDW. B. WYMAN.

SHEPPARD MANUFACTURING COMPANY.

LOUISVILLE, KY., December 16, 1893.

DEAR SIRS:—Any information we may be able to give you in regard to our business for 1893 must necessarily be meagre, as our company is new, we having incorporated on the 4th of March last. We can say, however, that in spite of the unfavorable conditions of the finances of the country, and the difficulties attending the introduction of a new article on the market, our business has been excellent, having very materially exceeded our expectations.

We regard the prospects for the coming year as most flattering, and feel confident that we shall reap our full share of the harvest that must inevitably follow the reaction in the business interests of the country. We shall issue a new catalogue early in the coming year.

Very respectfully,
SHEPPARD MANUFACTURING COMPANY,
A. B. DUPONT, President.

J. H. McEWEN MANUFACTURING COMPANY.

RIDGWAY, Pa., December 14, 1893.

GENTLEMEN:—Business during the last year has been a surprise to us. We have had a remarkable sale of our engines, furnishing quite a number for street railway work, etc. We are now well established in our new works, having just completed the same. The buildings are of steel. The main building is 120 × 260 ft.; galleries on the sides, each 30× 160 ft. We have a twenty ton Morgan electric crane in our machine shop, which covers a floor space of 60 × 170 ft., and have hydraulic cranes in the foundry. In fact, we believe we have one of the most complete plants in the country. It looked at one time as though business was going to be dull with us, and in July we reduced the hours of our men to eight hours per day, but at the end of fifteen days we put the men back to full time again, and are now running full force.

Inquiries are such that we are led to believe that business will continue to be good for some time to come.

Yours truly,
J. H. McEWEN MANUFACTURING COMPANY,
Per J. H. M.

THE PELTON WATER WHEEL COMPANY.

SAN FRANCISCO, CAL., December 19, 1893.

GENTLEMEN:—Our business up to July was of large volume, and everyway up to expectations. It has, however, been much restricted by the general financial distress, more especially as we were so closely connected with mining interests that have suffered so much from depreciation in silver.

Business has, however, improved much during the past month, and there are indications of increased activity the coming year.

Yours very truly,
THE PELTON WATER WHEEL COMPANY.

SHAWMUT FUSE WIRE COMPANY.

BOSTON, MASS., December 20, 1893.

DEAR SIRS:—We are pleased to say that any note from us on the condition of business must be one of cheerfulness and encouragement. The volume of our business in 1893 has been more than twice what it was in 1892, and the "signs of the times" give no evidence of a decrease in the growth. If the demand for fuse wire is any criterion of the loads on cars and circuits there cannot be serious anxiety in the minds of the electric companies.

Yours very truly,
SHAWMUT FUSE WIRE COMPANY.
J. McK. FERRIDAY, Assistant Treasurer.

REED & McKIBBIN.

NEW YORK, December 14, 1893.

GENTLEMEN:—The last year was the busiest year we have had, and the most successful. We have completed contracts for street railway construction in the following cities: Brooklyn, N. Y.; Paterson, N. J., four contracts; Easton, Pa., two contracts; Norwalk, Conn., contract for entire construction and equipment.

We have contracts now on hand for the entire construction and equipment of the Lock City Electric Railway, Lockport, N. Y., and the Colonial City Electric Railway, Kingston, N. Y.

On account of our constant increase of business, we have been obliged to lease a larger suite of offices in the Union Trust Building, No. 80 Broadway, near the corner of Wall Street, where we will be located after the first of January.

Yours very truly,
REED & McKIBBIN.

THE ELLIOTT-LINCOLN ELECTRIC COMPANY.

CLEVELAND, O., December 16, 1893.

GENTLEMEN:—Our business this winter has been very satisfactory in volume. Notwithstanding the fact that we are comparatively new in the field, our apparatus is meeting with a great deal of favor. We have several lighting machines operated by gas engines for private plants, which are doing excellent work. We believe that there are in this direction, prospects for a large increase in our business.

While collections have been hard during the summer and fall, we believe that business will be better soon after the first of the year, and are confidently looking forward to doing a very much increased business next spring. Our quarters will be changed so that our facilities for turning out work will be more than doubled.

Yours truly,
THE ELLIOTT-LINCOLN ELECTRIC COMPANY.
J. C. LINCOLN.

THE LANE & BODLEY COMPANY.

CINCINNATI, December 14, 1893.

GENTLEMEN:—We think that there is a favorable outlook for 1894 in the street railway business. We have been preparing this year a new line of engine patterns with stiffer frames for electric railway service. Quite a number of these patterns are in use and realizing our expectations. The volume of business this year has been considerably less than last.

There seems to be some hesitation at present among buyers as to the future drift of the best engineering practice in the matter of direct and belted driving of generators and in size of units. It is the Lane & Bodley Company's opinion that this will probably work itself out differently in different cities, and that the general conclusion will be favorable to the belt driven generator and horizontal releasing valve gear engine, to be compounded wherever condensing is possible.

Yours truly,
LANE & BODLEY COMPANY.

WM. P. CRAIG.

EAST ORANGE, N. J., December 14, 1893.

DEAR SIRS:—The past season has not been a profitable one for me, but have held my end up, and have no fault to find. I completed the Newark end of the consolidated road running to Jersey City last week, and it is partly in operation now, and probably will be running regularly by January 1, 1894. I am now rebuilding the Suburban road in Orange; the trolley will be buzzing over that road between South Orange, Bloomfield, Montclair, Eagle Rock, East Orange and elsewhere by early spring. My little road in Palatka, Fla., is booming, and if any of your representatives give us a call during the winter, they will find the writer on hand to treat them in good Southern style. There is one thing that cannot be said of us down there, that we have not plenty of sand. Yours truly,

WM. P. CRAIG.

THE PHOENIX IRON WORKS COMPANY.

CLEVELAND, O., December 18, 1893.

GENTLEMEN:—We wish to say that our business is very good at present and that the outlook for 1894 is very encouraging indeed, unusually so, we think. Among the contracts we have just closed are the following important ones: Two fifteen ton hand power cranes for the St. Louis Water Works, of St. Louis, Mo., and seven large steam cranes for Akron Steam Forge Company, of Elwood, Ind. Street railway managers have found out that their power stations are not complete without a traveling crane, which accounts for the increasing demand. Our traveler, for which a patent has been applied for, has shown its superiority over other cranes for power house work.

Very truly yours,
THE PHOENIX IRON WORKS COMPANY,
L. C. SHIPHERD, Sectretary and Treasurer.

WOODBRIDGE & TURNER ENGINEERING COMPANY.

NEW YORK, December 22, 1893.

GENTLEMEN:—Our business in electric street railway construction for the season now drawing to a close has been large and very satisfactory to us. Among our larger contracts may be mentioned the overhead line construction for all the Providence street railways, line construction for the Union Railroad, of Chester, the track and line construction for the Brigantine Transit Company, Brigantine, N. J., and the track and line construction for the Chester, Darby & Philadelphia Railway. We are prepared to handle an increasing amount of business the coming year, and expect to do so if the financial skies will but brighten with the coming of the spring.

Yours truly,
WOODBRIDGE & TURNER ENGINEERING COMPANY,
WM. S. TURNER, President.

THE NEW HAVEN CAR REGISTER COMPANY.

NEW HAVEN, Conn., December, 28, 1893,

GENTLEMEN:—The growth and advancement of our business during the past year has been very gratifying, and the fact of our receiving the highest and only medal and diploma awarded on stationary fare registers at the World's Fair is, of course, very satisfactory and a great advertisement for us. Our registers are constantly becoming more widely known and appreciated, and we have recently completed large orders for export, and closed contracts with some of the largest street railway syndicates in the world, and we expect the coming year to do a largely increased business, not only at home but abroad, in all countries in which street railways exist.

Very truly yours,
THE NEW HAVEN CAR REGISTER COMPANY,
JOHN S. BRADLEY, Secretary.

THE BILLINGS & SPENCER COMPANY.

HARTFORD, CONN., December 15, 1893.

GENTLEMEN:—The principal dealings we have with the street railway trade are confined to the sales of our drop forged, pure copper commutator bars, and up to August 1, we were filling large and frequent orders from the street railways for this material. The subsequent falling off we suppose has been entirely due to the general financial stringency. We have lately received some very large orders for these goods, mostly from manufacturers of street railway motors, which make us hope for a return to a more healthy state of affairs than has been prevailing for the past two months.

We believe that the country still lives, and have increased our facilities by new buildings and new machinery, with the expectation of better times. We have a first class article in our patent commutator bars and never lose a customer who has given them a trial.

Yours respectfully,
THE BILLINGS & SPENCER COMPANY.
F. C. BILLINGS, Superintendent.

THE C & C ELECTRIC COMPANY.

NEW YORK, December 13, 1893.

GENTLEMEN:—Our company has recently been reorganized with a view of extending our business, and we have secured large works, which we at present are having fitted up for our use, at Garwood, N. J., and into which we expect to move during February and March. Our object in taking these works is to extend our business into a line of apparatus, from which, on account of our cramped quarters at present, we have been prevented manufacturing. We contemplate making a line of direct connected and belted multipolar generators, and hope in the near future to undertake the manufacture of street railway apparatus; this latter plan, however, is one depending upon the course of business within the next six months.

In regard to the amount of business, we can only say that, as you will know, business has been very much restricted within the last six months, although we feel that we have certainly held our own in comparison with the previous year's record, and that in the spring, with our largely increased facilities, we will do a much larger business than formerly.

Very truly yours,
THE C & C ELECTRIC COMPANY.
A. MITCHELL HALL, General Manager.

THE JEFFREY MANUFACTURING COMPANY.

COLUMBUS, O., December 18, 1893.

DEAR SIRS:—Referring to our business with the street railway people, I would state that while we do not deal directly, to any great extent, with the street railroad companies, we sell largely to the manufacturers of motors, cars and such, material used by the railroad companies. Our sale of drive chain for this class of work has been very good in the past year, notwithstanding the stringency, and it is safe to say that our sales have exceeded those of the previous year by at least 25 per cent. We believe this is due entirely to the high class of drive chain that we manufacture. We do not hesitate to claim that our steel drive chains are superior to any made, while our standard line of malleable chains is equal to any for the transmission of power for general elevating and conveying work.

Yours respectfully,
C. W. MILLER, Secretary.

THE LITHOGRAPH STREET CAR TICKET COMPANY.

CLEVELAND, O., December 16, 1893.

GENTLEMEN:—Though we have just got our business fairly established, having only been operating since September 1, we have in this short time received many orders from the street railway companies in the United States both for lithographed, printed, aluminum and rubber tickets. Making a specialty of this class of business, as we do, our facilities are such that we can produce the very best class of work in any quantity at the lowest prices. The coming year will see our company an incorporated one, and our whole attention will be given to the street railway trade of making tickets, bonds, stock certificates, commercial and color work. If the past four months is any criterion to go by the coming year will certainly be a good one. We are always glad to give any information in regard to the way we run tickets and keep them from being counterfeited.

Yours very truly,
THE LITHOGRAPH STREET CAR TICKET COMPANY,
E. RETTBERG, Secretary.

YOUNG LOCK NUT COMPANY.

DECEMBER 18, 1893.

GENTLEMEN:—Although our company, organized only last spring, started in the face of unusual business depression to introduce a nut lock opposed in every way to the old idea of a spring washer, still it has reason to feel more than satisfied with the result of its six months' work. Endorsed by some of the ablest engineers in the United States, such as Col. H. G. Prout, of the *Railroad Gazette*, A. M. Wellington, C. E., of the *Engineering News* and M. N. Forney, C. E., of the *Engineering Journal*, as well as men more closely indentified with active railway construction, the Young lock nut has proved itself by actual test in every way worthy of the favorable comments it has received. Devoid of all the weak and injurious features of the spring washers, and depending on a never failing natural law for its efficiency, the Young lock nut has proved that it cannot be overlooked by any railroad which has the economical maintenance of its system at heart. Not only with the steam railroads but even more so, if possible, with street railways has this lock proved its efficiency and economy. It has been adopted by some of the best railways, both steam and electric, in the country, and is the only one used by the Manhattan Elevated Railway Company, of New York. The future success of the company, we believe, seems only limited by the requirements of the country.

Yours truly,
YOUNG LOCK NUT COMPANY.

RELIABLE MANUFACTURING COMPANY.

BOSTON, MASS., December 23, 1893.

GENTLEMEN:—The Reliable Manufacturing Company, of Boston, has just completed a contract with the Brooklyn Heights Railroad Company, Brooklyn, N. Y., for the equipment of 210 cars with the Reliable sand boxes. This street railway company has now 500 cars all equipped, and with the sand box, and this last order makes 710 cars on this road equipped with the Reliable sand box. This, we think, is an excellent testimonial to the superiorty of this box over all others, together with the fact that several hundred other street railways are using this sand box with satisfaction.

This company increased its business 50 per cent. during the year of 1893, and with the contracts now on hand, and others about to be closed has bright prospects for the future. The business outlook for the year 1894 warrants the belief that this year's business will be 50 per cent. more than 1893.

During the year the company has manufactured several new appliances for electric street cars, the principal one being the Cochrane electric heater, for which a patent has been granted. We are now busy receiving and filling orders for this heater which gives satisfaction wherever used, becauses it heats the cars, pleases the passengers and makes money for the stockholders.

The trolley wheels manufactured by this company are having a large sale, as well as the trolley heads made both in malleable iron and brass. The Collett ratchet brake handle is one of the appliances that always find a ready sale the year round.

Yours truly,
RELIABLE MANUFACTURING COMPANY.

J. G. BRILL COMPANY.

PHILADELPHIA, PA., December 15, 1893.

DEAR SIRS:—This year, closing with us December 31, has been a remarkably busy one. We will have furnished by that time about 1,400 cars and 2,500 trucks. From a street car building standpoint, the work this year has been good in some ways, orders of considerable magnitude having been placed, but the business has been most troublesome in its financial aspect from the fact that new enterprises in street railways are invariably carried out on proceeds of bond sales, and since July 1, 1893, such sales have ceased practically. In our opinion, the outlook for 1894, excepting for the uncertainty as to the money condition of the country, is fairly promising. There are, as you know, a great many projected roads in the country, the construction of which is dependent upon the money market. These particular roads are, of course, at the present time held back, but when affairs brighten up there will be a good deal of work to be scrambled for by the lusty and already overgrown fraternity of car builders.

Yours very truly,
J. G. BRILL COMPANY.

FROST VENEER SEATING COMPANY.

NEW YORK, December 20, 1893.

DEAR SIR:—We are pleased to say that we have exceeded our last year's trade by about 15 per cent. This, in times such as we are now passing through, we think flattering. This excessive business we attribute largely to the change of the street car system from the old time horse power to electric and cable cars.

The history of our business shows a steady growth, and we feel absolute faith in our ability to make 1894 show better than the year just closing. Should there be a recovery from the present depression, we shall make 1894 the best year in our history. We are now having a large export trade, which comes in very good during these dull times. Our factories—East and West—are in a position to turn out work better and faster than heretofore, with our increased facilities. The opening of the spring we fix as about the earliest time that we shall really see a bright outlook for the country, and also as the time for still greater changes in the street car system.

Very respectfully,
FROST VENEER SEATING COMPANY.
W. P. SEGUINE, Manager Railroad Department.

E. F. DEWITT & COMPANY.

LANSINGBURGH, N. Y., December, 23, 1893.

GENTLEMEN:—We take pleasure in reporting that we have met with great success during the past year in the introduction of our sand box for street car service. The principles of this box are well known to your readers through illustrations and articles which you have published concerning it. It is only about a year since the prinple of the box was devised, and the patent which covers the box was only ten months old on December 7, 1893. From this it will be readily seen that, considering the short time the box has been on the market, its success has been remarkable. We have had orders from street railway companies in the following cities; Burlington, Vt.; Syracuse, N. Y.; Gloversville, N. Y.; New Haven Conn. (the Street Railway Company); New York (Broadway Cable Railway); Steinway, New York; Bangor, Pa., and Baltimore (the Lake Roland Elevated Railway). In addition to these the sand box is in use on a number of other roads from which orders are expected soon. On the Gloversville Railway the cars run over a four mile grade, giving a good opportunity for a thorough testing of the box, and the satisfaction given on this road is a good evidence of the success attained by it.

Yours truly,
E. F. DEWITT & COMPANY.

THE COMPLETE ELECTRIC CONSTRUCTION COMPANY.

NEW YORK, December 16, 1893.

GENTLEMEN:—We take pleasure in availing ourselves of the opportunity which you extend to us in furnishing you data relating to our business. We are prepared, and have been for the past five years, to take contracts to build and equip complete both electric and steam railroads; also, the complete construction and equipment of electric light plants.

Our last year's business consisted of the following electric railroads: St. Clair Street line, Cleveland, O., six miles double track, ninety pound girder rail, with overhead construction complete; Norristown Passenger Railway, Norristown, Pa., four miles single track and turnouts, including roadbed, overhead construction, power house and plant complete; Mobile & Spring Hill Railroad, Mobile, Ala., seven miles single track, including entire equipment, except the steam plant; Camden, Gloucester & Woodbury Railway, New Jersey, five miles double track and five miles single track, overhead construction, car equipments, motors, generators and engines all complete, besides two electric light plants and several isolated plants in large buildings.

Our gross business of last year amounted to $925,000. The outlook for business in 1894, we think, far exceeds our business of 1893. We have estimates in now for 1894 business aggregating some $310,000, and are estimating every day on new contracts. We believe that the year 1894 will be a "banner" year, especially for the electric railroad construction.

Very respectfully,
THE COMPLETE ELECTRIC CONSTRUCTION COMPANY,
JOHN A. SEELY, General Manager.

PEPPER & REGISTER.

PHILADELPHIA, PA., December 19, 1893.

DEAR SIRS:—In relation to the amount of work which we have under way, we would state that at the present time we have the contract for the overhead construction work of the Philadelphia Traction Company, which amounts to over 136 miles, and we have just closed the contract for the Electric Traction Company, of Philadelphia, whose line is about 124 miles in length. This will give us a large amount of work in our own city which will not be completed for a couple of years to come. We are also glad to announce that we have quite a nice contract in Lynchburgh, Va., the building of an electric railway there, including laying of tracks, paving streets, steam plant and overhead construction.

We have recently, in connection with our business, taken the agency for the J. H. McEwen Manufacturing Company, of Ridgway, Pa., manufacturers of high grade automatic engines, and we are pushing the sale of the engine in this locality.

We regard the outlook as very favorable in the street railway line, as idle capital in this locality is seeking investment now while material and labor are cheap.

Very truly yours,
PEPPER & REGISTER.

THE KEASBEY & MATTISON COMPANY.

54 WARREN STREET, NEW YORK, December 13, 1893.

GENTLEMEN:—Each year since we started the manufacture of Magnesia coverings we have increased our plant, and have made a larger stock during the past summer and fall than the year before, This year the plant and store are, as usual, increased, and very much increased. We have never shipped from our factory as much covering as we are shipping at this time. Our output was never as large. This, considering the alleged dullness of times, we think, is a pretty good showing. During the summer and fall, we have performed work at the following railway stations: Brooklyn Heights Railroad Company: 52d Street station, South Brooklyn; Kent Avenue station, Brooklyn; Ridgewood Station; Smith and 9th Streets station, Brooklyn. Broadway cable road: Houston Street station; 51st Street station. Third Avenue cable road: Bayard Street Station; 65th Street station. Utica Belt Line road, Utica, N. Y. Olean Street Railway, Olean, N. Y. Buffalo Street Railway, Buffalo. N. Y. Consulting engineers, architects and business men generally throughout the state, have been giving us more trade direct, that is, without an investigation, than ever before, showing that "Magnesia" has made such a name for itself that comparisons are odious.

Yours very truly,
ROBERT A. KEASBEY.

CHARLES MUNSON BELTING COMPANY.

CHICAGO, ILL., December 14, 1893.

GENTLEMEN.—Our business, considering the times we have had this year, has been very good. In fact, it has been beyond our anticipations. We have reason to believe that we have had a better trade than any other manufacturer in our line of business. We have gained a great many new customers, which is probably due to the company's changing hands, and business being conducted in a more satisfactory way to our customers. But the main advantage that we can see in our trade this year has been on account of the quality of the leather. The Munson Eagle belt is fast gaining a reputation as being a superior belt to any other upon the market, and those who have used the Munson belt say that they notice a saving in their belt account. People do not have trouble in taking up their belts on account of slack; the belts transmit full horse power.

We have made preparations in the past thirty days to lay in a large stock of Eagle belting to meet the increased trade which we anticipate at the first of the year. This company has always been exceedingly busy from January until May. It can guarantee its customers prompt shipment upon receipt of orders, as it has increased its facilities for turning out leather belting.

Yours respectfully,
CHARLES MUNSON BELTING COMPANY,
W. C. GROETZINGER, General Manager.

RAILWAY EQUIPMENT COMPANY.

CHICAGO, ILL., December 14, 1893.

GENTLEMEN:—Concerning our business since January 1, we beg to state that up to a few months since we had a very large increase of business. Being particularly fortunate in having a superior line of overhead material, we were able to secure a very large number of the best contracts in different parts of the country as well as Canada.

Confining our business strictly to the manufacture and sale of electric street railway supplies, and carrying in stock everything in this line, our supply business had a steady increase. The financial troubles of the last few months have interfered very seriously with business, and a large number of contracts which were about to be closed were, of necessity, put over until next season.

Our line of customers has really increased during the last few months, but roads in all parts of the country are buying only absolute necessities, which reduces the volume of business very materially. On account of the large amount of business done early in the year, our business for 1893 will compare very favorably with former years.

Concerning the outlook for next year, we consider it very encouraging, and we are already figuring on a great deal of business which will undoubtedly be given out during the early part of next season.

Wishing the JOURNAL continued prosperity, and a happy new year, we are, Very truly yours,
RAILWAY EQUIPMENT COMPANY,
W. R. MASON, General Manager.

FITCHBURG STEAM ENGINE COMPANY.

Fitchburg, Mass., December 15, 1893.

Gentlemen:—We can hardly give any interesting details as to our business except that from September to September. This was about 30 per cent. larger than it had been any previous year, and has tended to larger sizes of engines, many of them for electric light and electric power purposes from 600 H. P. down. Our business has also shown a decided increase in the number of compound condensing engines used. We have been able to keep our full force busy full time up to the present date, although it is harder to obtain business, and prices are somewhat lower. We can hardly tell what the outlook is for 1894, the political aspect of affairs having a very decided effect upon those whom we see as prospective purchasers. The uncertainty in this direction affects us as well as them.

We recently received a letter from Mr. T. J. Fillebrowne, chief engineer of the Hoosac Valley Electric Railway Company, showing his opinion of our engines in street railway work, as follows: "The engines at railway plant are running splendidly. I cannot conceive of a better engine for a power station than the tandem compound. We cannot tell from any appearance of engine whether we are using 200 H. P. or the cars are all standing still. The speed is unchanged and that is all there is about it."

We have many engines in such work.

Yours very truly,
Fitchburg Steam Engine Company,
F. Fosdick, President.

HARRISBURG FOUNDRY & MACHINE COMPANY.

Harrisburg, December 21, 1893.

Gentlemen:—The street railway work installed by us recently consists of two 200 H. P. Ideal tandem compound engines for the Wilkesbarre & Wyoming Valley Traction Company, Wilkesbarre, Pa., including a complete power plant, boilers, etc. We are now duplicating this plant with the Wilkesbarre & Wyoming Valley Traction Company, consisting of two more 300 H. P. Ideal tandem compound engines, with boilers complete, delivered and erected, and expect to have the same running by the 1st of January.

We have also equipped the Citizens' Electric Railway (Steelton, Pa.) power plant with engines and boilers and all appurtenances, consisting of one 300 H. P. Ideal tandem compound engine, and two Ideal tandem compound engines of 150 H. P. each.

We have sold through W. R. Fleming & Company two 300 H. P. Ideal tandem compound engines for Montreal, Can., and two 250 H. P. each for New Bedford & Fairhaven Traction Company, New Bedford, Mass. Also two 300 H. P. for Bridgeport, Conn.; two 150 H. P. Ideal tandem compounds for the Owensboro Street Railway Company, Ky.; one 50 H. P. for Oil City Electric Railway and Hanover, Pa. The above are exclusively for electric railway service.

We have also installed a large number of electric light plants: Two 300 H. P., tandem compound engines at Irwin, Pa.; two 300 H. P., tandem compound engines for the Maryland Electric Company, of Baltimore; also one 300 H. P. for Taunton, Mass., and a large number of direct connected electric light engines of various sizes.

Yours respectfully,
Harrisburg Foundry & Machine Works,
M. E. Hershey, General Manager.

DAVIS CAR SHADE COMPANY.

Portland, Me., December 13, 1893.

Gentlemen—We are pleased to state that we have had a very satisfactory year, notwithstanding the general depression in business circles which has prevailed for the past few months. Our automatic shades have been indorsed by a large number of the leading railroads of the country, and are now in service on a large number of roads, including some of the largest systems in this country.

While we make a specialty of our patent automatic shades, yet we also manufacture all kinds of cloth rolling shades for cars, besides doing repairs. While we now have facilities for making all kinds of cloth rolling shades which are not surpassed by any concern in the country, our business is increasing so rapidly that we find it necessary to increase our capacity, and are now making preparations to this end. We have recently received several large contracts for the Davis automatic shades for spring delivery, and it gives us pleasure to state that the outlook for the coming year is encouraging in our line.

We have not issued any catalogues since early in the year, but are now preparing one which we expect will be ready for distribution early in January. It will be on a more elaborate scale than the last ones.

We have not only been successful the past year in interesting many roads which have never used automatic shades, but have found little difficulty in securing contracts from those which have tested the merits of other similar devices. The need of a desirable covering for car windows has long been felt, and prior to the introduction of automatic shades, nothing which seemed to fill the bill was obtainable. Slatted blinds have always been a nuisance, and the ordinary cloth rolling shades without any holding device, which have been used to some extent, were little improvement.

Automatic shades for railway and street cars are rapidly coming into favor, and nearly all new equipment is fitted with them. In our opinion it is only a matter of a short time when all other kinds of car window coverings will be things of the past.

Yours respectfully,
Davis Car Shade Company.
E. E. Piper, Treasurer and General Manager.

THE EDWARD P. ALLIS COMPANY.

Milwaukee, December 20, 1893.

Gentlemen:—We give below a list showing what we have done in the way of installing power in street railway service during this year, and some orders now being completed:

Brooklyn City Railroad Company, Brooklyn, N. Y., four 32 and 62 × 60 ins. and six 26 and 48 × 48 ins. compound condensing Baltimore City Passenger Railway Company, Baltimore, Md., three 30 × 60 ins. compound condensing. Cass Avenue & Fair Grounds Railway, St. Louis, Mo., three 34 × 60 and one 18 × 36 ins., compound condensing. People's Traction Company, Philadelphia, Pa., three pair of tandem compound condensing, 24 and 48 × 60 ins. Duluth Street Railway Company, Duluth, Minn., one pair of 26 × 60 ins. compound condensing. Central Railway Company, Peoria, Ill., one 26 × 48 ins. compound condensing. Valley Springs Railway Company, Memphis, Tenn., one 26 × 48 ins. compound condensing. Citizens' Passenger Railway Company, Indianapolis, Ind., three 22 and 42 × 48 ins., compound condensing. Louisville, Railway Company, Louisville, Ky., two 24 and 44 × 48 ins. compound condensing. Anderson Electric Street Railway Company, Anderson, Ind., two 22 × 48 ins. compound condensing. Southern Electric Railway Company, St. Louis, Mo., two 22 × 42 ins. compound condensing. La Crosse City Railway Company, La Crosse, Wis., one 18 × 42 ins. condensing. Con. Traction Company, Jersey City, N. J., three 16 and 32 × 42 ins. and one 19 and 36 × 48 ins. compound condensing.

In a general way the demand for more power in the street railway line has suffered quite as seriously as in the general manufacturing interests. Regarding the prospect for the coming year, we are unable, during these good Democratic times, to give any reliable forecast,

Yours truly,
The Edward P. Allis Company.

J. H. BICKFORD,

CONSULTING AND CONSTRUCTING ELECTRICAL ENGINEER.

Salem, Mass., December 14, 1893.

Gentlemen:—My business for the last year comprised the designing of all and supervision of erection, except in two instances, of the following buildings and equipments for the roads named: Complete power station buildings and machinery, ultimate capacity 3,000 H. P., for Scranton Traction Company, Scranton, Pa.; one brick and iron car house, capacity fifty cars, for Scranton Traction Company, Scranton, Pa.; one brick and iron car house, capacity fifty-five cars, for Reading Traction Company, Reading, Pa.; one brick and wood car house, capacity twenty cars, for Reading Traction Company, Reading, Pa.; twenty-three miles of overhead trolley lines complete, for Reading Traction Company, Reading, Pa.; complete power station buildings and machinery, ultimate capacity 3 000 H. P., for Steinway Railway Company, Long Island City, N. Y.; complete power station buildings and machinery, ultimate capacity 2,500 H. P., for North Shore Traction Company, Salem, Mass.; one brick and iron car house, capacity 100 cars, for the Lynn & Boston Railroad Company, Lynn, Mass.; 700 H. P. additional equipment to Chelsea station of the Lynn & Boston Railroad Company; 700 H. P. additional equipment to Lynn station of the Lynn & Boston Railroad Company; power station buildings and general outline of machinery, of 300 H. P. capacity, for Northampton Street Railway Company, Northampton, Mass; power station buildings alone, for Alton Street Railway Company, Alton, Ill.

The prospects for business for the coming year appear well, provided promoters of enterprises can get money to float them. We already have in hand several schemes which will probably materialize sooner or later.

Yours truly,
J. H. Bickford.

VALENTINE & COMPANY.

New York, December 18, 1893.

Gentlemen:—Our business during the last year has been most prosperous. Early this year it became necessary to increase our storage capacity for varnish. The alterations have but just been completed, and now the largest of our several tank rooms has a capacity of 145,000 gals. Two other tank rooms have a capacity of 74,000 gals., giving a total for these three rooms alone of 219,000 gals., and this is exclusive of the varnish in the factory proper and stocks carried at our warehouses in Chicago, Boston and Paris, and in the hands of our regular agents. Thus it is that this company is enabled to hold an enormous stock of varnish for the purpose of ripening and maturing.

We have just received from our Canadian representatives some figures respecting the varnishes and colors used upon the vehicles shown at the exhibition recently held in Toronto, Can., which are highly gratifying and in line with our previous triumphs over foreign manufacturers. 291 vehicles of all kinds were there exhibited, ranging from broughams, landaus, landaulets, buggies, etc., down to sleighs and cutters. The exhibits included 42 different variety of vehicles, buggies and dog carts predominating; and of the above 291 vehicles, 161 were finished with Valentine's varnish, 69 with varnish of English manufacture, the remainder (used on a cheaper class of work) being Canadian. It is said that there was only one other American manufacturer of varnishes represented, and that upon one vehicle only out of the 291. Our superfine colors were only second to our varnishes in the record made at this exhibition. Only 260 of the 291 exhibits were painted, and on 98 of this number Valentine's superfine japan colors were used.

Yours truly,
Valentine & Company.

THE LEWIS & FOWLER MANUFACTURING COMPANY.

BROOKLYN, N. Y., December 20, 1893.

DEAR SIRS:—Replying to your inquiry of recent date requesting a synopsis of our company's commercial experiences for the year just ending, we have to state that we have not in the past taken up this subject for publication purposes, but inasmuch as the object the JOURNAL has in view is commendable, and will doubtless prove interesting reading to a large number of your subscribers, we herewith submit a general resumé of our business for the year 1893.

In entering upon the year 1893 we felt, at the very start, the impetus given to car manufacturers and railroad supply people by the general change all over the country from horse traction to electric power, and almost without cessation we have been obliged to work our shops overtime in order to make stipulated deliveries promptly; this has been the rule rather than the exception up to the present time, and the outlook for the year 1894 is even more promising, aside from the orders already received and which insures continued activity throughout the coming year; our inquiries, together with specifications and estimates already submitted is, we consider, proof positive that 1894 will eclipse all previous years' business results with our company.

We realized during the past year that there were several necessary changes to be made in our shops in order to facilitate prompt deliveries, and which we proposed to make a special feature, and with this idea in view we started in to reorganize the shops throughout with a good and efficient system, which we have accomplished after much labor.

We have secured the services of a new superintendent, who is well known as a practical car builder, and have also new foremen in all our various departments, and our staff of employes is composed of the best mechanical and skilled labor that can be procured.

It is a source of considerable gratification to be able to submit such a favorable condition of affairs when we take into consideration the continuous spell of financial depression the whole country has passed through.

Yours, very truly,
G. W. MYERS, Secretary.

THE CUTTER ELECTRICAL MANUFACTURING COMPANY.

PHILADELPHIA, PA., December 20, 1893.

GENTLEMEN:—From the date of its organization and up to the commencement of the year 1893, the efforts of this company had been in the direction of producing a line of special switches, shades, cut-outs and the like, adapted to incandescent lighting, aud we had given no attention to the street railway needs. However, about the beginning of the year we turned our attention in this direction and, as a first effort to supply a want in this field, we have devised an automatic magnetic cut-out of unique design and extended scope. It is eminently adapted to street car work, as it will locate a ground or short circuit to the car in which it occurs, and will stop that car only, without disturbing the main magnetic cut-out at the power station. It may be adjusted and set to open at any predetermined overload, and will also open safely upon the occurrence of a dead short circuit with all the force of the power station dynamos behind it.

This device was first presented to the notice of the trade at the annual convention in Milwaukee, and it received the most flattering attention from all in interest. This attention has since been supplemented by inquiry and correspondence to an extent that promises a very successful trade in the immediate future. Already we have found it necessary to extend our factory in order to be able to supply all demands promptly.

It is our intention to produce other devices in the street car field, and we already have several in process of development. Our quadruple break switch, which we have been manufacturing for some time, is particularly designed to operate incandescent lights on a 500 volt circuit. These switches have long been in successful operation in other fields, and the street car people are beginning to substantially appreciate their merits.

We would say that the prospects for this company in the street railway field for the coming year are excellent.

Very truly yours,
LUCIUS T. STANLEY.

DETROIT ELECTRICAL WORKS.

DETROIT, MICH, December 20, 1893.

GENTLEMEN:—The railway business of the Detroit Electrical Works for 1892 and 1893 is shown by comparison as follows: 1892, total horse power of generators and motors sold, 5,508; 1893, tota. horse power of generators and motors sold, 3,576.

Among our orders closed during 1893 were the following: Detroit Citizens' Street Railway Company, Detroit, Mich., fifth, sixth and seventh orders, comprising 760 H. P. of motors; Calumet Electric Street Railway Company, Chicago, Ill., eighth and ninth orders, 480 H. P. of motors, and 1,064 H. P. of generators; Atlanta City Street Railway Company, Atlanta, Ga., first, second and third orders, comprising 280 H. P. of motors, and 212 H. P. of generators; Belle City Street Railway Company, Racine, Wis., 180 H. P. of motors, and 600 H. P. of generators. The first and latter two orders include spring supported, single reduction railway equipments.

The stationary motors and lighting station business is shown as follows: 1892, stationary motors aggregating 372 H. P.; 1893, stationary motors aggregating 550 H. P.

The sales in the telephone, telegraph and merchandise department show about even for the two years, being a little more in 1893 than in 1892.

The gross business of 1893 compared with 1892 shows a net falling off of 45 per cent., excluding for 1893, of course, the amount represented by orders carried over to 1894.

As a beginning for 1894 the company is carrying over from this year to next orders for railway apparatus as follows: Double reduction equipments, 150 H. P.; generators, 376 H. P.; spring supported, single reduction equipments, 1,150 H. P.; total, 1,676 H. P.

It seems quite probable that, inasmuch as there is now plenty of money idle in the banks, it will, at a not very distant date, begin to seek investment; but no doubt, investments, to be attractive in future, must, as a rule, have fewer elements of a speculative quality than heretofore. Again, the consumption now, while perhaps restricted to less than what has been the normal for several years past, is still going on, with the natural result, that manufacture must again be resumed when supplies are exhausted.

These two positive elements would seem to control the future more effectively than hopes or fears. The prospects for 1894 are not extremely difficult to analyze. Individuals and concerns are using up fully what they need to consume, the consumption is reduced to a minimum, money is plentiful and will seek good investments at no very late date, and everybody is very well contented to take a rest for a while with what they have of their own. Therefore, as soon as the consumption is ahead of the supply, good needs for money will arise, and everybody will get up and start ahead once more, keeping, perhaps, to narrower paths than heretofore, at least until the experience of 1893 is forgotten in the rush for a dollar.

Yours truly,
L. WARFIELD.

Business of the Westinghouse Electric & Manufacturing Company.

While the year 1893 has been remarkable as a period of great depression in the financial and industrial conditions of the country, there have been a few industrial establishments upon which the general conditions did not have the same effect as upon others. Among these the Westinghouse Electric & Manufacturing Company may be justly mentioned as one of the fortunate few, and the company has just closed a year of successful and profitable business.

Of course, it must not be forgotten that the company's standing in the business world, and the reputation of the Westinghouse apparatus is such that whatever business there is in the electrical industry the Westinghouse Company undoubtedly gets its own share of it. Hence it is not astonishing that many of the largest and most profitable contracts of the year were filled by that company.

In the lighting business the contract for illuminating the World's Fair was given to the Westinghouse Company, and here a record was made which has never been equaled in the world. The company furnished machinery for six months for 84,000 lights, for which the Columbian Exposition Company paid upward of $500,000. The work was done to the greatest satisfaction of all parties, and during the entire period of the Fair, not once was there fault found with the apparatus or with the service it gave. Since the closing of the Exposition, the Westinghouse Company has taken back the entire plant, and the total capacity of apparatus, twelve 10,000 16 C. P. light dynamos, has been sold to different central station plants throughout the country. Another large contract for central station Westinghouse alternating current, electric lighting apparatus the company obtained from the Louisville Gas Company. Besides this work, Westinghouse alternating current and direct current lighting and power apparatus was installed in a number of new central stations and isolated plants.

The business of long distance transmission of power has been greatly developed, and, owing to the enviable position the company occupies in this respect by the control of the Tesla polyphase system, that branch of the electrical industry is practically entirely in the hands of the Westinghouse Company. That it is the only commercially practical system of economically efficient transmission of power cannot be better emphasized than by the fact that the Cataract Construction Company awarded the Westinghouse Company the contract for transmitting electrically the power of Niagara Falls. The importance of this is very great, when it is remembered that the entire electrical world had been bidding to obtain this work.

However largely the Westinghouse Company has been occupied in the production of general electrical work, the manufacture of railway apparatus has constituted the major portion of the business of last year. The Westinghouse electric railway apparatus is now accepted as standard throughout the country, and the best evidence as to what the users think of it is that wherever that apparatus has been installed it has never been thrown out or replaced by another system. The railroad manager realizes its advantages in the substantiality and durability of construction and ease of operation, while the investor appreciates its efficiency and cheapness of operation, which assures profits and dividends.

During the last year the company was engaged in filling the large unfinished orders for the Philadelphia Traction Company, which called for 600 single reduction motors. Even the last week of 1893, this company ordered of the Westinghouse Company, power station apparatus for a capacity of 11,250 H. P., consisting of six 1,500 H. P. and three 750 H. P. generators. All of these machines will be direct connected. In addition, the orders for the Chicago City Railroad Company and the South Chicago Passenger Railway Company were also completed, and they commenced operation about the time the World's Fair opened. The record of these roads during the busy period of the Exposition was phenomenal. The Lindell Street Railway Company, of St. Louis, also had its lines equipped with Westinghouse apparatus, and the lines of the Atlantic Avenue road, in Brooklyn, were also com leted.

In spite of the large amount of unfinished contracts, the Westinghouse electric railway system was installed in all the larger cities of the Union, as well as in Canada.

The Business of the General Electric Company.

The progress made during the past year by the General Electric Company, both in the development of new and improved railway apparatus and in the amount of railway business done, marks more than ordinarily the character of the company. Despite the depressed condition of the whole business field, we learn that the number of orders received differ by but a few from those of so called good years, and while the amount of apparatus shipped is not so great, in diversity and improvement it has fully come up to expectations.

The list of new apparatus which it has brought out is surprisingly long, and as each device has proved a marked advance, so has it proved a marked success, so much so, indeed, that the orders for the new apparatus have come in in sufficient numbers to cause a sentiment of gratification to pervade the whole railway department. Foremost among the new devices is, of course, the new motor, known familiarly as the G, E. 800. This was shown in operation at the Street Railway Convention at Milwaukee, and each of its superior features was investigated and commended by all the members of the fraternity present. The G. E. 800 is and has been operating on a great number of roads, and in each and every instance has proved so successful as to elicit spontaneous letters of commendation from the managers, dwelling in particular upon its extreme lightness, its efficiency (qualities gained without sacrifice of either mechanical strength or electrical power) and general superiority over other motors which they had previously been using. The G. E. 800 is now in use in large numbers on the lines of the Denver Tramway Company; the Pittsburgh, Allegheny & Manchester Traction Company, of Allegheny, Pa.; the Cincinnati Street Railway Company; the Brooklyn City Railroad; the Union Railroad, of Providence; the East Cleveland Railway; the State Street Railroad, of New Haven, Conn.; the Buffalo Railway; the Union Depot Company, of St. Louis; the Trenton Passenger Railway Company; the Worcester Traction Company; the Reading Traction Company; the City & Suburban Railway Company, of Baltimore Md.; the Pacific Improvement Company and Pasadena Railway, both of San Francisco, and on many other lines throughout the United States.

The necessity for a more perfect controlling device called into existence the type K controller, from which every objectionable feature, noticed in preceding controllers, has been carefully eliminated. The type K, series parallel controller is perhaps the most compact and comprehensive controller now in use. In conjunction with the G. E. 800 motor, it forms an economical combination which it would be difficult to rival in the field of car operation, and its appreciation by railway men has been both high and extensive.

The activity of the engineering force of the General Electric Company, has, however, by no means been confined to the motor and controller. The requirements of the Intramural Railway at the World's Fair necessitated the creation of new apparatus to meet them. The successful operation of this road, which we have described in full, was, perhaps, the most striking feature of the Exposition. Millions of passengers were carried without either a hitch in the regularity of the service, or an accident to any person. The motors used, known as the L. W. P. 20, were built especially for this service, and four, with an aggregate of 533 rated horse power, were mounted on each motor car, drawing four trailers. They were regulated and controlled by the special series parallel controllers operated pneumatically. The cars were operated by direct coupled generators, and these were among the earliest slow speed generators used for railway service in this country. One in particular, the 750 K. W., was found to be sufficient to the entire operation of the road under ordinary conditions. In times of heavy travel, however, power was supplied from the great 1,500 K. W., direct coupled generator, which was at that time the largest electrical generator in the world. Its success has caused its duplication both in Brooklyn and Philadelphia. A circuit breaker was used in connection with this machine, that proved itself capable of interrupting a circuit of 10,000 amperes.

In addition to the direct coupled generators just mentioned, four of other sizes have been built. They are all of the multipolar type, have iron clad armatures, are of great mechanical strength, highest electrical efficiency, and perfect ventilation. The armatures are so constructed that any good electrical mechanic can readily inspect and repair any part of the armature winding without disturbing any other part.

In order to make the road equipment complete, and keep everything up to the standard of the generators, motors and controllers, the overhead devices were in great measure redesigned, and a new insulation, known as the L compound, introduced. The introduction of this new moulded insulating material and its success have evidently justified the steps taken.

There has also been a very large demand for the new panel switchboards which are confessed to be both simple and perfect, carrying all the measuring and indicating apparatus necessary, and, especially, the new automatic circuit breaker with electrical reset.

We must not omit mention of the thirty-ton electrical locomotive. Its appearance is an event hardly less important than that of the first steam engine. It was the first electrical locomotive in the world, and proved the feasibility of the operation of the steam road by electricity. At the World's Fair it was the center of attraction of every steam railroad man.

Among the most important orders and shipments of direct coupled generators received and made by the General Electric Company may be mentioned six of 1,500 K. W. to the Brooklyn City Railroad, two of which are in operation, three of 1,500 K. W. to the People's Traction Company, of Philadelphia; three of 730 K. W. to the Cass Avenue & Fair Grounds Railway, of St. Louis; two of 750 K. W. to the Union Railroad, of Providence; four of 500 K. W. to the City & Suburban Railway Company, and four to the Baltimore & Ohio Railroad, both of Baltimore; four of 400 K. W. to the Union Depot Company, of St. Louis, and three of 250 K. W. to the Electric Traction Company, of Philadelphia; of the belt driven generators, twenty five of 500 K. W. have gone to the West End Railroad, of Boston, twelve to the Brooklyn City Railroad Company, three to the Atlantic Avenue road, of Brooklyn; three to the Union Railroad, of Providence; and other roads too numerous to mention in detail are now operated by these generators, as well as by generators of 300 K. W. and 100 K. W. capacities, making a total of direct coupled and belt driven generators of more than 500, while the total number of motors of all kinds turned out is considerably above 5,000.

There is an air of expectancy about the railway department of the General Electric Company which augurs well for the prospects of business during 1894. They are more hopeful even than they were at the end of last year, and the officials declare that, with their improved apparatus, they fear no competition, but are prepared to meet it and do an extremely large business.

Business of the Providence Steam Engine Company.

The Providence Steam Engine Company, of Providence, informs us, concerning its last year's business, that its improved Greene engines have been very satisfactory, and to judge by the work done business has been good with them. During the past year this company has installed or is now constructing the following engines: For the Union Railroad Company, of Providence, two compound condensing engines, of 1,800 H. P. capacity; for the Rotch Spinning Corporation's Mill, at New Bedford, one triple expansion engine of 550 H. P. capacity and another of 600 to 700 H. P., and in the same city has recently placed one 1,500 H. P. and two 600 H. P. compound engines. The company recently completed and is now engaged in the construction of compound engines for the Albany Electric Illuminating Company, of 400 H. P.; National Carbon Company, Cleveland, O., 900 H. P.; League Island Navy Yard and Charlestown Navy Yard, 250 H. P. and also some fifty other engines of from 1,200 to 75 H. P. each. The demand for the engine has required an enlargement of the works, and every available inch of ground is now covered with buildings to provide for the constantly increasing business.

Business of the Johnson Company.

The Johnson Company, of Johnstown, Pa., has done a large business during the past year in its various street railway specialties. Its girder rails, turntables, switches, curves and crossings are well known and have been largely used. The company, as is well known, has made a specialty of electrically welded rails and street construction; also electrically welded rails and chairs, and has shown its enterprise in going to great expense in experimenting in this and other lines to determine what improvements are possible in the girder rail system for street railway service. This company makes a specialty in the manufacture of patented specialties in street railway construction.

Equipment Notes.

The Billings & Spencer Company, of Hartford, Conn., has opened a Western office at 59 South Canal Street, Chicago, Ill., in charge of W. A. Davis. A complete line of its goods will be shown here.

Julius Meyer, consulting engineer, Temple Court, New York, has just completed for the stockholders of the Cincinnati Edison Electric Company, an investigation of that company's affairs and reported on the commercial and technical condition of the property.

J. D. Murray, of New Brunswick, N. J., has recently completed twenty miles of track in the work of electric construction, which the Baltimore (Md.) Traction Company is installing. Mr. Murray has had long experience in this class of work, and has laid a great deal of track in Baltimore and other cities.

Thomas S. Crane, expert in patent causes and in the designing of patent machinery, has opened an office at No. 10 Wall Street, New York. Mr. Crane has had an experience of thirty-six years as a mechanical engineer, and has prosecuted over 1,900 applications for letters patent in the United States and foreign patent offices.

The Ball Engine Company, of Erie, Pa., has sold its 500 H. P., cross compound, condensing engine exhibited at the World's Fair, to the Maryland Lighting Company, of Baltimore, Md. This engine received the highest award. The particular work of the engine at the Fair was the illumination of the electrical fountains.

William C. Baker, of 143 Liberty Street, New York, inventor and manufacturer of the Baker car heater, writes us that he is adapting his hot water car heaters to street cars, as well as to the large cars of steam railroads, the great desideratum being to have hot water heated pipes directly under the feet of each of the passengers as they sit in their seats.

The P. Wall Manufacturing Company, of Pittsburgh, Pa., is doing a good business. Mr. Wall tells us that he has recently shipped two roof gongs to the Melborne Electric Railway Company, of Melborne, Australia, showing that his goods are as well liked at the antipodes as in this country. Mr. Wall is also doing a large business in the United States.

The Phosphor-Bronze Smelting Company, Ltd., of Philadelphia, has moved its offices to 2,200 Washington Avenue of that city. At this point the company has erected a new foundry and smelting works, and has greatly increased its facilities in every department for the manufacture of "Elephant Brand" phosphor-bronze, ingots, castings, wire, sheet rods, etc.

The Bemis Car Box Company, of Springfield, Mass., has recently received an order from the Laclede Car Company, of St. Louis, for fifty more of its standard motor trucks, a total of 300. These will be installed on the lines of the Philadelphia Traction Company. The company has recently placed thirty-five trucks at Providence, R. I., among its other recent orders.

The Young Lock Nut Company, of New York, manufacturer of the Young gravity lock nut, has just issued a neat eight page circular containing an historical sketch of various forms of lock nuts, taken from the *Railroad Gazette*, together with press comments from several of the railroad journals, and a number of favorable testimonials from prominent railroad officials who have used these lock nuts.

The Berlin Iron Bridge Company, of East Berlin, Conn., is about to build a new car house for the Reading Traction Company at Reading, Pa. The building will be 180 ft. long and 85 ft. wide, with one row of columns through the center supporting the roof trusses. The side walls will be of brick, and the roof of iron. This company is also engaged in putting in place the roof of the new purifier house of the Northern Liberties Gas Company, at Northern Liberties.

The United Columbian Electric Company, of New York, manufacturer of the Winkler twin series motor, tells us that the Mobile (Ala.) & Spring Hill Street Railway, recently equipped with the Winkler system, has accepted all the equipments during the past month. The motors are showing very high economy, and in consequence the road has ordered additional equipments. These motors are replacing the steam dummies formerly in operation on the road.

The Clayton Air Compressor Works, of 43 Dey Street, New York, are working full time and full capacity at the shops in Brooklyn, and are even behind on their deliveries. In the prevailing business depression, this speaks volumes for the excellence of the air compressors built by this company. The company has recently taken out several valuable patents on a new triple compound, high pressure air or gas compressor, used largely by manufacturers of carbonic acid gas.

A. O. Schoonmaker, 158 William Street, New York, reports an increased demand for mica from the managers of electric street railroads. He is a large importer of East India mica, which is claimed to be the best in the market for insulating and other electric work. Mr. Schoonmaker offers this mica to the trade uncut or cut to size, and to meet the demand, he is now cutting it to shape ready for use for commutator segments, rheostats, etc. He will cut to any pattern wanted.

A. Groetzinger & Sons, of Allegheny, Pa., sole manufacturers of "Dermaglutine," write us that trade in "Dermaglutine" pinions has been picking up wonderfully lately, and orders are now coming in quite freely. Within the last month this has been especially true, the company having booked several large orders, principally from Western street railways. The general mechanical trade is now taking more interest in "Dermaglutine" than ever before, and orders are coming in generously from that source also.

The Allen Trolley Company, of Philadelphia, has changed its title to the Allen Electric & Supply Company. The office of the company is located at 232 Carter Street. The company reports a rushing business, has accepted the agency for the Graham truck, and "proposes to push it from the Hudson to the Missouri Rivers." The trucks will be made in Philadelphia complete, and a sample truck will be on exhibition at the company's office. Consumers will save freight by ordering direct from the Philadelphia office.

The Laconia Car Company, Laconia, N. H., the largest builders of steam railroad cars in New England, has taken a large number of orders recently for street railway cars of all kinds, electric, cable and horse. The high class of work which this company has turned out for steam railway service is sufficient proof that its street railway cars will be of the very best workmanship. The company employs between 600 and 700 men, and its facilities for turning out work are of the best. We understand that the company's street railway department will be in the charge of F. E. Huntress, 8 Oliver Street, Boston, Mass.

T. J. Murphy & Company, of New York, have issued a circular giving size, styles and prices of electric slate for switchboards, bases, etc., manufactured by them of a carefully selected grade of Vermont slate. This slate can be drilled and tapped with great facility. A New York construction company recently drilled 12,000 quarter inch holes in a slate five-eighths of an inch thick, and containing only twenty-two square feet, making the holes about a quarter inch apart. This slab stood shop handling and transportation without injury. These slates are furnished in flowed and marbleized finishes, which add to their strength and durability.

N. H. Green, of New York, general agent for the Maddox cotton and wire belting, informs us that the belting is giving excellent satisfaction wherever used. Numerous orders are being received, and prospects are bright for a large business in 1894. The following are in use and giving satisfaction: Chas. B. Paul, 467 Kent Street, Brooklyn, twenty-eight feet of nine inch belting for dynamos; McConway & Torley Company, Pittsburgh, Pa., fifty-six feet of six inch belting; Arlington Mills Company, Lawrence, Mass., twenty-seven feet of eight inch belting: H. W. Coleman Machinery Company, New Orleans, La., twenty-six feet of three and a half inch belting; Petross Stump Lumber Company, Tuscahoma, I. T., twenty-eight feet of six inch belting; Steinway & Sons, New York City, sixty-seven feet of four inch belting, and others.

J. H. Stedman, transfer agent, of Rochester, N. Y., having devoted more than two solid years to the transfer business, has aroused, he believes, the street railway companies of the United States to the importance of short time limit and a way to prevent the fraud practiced by passengers and employes. His ticket, he claims, makes the former simple, and the latter almost absolute, and while simplifying detail and saving labor, improves the transfer business in every way. Upon entering the field Mr. Stedman found practically no system, no detective features, and few conveniences. Each company was using an individual idea, often jumped at in haste and continued for lack of something better. He combined his ideas with the consensus of the knowledge of a great many general managers of reputation and experience, evolving in this way his present system. The principles of the Stedman tickets are fully covered by patents, and he has announced his intention of defending his rights in the courts.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., is obtaining flattering orders for its automatic wheel guard board and pickup fenders. The company's recent orders include those for the complete equipment of all cars for the Philadelphia Traction Company, Citizens' Street Railway Company, Indianapolis; Central Traction Company, Pittsburgh; Pittsburgh & Birmingham Traction Company; Pittsburgh & Duquesne Traction Company; Pittsburgh Traction Company, with assured expectations of several more large orders for January. These safety appliances have received the endorsement and approval of leading street railway managers, being constructed on practical and mechanical principles that conform to railway requirements. The fender is the result of three years' study and practice on the part of the inventor, Mr. Crawford. By order of the Commissioners of Public Safety, of Pittsburgh, all street car lines in that city not already furnished with the automatic wheel guards and pickup fenders of the Crawford Company must be so equipped at once.

The Ball & Wood Company, of New York, reports that in spite of the business depression its factory is crowded with work. Although it is not customary to the Ball & Wood Company, of New York, to advertise its sales, yet recent inquiry shows such activity at the works of this company that for the encouragement of those who fear that the factories are all closing, we are permitted to publish the following recent orders on installations: At Binghamton, N. Y., two engines; at Faribault, Minn., two engines; at Hartford, Conn., one large compound engine; at Frankfort, Ky., one engine; at Meriden, Conn., three engines; at Naugatuck, Conn., two engines; at Buffalo, N. Y., one engine; at Canton, Maryland, three engines; at Sweveghem, Belgium, one engine, besides others in West Pullman, Ill.; Elizabeth, N. J.; Cloquet, Minn.; Waterbury, Conn.; Scranton, Pa.; Bath. Me., and Millville, N. J. In addition to the above, the five engines comprising the exhibit of the Ball & Wood Company at the World's Fair, have also been disposed of, these engines being the first out of Chicago as they were the first installed.

Samuel Lewis, of 10–18 Larrimer Street, Brooklyn, N. Y., manufactures a wood mat for street cars, which is growing in popularity with street railway companies. Besides his customers among the street railway companies, Mr. Lewis has supplied the orders of a large number of car builders, including the John Stephenson Company, the Lewis & Fowler Manufacturing Company, the J. M. Jones' Sons Company, the J. G. Brill Company, the Laclede Car Company and the Pullman Palace Car Company. It is a very common thing when a street railway company orders its cars for the specification to be included that the cars are to be equipped with the Lewis patent wood mat. These mats are interchangeable and reversible, and are made of well seasoned maple wood slats, assembled with strong screw rods, which cut their own thread. This renders the infiltration of dust or liquids impossible while maintaining the mats smooth and preventing warping, so that the underlying material is not injured. These screw rods also give great strength, and insure durability to the mats, so that some have been worn by usage until the screw rods in the middle of the slats were exposed without decreasing their firmness and strength. The mats are easily repaired by screwing two half slats in the place of the one broken. Mr. Lewis has been in the wood mat business for a long time, and brings to his work the accumulated experience of many years.

The Southwark Foundry & Machine Company, of Philadelphia, Pa., makers of the Porter-Allen automatic engine for street railway and electric lighting uses, reports through its St. Louis agents at 32 Laclede Building, that city, the sale of two 1,000 H. P. engines to the Union Depot Railroad Company, of St. Louis. One of these is to be installed in the railway company's Gryer and Jefferson Avenues station, and the other in the Bellefontaine station on North 20th Street. Each of these engines is to be direct coupled to a 1,000 H. P. General Electric Company generator running at 100 revolutions per minute. Three 750 H. P. Porter-Allen engines have lately been ordered by the Compton Heights, Union Depot and Merchants' Terminal Railway Company, the Park Avenue branch of the Lindell Railway system. Each of these is to be direct coupled to a 750 H. P. Westinghouse generator of the latest type, as exhibited at the World's Columbian Exposition. The Southwark Company claims that the 1,000 H. P. engines can work up to 1,500 H. P. with the greatest ease, and the 750 H. P. to 1,000 H. P., in keeping with the varying loads common to street railway working. The Porter-Allen engines supplied to the Lindell Railway's old power station at Compton Avenue and the Missouri Pacific Railway tracks, although belted to the old type of Edison generators, have long ago demonstrated their ability to meet all demands put upon them. And it was principally for this reason that it was awarded the second Lindell Railway contract.

The Pierce & Miller Engineering Company, of New York, has sent us some of the results obtained by the World's Fair engineers,

showing the combined efficiency of a McIntosh & Seymour engine and a 10,000 light Westinghouse dynamo driven by belt to be 86¼ per cent. The variation in speed of the engine was less than one revolution under a change of load from zero to 1,360 H. P. In the December issue of *Cassier's Magazine*, under "Current Topics," an interesting item is given of this machine. This is as follows: "A rather startling story is told by an engineer who visited the late World's Fair, concerning the perfection of the governor of the large McIntosh & Seymour tandem compound engine which was on exhibition there. The engine, like most of those shown, was furnishing power for electric lighting, and ordinarily carried a load of about 800 H. P., which was considerably below its full capacity. On one occasion, through a mistake of the switchboard attendant, this load was suddenly increased by something like 60 per cent.. and was, a few moments afterwards, quite as suddenly reduced to the original figure without having attracted the attention of the engineer in charge by any change in the working of the engine, or without having in the least affected the various lights on the circuit. Changing the load on the engine by the amount noted, and with the result claimed, was about as severe a test of the governor as it is possible to make, and the builders of the engine ought to derive a goodly amount of satisfaction from it."

A. B. Wetmore, of 10 West 23 Street, New York, manufacturer and wholesale dealer in hard woods and North Carolina pine, has for many years been associated with the wholesale lumber trade of New York City, and has become prominent in the furnishing of special and difficult bills of lumber for car building and export trade. With the rapidly growing scarcity of good lumber, no industry has found it so difficult to fill its wants as the street car building trade. As will be seen elsewhere in this issue, Mr. Wetmore is a specialist in many classes of woods used in the construction of street railroad cars, and is prepared to furnish some of the best material and manufacture. The making of street car and coach panels, and especially the former, is a business requiring great judgment, skill and experience. The best whitewood timber for this kind of work must not only be large, but it must be of thrifty growth, making panels that are not only free from knots, but also from many of the defects which occur in very old whitewood trees. To obtain just such timber, to have it manufactured into truly made boards five-eighths of an inch thick, and from sixteen to twenty-six feet long and of a grade suitable for the work requires the attention of expert lumbermen. These Mr. Wetmore has had in his employ for a long time, and has produced results most satisfactory to the receivers of the lumber. Mr. Wetmore claims to have filled the contracts for panels of the most exacting purchasers, and his panels were used exclusively in the building of the cable cars made by the Stephenson Company for the Broadway Railroad.

The Fishkill Landing Machine Company, of Fishkill-on-the-Hudson, N. Y., builder of the improved Fishkill-Corliss engine, is doing a good business. Its engines are in demand by manufacturers generally, and are also used for electric lighting and street car purposes. The Rochester (N. Y.) Electric Light Company is using a Fishkill-Corliss engine of 500 H. P. Among the larger engines which this company has recently erected are two of 300 H. P. each for the Atlas Cement Company, at Coplay, Pa.; one of 250 H. P. for the Grand Central Palace, New York City; one 175 H. P. for R. M. Wilson, Rome, N. Y.; one 175 H. P. for F. Hosch, Brooklyn, N. Y.; one 250 and one 100 H. P. for the Canda Manufacturing Company's car works at Carteret, N. J.; one 100 H. P. for the Smith Premier Typewriter Company, Syracuse, N. Y.; one 175 H. P. for the Cortland, (N. Y.) Wagon Company; one 200 H. P. for David Miller, New York; one 100 H. P. for the Eastman Kodak Company, Rochester, N. Y.; one 300 H. P. for the Metropolitan Realty Company, New York; one 200 H. P. to the National Casket Company, Oneida, N. Y.; one 300 H. P. for the Glens Falls Paper Mill Company, Fort Edward, N. Y.; one 250 H. P. for Kinney Brothers, New York, and one each of 300 and 350 H. P. for sugar plantations in Cuba. It will be recalled that the engines for the immense grain elevators of the New York Central & Hudson River Railroad Company, New York city, one the West Shore Railroad, at Weehawken, N. J.. (one of 1,000 and one of 800 H. P.) were built by this company. The officers of the Fishkill Landing Machine Company are: Robert J. Halgin, president; W. F. Sage vice-president, and James L. Teller, secretary.

Mr. Wm. Hazelton, 3d, has been appointed the exclusive agent for the United States of the Société Anonyme Industrielle des Etablissements Arbel, Rive-de Gier (Loire), France. This company is probably the best known manufacturer in Europe of wrought iron ,forged centers for all kinds of wheels, making a specialty of this business. During the World's Fair, Mr. Arbel, with a staff of engineers, visited this country, and during his stay here visited many cities, seeking particulars and information regarding the operation of street railways. The appointment of Mr. Hazelton as the American representative of the company is the first step of the company in establishing an American branch. Mr. Hazelton will open offices in the Havemeyer Building, New York City, January 1, 1894. The wrought iron, forged centers of the Arbel manufacture are especially adapted to cable and electric service, and are sold with a five years' guarantee. These centers are used almost exclusively in France and many other European countries. Since Mr. Hazelton resigned from the Short Electric Railway Company, last summer, he has, in addition to devoting much time to several railway projects in which he is interested, been negotiating with several large manufacturers to represent them in the East. He will continue in the contracting for and building of street railways complete, in which line he is well known, and has had a long practical experience.

Mr. Hazelton has the faculty of knowing a good thing when he sees it. He was one of the earliest workers in the electric railway field, and during his connection with the Sprague Electric Railway & Motor Company, of New York, was largely instrumental in starting the great impetus in electric railway construction in the states of Pennsylvania, New Jersey and Delaware, where he represented that company. After the absorption of the Sprague Company with the Edison General Electric Company, Mr. Hazelton was general sales agent of the Wenstrom Consolidated Dynamo & Motor Company, and advocated the use of the slow speed, single reduction motor for street car service, which has since become a standard. While assistant general manager of the Short Company Mr. Hazelton was active in bringing out the first gearless motor used in street railway service. He has always been employed in new fields of work, and we anticipate a large success for him and for the company of which he is the representative, in introducing the Arbel wheels into the American field.

WESTERN NOTES.

The Valley Steel Company, of Belleville, Ill., is the title of the new company which has purchased the works of the Belleville Steel Company which failed some time ago. The new company has a capital of $400,000, and expects to have the plant running by January 1, giving work to 800 men.

Taylor, Dee & Mack, of Chicago, is the title of the firm which is carrying on the business formerly owned by Taylor, Goodhue & Ames. The firm is at 348 Dearborn Street Chicago, and is agent for the Burton electric car heater manufactured by the Burton Electric Company, of Richmond, Va., one of the earliest car heaters put upon the market.

McLure & Kaufman, of San Francisco, have recently opened an office at 216 Bush Street, that city, for the sale of general street railway supplies. They are agents of Pittsburgh Steel Hollow Ware Company, of Allegheny City, Pa. J. A. McLure is well known in the field, having recently been connected with Siemens & Halske, and before that with the Short Electric Railway Company and the Sprague Electric Railway & Motor Company.

The Walker Manufacturing Company, of Cleveland, O., as mentioned elsewhere in this issue, is proposing to add an electrical department to its extensive works. Its facilities for the manufacture of a line of high grade generators and motors are of the best, and the well known reputationof this company for turning out work of standard quality especially fits it for entering the electric railway field. Mr. Walker, in this connection, recently assured a representative of the Street Railway Journal that this work will be done in an entirely separate department, and will in no way interfere with the company's regular work of manufacturing cable and hydraulic machinery for which the Walker Company is noted the world over.

The Scarritt Furniture Company, of St. Louis, informs us that it is receiving numerous inquiries from various parts of the country regarding its new double seats for street cars, similar to those supplied to the Lindell Railway and Compton Heights, Union Depot and Merchants' Terminal Railway companies, of St. Louis, and which have been illustrated in the columns of the Street Railway Journal. These inquiries have not only come from street railway companies, but street railway car builders as well. The superiority of these seats has often been remarked upon, and the Scarritt Company thinks that their use for street railway purposes has been proven a great success in the case of the two St. Louis companies above mentioned.

The National Electric Company, is a new corporation organized at Eau Claire, Wis., to operate the plant formerly owned by the National Electric Manufacturing Company of that place. The officers of the new company are: A. L. Ide, president; Peter Truax, vice-president; F. P. Ide, secretary, and W. A. Rust, treasurer. The company has issued an announcement to all interested in electric lighting, to the effect that it is prepared to furnish alternating and direct current apparatus, multipolar power generators and motors, transformers of any capacity and voltage, as well as other electrical apparatus and appliances, promptly upon receipt of orders. To the former patrons of the National Electric Manufacturing Company is especially extended a cordial greeting, as well as a solicitation for a continuance of patronage. The company will take pleasure in quoting prices to all, and in furnishing other information desired relative to its apparatus, promptly upon application.

The McGuire Manufacturing Company, of Chicago, writes us that its adjustable traction truck is becoming more and more popular. These trucks have been in use for nearly a year on the Cicero & Proviso Street Railway, Denver Tramway and the Citizens' Street Railroad, Indianapolis, and in every case the new feature has proven to be all that is claimed for it. The peculiarity is the fact that all the traction is placed upon the four drive wheels, leaving the four small guide wheels to be simply what they are called, on a straight track. But the moment the truck enters a curve, an ingenious cam arrangement shifts any desired proportion of the load on to these drive wheels while in the curve, thereby preventing derailment. The Patent Office has granted patents on the claims made for this feature, and after a thorough search through the condition of the art, nothing is found that operates at all like it. It is an interesting device and proved decidedly attractive at the World's Fair.

The Central Electric Company, of Chicago, reports that its sales of Anti-thunderbolt oil paper show a large and increasing demand for a product of this nature, which is absolutely reliable. This paper is a preventive for short circuits and grounds when used in winding armatures, fields and converters, and is unsurpassed for electric manufacturing and repairing. It will resist the highest voltages, also the action of oil, water and dampness and the injurious action of chemicals and gases, and it does not break or tear when folded. The genuine oil paper is stamped "Anti-thunderbolt." This company also writes us that it has made large sales on the various grades of P. & B. paints and varnishes, which it is handling as general Western agent for the stan-

dard Paint Company. The company's stock represents the different grades of these products, put up in packages ranging from one gallon to a barrel. It has also gotten out a striking advertisement of "Okonite," in the form of a neat leather pocket watch safe which it is now distributing.

The Brownell Car Company, has recently delivered a trial order of fifty of its celebrated "Accelerator" cars to the West End Street Railway Company, of Boston, Mass. They are eighteen feet in length and of the West End Company's standard dimensions, style and finish, except that they are provided with the advantageous features of the "Accelerator" type of car. The car company has received the most flattering assurances that the "Accelerators" furnished are doing all that was expected of them and very much more, as shown by comparing the registers of the old style cars and the "Accelerators." A large number of "Accelerators" have recently been shipped to Brooklyn and Baltimore, and the same success and favor with the public are heard on all sides in those cities as well as in Boston. The Brownell patent electric motor truck has met with great favor among the street railway fraternity, and already it may be seen under cars in the principal cities of the country where electric cars are used. As is well known, the truck is of the non-oscillating type without the introduction of the extended spring base feature, the advantageous equalizing levers doing away with all oscillation of the car body.

The Metropolitan Electric Company, of Chicago, has added another very important name to its list of specialties— a new patented incandescent lamp. This is to be known as the "Metropolitan," and embodies the latest improvements in incandescent lamp manufacture. By the utilization of new and improved methods, the lamp offers, it is claimed, a very high efficiency, and that it will maintain its full candle power throughout its entire life. The company has also secured the entire output of H. T. Paiste's factory, and hereafter will market exclusively these specialties. The company is also gathering together a very important line of electric railway devices, prominent among which are the Standard Paint Company's P. & B. specialties, the "Anti-thunderbolt" oil paper, special glass insulators, N. I. R. feed wire, etc. The "Mac Tape," with which this company has had great success, is guaranteed to withstand the severest climatic changes, not to be affected by acids, and to possess qualities that no other tape in the market has. It sticks to the wire and not to the hands, and will not oxidize the wire. Its adhesive qualities are such that it is practically indestructible, and, hence, will not deteriorate with age.

The Shultz Belting Company, of Broadway and Barton Street, St. Louis, reports business as very steady considering the dullness of the times. The company's works are running full time mostly on small work. Promoters of electric railways and electric lighting plants, especially the larger ones, are sending in no orders until money is easier and their projects receive more encouragement. Hides are very cheap, but the stocks are low as in almost every other line of trade, and the inducements to buy are great, but the unwillingness and sometimes inability of the banks and trust companies to lend money have tended to throttle legitimate enterprise for the present, and the leather belt business feels the effects of such a state of affairs. Notwithstanding this, however, there are enough orders to keep the company's works in operation and give employment to their operators. The management has recently received some glowing testimonials from a number of its largest customers, testifying to the superiority of the Shultz patent woven leather belt and their rawhide belt. The company's representatives in New York and other Eastern cities, as well as in London, England report the prospects for the immediate future as very encouraging in the belting business.

The Heine Safety Boiler Company, of 706 Bank of Commerce Building, St. Louis, maker of high class, safety, water tube boilers, is pleased to state that its books are sufficiently full of orders to keep its works running steadily for some time to come. Among the company's recent orders is one for eight boilers of 375 H. P. capacity each, an aggregate of 3,000 H. P., for the Midwinter Exposition Company, at San Francisco, Cal. This contract was obtained in the face of the severest competition, and awarded to the Heine Company solely on the well known merits of its boilers. These boilers will supply the necessary power for the entire Midwinter Fair. They will serve as the Heine Company's exhibit at the Fair. The company's employes are now busily engaged in installing the boiler equipment in the new Planters House at St. Louis, consisting of two boilers of 300 H. P. capacity each, an aggregate of 600 H. P. There are a number of new orders on the company's books, mostly of a small character. Boiler makers are awaiting the same prospects as those in other pursuits, and are looking forward to the decision of promoters of new railway and lighting stations. The management has received numerous responses regarding its new book entitled "Helios," which go far towards establishing the fact that the Heine Company can hold its own at all times on account of the superiority of its product.

The St. Louis Register Company, 603 Houser Building, St. Louis, maker of the celebrated Security fare register, reports that it is receiving many orders and its fare registers that have been on trial for some time past have proven to their users the superiority of the Security register, and orders have followed. The company has several trial registers in use on the lines of the Chicago City Railway Company, of Chicago, Ill., and they are sustaining the reputation of the firm for accuracy, durability and simplicity. The company confidently expects an order from this railway for 1,200 or more of its registers. Reference to the company's advertisement on page 96 in this issue will reveal a very good cut of its new combination register for registering both full and half fares or full fares and transfers, as desired. At the recent convention of the American Street Railway Association, at Milwaukee, Wis., in October, both the combination and single type of registers attracted a great deal of attention from the delegates. The company reports among its late orders one for the equipment of the cars of the Philadelphia Traction Company, with its Security registers, as mentioned elsewhere in this issue. The company's transfer registers are meeting with especial favor, and the St. Louis Register Company has received many orders for this machine.

A. W. Slee, 500 American Central Building, St. Louis, representative of Wm. Wharton, Jr., & Company, Incorporated, of Philadelphia, Pa., states that that company has just completed laying twenty-eight miles of its standard six inch, seventy-eight pound girder rail for the Union Depot Railroad Company, of St. Louis. A large amount of this has replaced a fifty-seven pound "butterfly" girder rail which was laid in horse car days, and has not been able to stand the constant and heavy wear and tear of electric motor cars. The Wharton Company has been supplying the Union Depot Railroad and Lindell Railway companies with its new "Integral" work in crossovers, frogs and switches. Both these companies have adopted the "Integral" as their standard. The Lindell Railway laid some "Integral," built-up and cast iron work about the same time, and it is almost useless to say that the "Integral" has survived the other two. The built-up work has become loosened and rattles, and the cast iron work, also made by the Wharton Company, has worn away too quickly under the weight of the heavy forty-eight foot electric cars used by the railway company. The management of the Union Depot Railroad Company is very well satisfied with the groove rail crossovers supplied by the Wharton Company. Mr. Slee, the company's representative, expects a revival of trade as soon as the spring weather sets in, when the money market will be settled and in a condition to lay tracks.

Thos. Ashburner, of 608 Security Building, St. Louis representative of the Babcock & Wilcox Company, reports that the boiler business in the St. Louis district is very brisk considering the little work that is being done on street railway and electric lighting power stations. However, the Babcock & Wilcox Company is getting its share of the water tube boiler business in St. Louis, an order for four boilers of 250 H. P. capacity each, aggregating 1,000 H. P., having recently been received from the Union Depot Railroad Company, of St. Louis, for future delivery; also one from the Missouri Electric Light & Power Company, of St. Louis, for two boilers of 250 H. P. capacity each, aggregating 500 H. P. These have already been installed, and are giving great satisfaction. Also a third order for four boilers of 250 H. P. capacity each, aggregating 1,000 H. P., for the St. Louis Terminal Railway Association, to be installed in the new Union Passenger Station at St. Louis. The company considers this last a great achievement, as the odds were very great against it from outside as well as local competition. The company now recognizes the importance and great advantage of locating a district office in St. Louis according to its representative, and the good will and wishes of steam users go with it in its elegant quarters in the new Security Building. The office has been located in St. Louis only a short time, and the above, besides many smaller orders, attest the wisdom of the move and the substantial progress already made in the St. Louis district.

Guido Pantaleoni, of 608 American Central Building, St. Louis representative of the Westinghouse Electric & Manufacturing Company, reports business as very brisk in the St. Louis district. A large 500 H. P. Westinghouse generator, direct coupled to the latest type of Westinghouse vertical engine of 500 H. P. capacity, has recently been installed in the incandescent lighting plant of the Missouri Electric Light & Power Company, of St. Louis. This is a duplicate of one of the set of direct coupled generators and engines exhibited by the Westinghouse Company at the World's Columbian Exposition. The electric lighting plant above mentioned is one of the largest in the country, and is operated entirely by Westinghouse apparatus, both engines and generators. It is a model of economic management, and attests the superiority of the Westinghouse Company's apparatus. The plant was lately doubled in size, and the additional property adjoining will soon be built upon if the company's present success continues. The Lindell Railway, Southern Railway and Compton Heights, Union Depot and Merchants' Terminal Railway companies all report in a most flattering manner regarding the Westinghouse single reduction motors used by them, and recently adopted as their standard. The new power station of the Lindell Railway Company is being installed with Westinghouse generators only. There are to be three generators of 750 H. P. each, direct coupled to three Porter-Allen automatic engines, built by the Southwark Foundry & Machine Company, of Philadelphia, Pa. This is the first railway power plant in St. Louis to be equipped with the Westinghouse Company's apparatus, and according to that corporation's St. Louis representative, it will not be the last.

Littlefield & Meysenburg, 806 Bank of Commerce Building, St. Louis, representative of the Johnson Company, of Johnstown, Pa., informs us that this company has received the contract from the General Electric Company, of New York, to supply the rails for the electric railway being built by that corporation in Belleville, Ill. Mr. Atterbury, of the Belleville Electric Railway Company, has just closed negotiations for the equipping of the road with the Johnson girder rail at that company's St. Louis office. An order has also been received, for future delivery, from the Baden & St. Louis Railroad Company which is practically the northern extension of the St. Louis Railroad Company's Broadway cable line. It calls for six miles of the Johnson Company's standard six inch, seventy-eight pounds to the yard girder rail. No fishplates will be used, but the rails will be welded together electrically, making a continuous line of rails from one end of the road to the other. A seventy-eight pound rail was adopted in order to conform to the standard size in use on the Broadway cable road. The rails will not be punched, but their ends will be welded together. They will not be welded to chairs and will have no base, as in former practice, but will be of the standard shape and dimensions. No track wiring will be necessary in this system, the rails themselves forming

a complete and continuous circuit. One of the Johnson Company's electric welding cars will be sent to St. Louis, and as the rails are laid they will be welded, current being taken for the purpose from the ordinary street railway circuit of 500 volts. It may be stated here that the Johnson girder rail is the standard used by the syndicate owning this line, as well as five others in the city of St. Louis. Other systems there have also adopted it as their standard.

Personal.

Mr. F. E. McCarthy, of F. E. McCarthy & Company, Boston, visited us last month while in New York.

Mr. S. A. Douglas has been appointed general sales agent of the General Incandescent Arc Light Company of New York.

Mr. Daniel F. Lewis, president of the Brooklyn City Railway Company, has been quite ill, but his friends will be glad to hear that he is recovering.

Mr. Edward E. Higgins, financial counsel and street railway expert, has moved his offices to the Havemeyer Building, 26 Cortlandt Street, New York.

Mr. Charles R. Henderson, president of the United States Trust Company, at a meeting of the Board of Directors of the Metropolitan Traction Company, held in this city last month, was elected a director and president of that company.

Mr. H. J. Medbery, president of the Fiberite Company, of Mechanicville, N. Y., and manufacturer of the Medbury insulation, called at our office last month. Mr. Medbury reports an increasing demand for the well known insulation of which he is the manufacturer.

Mr. G. J. Melms, formerly receiver and superintendent of the Milwaukee Electric Railway, sailed for France last month, and proceeded to Basle, Switzerland, to meet Mrs. Melms, who has been abroad for several months. After spending two or three months on the continent they will return to their Milwaukee home.

Mr. James Ross, principal owner of the Montreal Street Railway Company, and Mr. F. L. Wanklyn, engineer of the same company, visited the States last month, and inspected a number of street railway power stations in the vicinity of New York, for the purpose of comparing our methods of station equipment with those in vogue on the other side of the line.

Mr. A. N. Connett, chief engineer of the Baltimore Passenger Railway Company, visited New York last month, and gave us an interesting account of the progress of mechanical traction in Baltimore. The Passenger Railway Company has decided to change the remaining horse lines, about twenty-five miles, to electric traction at once, and plans are now being prepared.

Mr. W. J. Stephenson, president of the Metropolitan and Columbia railroad companies, of Washington, D. C., was a welcome visitor at our office last month. The operation of the storage battery cars on the Metropolitan lines has been suspended, and in case the consent of Congress can be obtained, some method of underground electric traction will, doubtless, be installed in the future.

Mr. Charles A. Schieren, head of the popular belt manufacturers, Charles A. Schieren & Company, who was elected, last November, Mayor of Brooklyn, commenced his term of office January 1, 1894. Mr. Schieren has announced it as his intention to conduct the city government of Brooklyn on the same lines which have made his own business successful, those in selecting his assistants on the ground of personal merit, and not for any political pull which they may be supposed to have. The appointments made by Mr. Schieren, already announced, indicate that this policy will be strictly adhered to. Brooklyn's new mayor was born in Germany in 1851, and he has been a resident of that city since 1856. Mr. Schieren was elected on the Republican ticket, and his majority, as will be remembered, was phenomenal in Brooklyn.

Obituary.

STEPHEN WILCOX, vice-president of the Babcock & Wilcox Company, New York and Glasgow, died, November 27, at his residence, 298 Washington Avenue, Brooklyn, N. Y., aged 63 years. The cause of his death was pneumonia. Mr. Wilcox was one of the founders of the Babcock & Wilcox Company, whose business was established in 1868.

Within a few weeks following the death of Mr. Wilcox, on December 16, at Plainfield, N. J., occurred the death of the other of the principal members of the Babcock & Wilcox Company, Mr. George H. Babcock, in the sixty-first year of his age. He was of great inventive and mechanical genius, and was a lecturer in the mechanical engineering course at Cornell University.

ALBERT B. PULLMAN, formerly vice-president of the Pullman Car Company, and late the head of the A. B. Pullman Company, of Chicago, died at his home in Evanston, Ill., December 18. His death, though rather sudden, was brought on by a complication of diseases superinduced by a severe attack of grippe two years ago. Mr. Pullman was born in Auburn, N. Y., in 1828. He moved to Grand Rapids in 1851, engaging in the furniture business there. From there he went to Chicago in 1860, where he became interested with his brother, George M. Pullman, in raising and moving buildings. When the Pullman Car Company was started he became actively connected with the construction of its cars, his mechanical ability standing him in good stead. Several years ago he retired from the Pullman Car Company, but other interests have kept him prominent in railroad circles.

New Publications.

Catalogue of Railway and Machinists' Tools and Supplies, January, 1894. Manning, Maxwell & Moore, 111 and 113 Liberty Street, New York. 1,103 pp. and nearly 6 000 engravings.

This volume is more of an encyclopedia of every possible tool, machine or supply that could be used in connection with railway or machine shop work. The index of separate classes occupies twelve and a half pages alone. The paper and binding are of very high grade and the illustrations gotten up in the best style. Each article is illustrated and described and the price quoted. This concern deals in the best forms of every article in its line, without regard to where manufactured, and the aim of this catalogue is to put into condensed form information of value to prospective purchasers of any sort of railway or machinists' tools or supplies. In this this firm has succeeded admirably, and aside from being a standard book of reference in its class it would be an ornament to any office library.

The C. & C. Electric Company.

The C. & C. Electric Company is the title of a new corporation which will continue the business carried on in the past by the C. & C. Electric Motor Company, this new company taking over the assets and assuming the liabilities of the C. & C. Electric Motor Company. The C. & C. Electric Company is provided with an ample capital, and through the acquisition of a large and thoroughly equipped factory at Garwood, N. J., will have greatly increased facilities for the manufacture of electrical machinery and for the prompt and thorough performance of such contracts as may be entrusted to it. The manufacture of dynamos and generators has within the last two years become an important feature in the business of the old company, and it seemed desirable on the organization of the new company to make the slight change indicated in the name, the old title having become to some extent a misnomer. The general management of the company and the interests represented by it remain unchanged.

Technical Instruction by Correspondence.

The Correspondence School of Technology, recently organized in Cleveland, O., by E. P. Roberts, M. E., and whose prospectus and plans were recently noted in the columns of the STREET RAILWAY JOURNAL, has gotten out the first of its lecture courses. The lecture on Mechanical Drawing contains a full and explicit description of all the instruments and apparatus used, and directions for their use and care, with full details of the process of making a finished drawing, and numerous exercises. The lecture on Constructive Geometry contains a full summary of the science of constructive drawing, with definitions, problems and exercises. Return blanks are also furnished with each lecture for questions on the problems contained therein.

These lecture courses, to judge from the first of the series, will be an invaluable aid to anyone who, from business or other reasons, is prevented from attending technical schools or colleges. Later lectures will cover, in the same comprehensive manner, different branches of mechanical science.

The Fulton Truck & Foundry Company.

The Fulton Truck & Foundry Company is the title of a new company which has been incorporated to succeed the Fulton Foundry Company. The company has two acres of land in the city of Mansfield, O., on which it is building a large truck shop, the dimensions of which are 60×175 ft. The building is of brick. On the balance of the land the company expects to build a large foundry and a frog and crossing shop. On December 11, the following directors were elected: W. E. Haycox, C. J. Langdon, Jr., of Cleveland, and Reid Carpenter, S. N. Ford, M. D Bushnell, W. S. Cappeller and G. W. Hancock, of Mansfield. On December 12, the directors elected the following officers; W. E. Haycox, president and general manager; M. D. Bushnell, vice-president; C. J. Langdon, secretary and treasurer.

The company writes that it will have the most complete outfit for the manufacture of street railway supplies in Mansfield, that can be found in the country, and that the foundry and machine shop in Cleveland will be retained. The company expects to be ready by February 1 to manufacture trucks and other railway supplies at Mansfield.

"394."

This is the name of a preparation, which when applied in small quantities to ordinary steam coal, will increase its firing properties from 10 to 20 per cent. This preparation is controlled for the Western and Northwestern States by the Northwestern Land & Coal Company, which quotes in its circulars testimonials from a number of steam users, which show a saving of from 20 to 33 per cent. in coal and of about 25 per cent. in ashes. To settle the question as to the value of this compound, a test was made in June, 1892, under the direction of Prof. Carpenter, of Sibly College, at the request of the editors of *Power*. This test was made with two kinds of coal, anthracite grate and bituminous slack, with and without treatment by the compound. The results showed that with anthracite grate under a small vertical boiler a saving of 9 per cent. in fuel was made, and with bitumious slack a saving of 16 per cent. This compound also prevents to a large extent the formation of smoke.

This company also controls the "Baker Process" for the manufacture of briquets of culm and lignite, or brown coal. These briquets make a quick, hot fire and lessen the smoke, and are especially valuable for use in locomotives, steamboats and domestic use.

List of Street Railway Patents.

ISSUED BY THE U. S. PATENT OFFICE, NOVEMBER 7, 1893, TO NOVEMBER 28, 1893, INCLUSIVE.

Prepared by E. W. Cady, Patent Solicitor, 99 Nassau Street, New York City.

NOVEMBER 7.

COMBINED RAIL SUPPORT AND CROSS TIE—Francis P. Reilly, New York, assignor by mesne assignments to the Johnson Company, of Pennsylvania. No. 508,049.

A metallic cross tie provided with vertical stamped up lugs and having a rail chair of box form fastened to a chair, the vertical webs of the chair being secured to the vertical lugs of the tie. The vertical webs of the chair are welded to the vertical lugs of the tie.

AN ELECTRIC RAILWAY SYSTEM—Carl T. B. Brain, Liverpool, Eng. No. 508,083.

A railway or tramway having a slotted power conduit is provided with a continuous cover for such conduit, consisting of hard bars or rail forming a bridge over the conduit slot, capable of supporting the road traffic and also being of a material capable of flexure, the bars or rails being connected together and adapted, by reason of their flexure, to be raised from the slot and in rear of the cover raising devices, to seat themselves. Also claims other specific details of construction.

SAFETY APPARATUS FOR ELECTRIC OR OTHER STREET RAILWAY CARS—William Cox, Hamilton, Can. No. 508,089.

An electric or other street railway car is provided with a safety device consisting of a rectangular frame double jointed at the corner, covered with wire cloth, netting or equivalent material and hinged to a gauge bar secured to the ends of the street car.

RAILWAY SWITCH—Edward B. Entwisle, Johnstown, Pa., assignor by mesne assigments to the Johnson Company, Pennsylvania. No. 508,095.

A spring switch constructed with a box or receptacle for the spring formed with a removable side for inserting and access to spring. The top of the box is provided with two inclines.

CONDUIT RAILWAY TROLLEY—Herbert A. Goreham, Decatur, Ill. No. 508,104.

A trolley for underground wire comprising a vertically slotted bracket, the trolley standard in the slot of the bracket, and the springs connecting the standard with the bracket and tending to force the standard downward.

CLOSED CONDUIT ELECTRIC RAILWAY—Otis B. Benton, Cleveland, O. No. 508,199.

Comprises a conduit for the feed wire, a service boxing or channel and towers connecting said conduit and boxes in connection with insulated flexible caps closely covering the tops of said towers, and contact makers in the towers passing through said caps and affixed thereto. Also embraces in an electric system, a movable contact maker, a current conveyor connected with the car and insulated means before and behind the said conveyor to depress said contact maker into contact.

CONDUIT ELECTRIC RAILWAY—Jacob Pawolowski, Cincinnati, O. No. 508,236.

Comprises in an underground conduit for an electric railroad, plain sections and interposed manhole sections having a continuous slot for the trolley arm, a downwardly projecting flange from one side of said slot, an upwardly spring-pressed trolley arm, a guard wheel carried by said arm and bearing normally upon the under edge of said flange, a trolley wire, hangers for supporting it from the top of the conduit, a main wire and feeders connecting the main and trolley wire.

ELECTRIC CAR ATTACHMENT—Isaac H. Davis, South Butte, Mont. No. 508,373.

Provides a car floor or analagous covering having an electric motor beneath the same and provided with an opening therethrough, with a metallic frame secured against the under side of the floor, and projecting inwardly beyond the walls of said opening to form supporting flanges, a cushion interposed between the said frame and the floor and covering said flanges, a plate of glass mounted in said opening and resting on the said cushion, and a guard hingedly mounted above the said plate of glass and having a series of openings therein.

NOVEMBER 14.

PASSENGER VEHICLE—John DeWitt, Washington, D. C. No. 508,414.

A passenger conveyance having a series of vertically adjustable seats arranged in step-by-step order and each provided with a foot rest.

FENDER FOR ELECTRIC CARS, ETC.—Caleb N. Homan, Lawrence, Mass. No. 508,472.

A car fender provided with a series of plates arranged in front of the car, each plate being carried by two or more coil springs, the outer ends of which are secured to an angular bar whereby each plate can yield independently of the other.

ELEVATED RAILWAY—Lysander Johnston, Chicago, Ill. No. 508,478.

An elevated railway structure comprising a plurality of yokes and supports therefor, said yokes being of inverted U shape and provided at the lower end with inwardly extending and upturned arms, and track rails of inverted U form, in cross section, resting upon and supported by the upturned lower ends of the said yoke.

ELECTRIC RAILWAY TROLLEY—Stephen D. Field, Stockbridge, Mass. No. 508,539.

A magnetically adhesive trolley for electric railways, embodying a wheel composed of magnetic metal and carrying two co-operating coils, both adapted to be energized from a main conductor, but having one of said coils adapted to be connected to a return conductor and outside of the motor section, and the other adapted for connecting with the motor circuit.

CAR FENDER—Alfred L. Clarke, Springfield, O. No. 508,565.

A fender for railway cars consisting essentially of a fender frame supported on suitable flange wheels, which wheels are adapted to rest on and follow the track on which the car runs, a connecting bar from said fender frame to the main car supporting frame or truck, said connecting bar being at one end pivotally connected to said fender frame and at the outer end to said car frame or truck.

CONDUIT FOR ELECTRIC RAILWAYS—Archibald J. Robertson, New York. Assignor to himself, George S. Brush, Brooklyn, N. Y., and Henry Carey, Elm Park, N. Y. No. 508,578.

A conduit or receptacle for naked electric wire having a storage capacity for water and having an inner surface of insulating material, whereby the water that may collect therein will be electrically insulated from the air.

ELECTRIC RAILWAY—John C. Henry, Westfield, N. J. No. 508,615.

Provides an electric railway, a series of poles arranged alternately on opposite sides of the roadway, a working conductor and short guy wires running out from each pole to said conductor. The working conductor is arranged in a zigzag or sinuous line in a horizontal plane, and there is used in connection therewith a car provided with a laterally movable trolley. Also in an electric railway, in which the track forms the grounded return conductor, a supplemental return conductor of comparatively high resistance connected at intervals with the track.

ELECTRIC CAR LIGHTING SYSTEM—John C. Henry, Westfield, N. J. No. 508,616.

Combines a series wound motor, an adjustable resistance in series therewith, a lamp or lamps controlled by the resistance, and means, substantially as described, adapted to increase the resistance when the motor exceeds a pre-determined speed and diminish the resistance when the motor falls below such pre-determined speed.

ELECTRIC RAILWAY TROLLEY—Walter H. Knight, New York. No. 508,622.

Combines with a suspended supply conductor, an electrically propelled vehicle and intermediate contact device, consisting of a trailing rod attached to one end of the car by a transverse pivot and carrying at its opposite end the contact device bearing upon the upper side of the supply conductor.

FLUID PRESSURE DEVICE FOR CONTROLLING ELECTRIC MOTOR—Horace F. Parshall, Lynn, Mass. and John W. Darley, Jr., Baltimore, Md., assignors to the General Electric Company, Boston, Mass. No. 508,630.

In a system of controlling electric motor, a source of fluid pressure, a cylinder carrying electric compacts and adapted by its rotation to vary the speed of an electric motor and means substantially as described, operated by the fluid pressure and adapted to rotate the cylinder.

CAR FOR ELEVATED RAILWAYS—John L. Pope, Cleveland, O. No. 508,631.

A car for elevated railways, forked at its under portion and adapted to be set astride a railway track, said car having an upper compartment and also compartments in the lower forked portion, a truck situated in the fork above the level of the track, and at the end of the car a platform extending across the track near the level, stairs leading to the platform from the lower compartments at the opposite sides of the car, and other stairs leading up from the other compartments.

SNOW SWEEPER—Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Company, of Connecticut. No. 508,668.

Comprises in a sweeper a carrier, a frame pivoted thereon and a rotary broom and motor geared together and supported on said frame on opposite sides of the pivot.

TROLLEY FOR ELECTRIC RAILWAYS—Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Company, of Connecticut. No. 508,669.

Embraces a pivoted trolley having tension springs attached to a toggle lever, a pawl to engage with the pole socket piece when the toggle is tripped and the pole drops and an arm on the toggle leader to normally hold the pawl out of engagement.

SWITCH FOR ELECTRIC RAILWAYS—Edward M. Bentley, New York. No. 508,672.

Combines with the main and branch conductors of an electric railway a switching conductor normally spring-pressed against the main conductor, a trolley pole carrying at its upper end a grooved contact device running in engagement with the other side of the conductor, and means for automatically depressing said conductor, below the normal plane of the main conductor at the junction, whereby said contact is enabled to pass from the main to the branch line without a jar.

BRAKE APPARATUS FOR ELECTRICALLY PROPELLED CARS—Francis O. Blackwell, New York, assignor to the Thomson-Houston Company, of Connecticut. No. 508,673.

Combines with a vehicle a brake shoe and an operating device for said brake shoe consisting of a rope attached thereto and wound loosely on the axle of the vehicle, and devices for tightening said rope on the axle irrespective of its direction of rotation, whereby in each direction of progress of the vehicle the tightening of the rope on the axle operates the brake shoe. Also embraces a brake actuated by the power of

the vehicle and the common controlling device for said brake and the motor.

Electric Railroad Track Cleaner—Hugh O'Connor, Passaic, N. J. No. 508,743.

Combines with a vehicle, a swinging arm pivotally secured thereto, a reversible metallic shoe secured to the lower end of said arm and provided with a brush and a rubber scraper, with means for operating the same.

Electric Brake for Railways—Armand de Bovet, Paris, France. No. 508,805.

A brake having a groove in its working face, an electric coil arranged to magnetize the parts of the pulley separated by said groove, a flexible plate carrying iron brake shoes entering said groove in the pulley and a circuit for the coil.

Life Preserving Guard for Cars—Anton Knoblauch, Minneapolis, Minn. No. 508,888.

A life guard immovably secured to the end of the car, consisting of an upright portion and a lower and outwardly projecting portion, springs extending longitudinally and transversely between the ends of said parts, and a flexible facing covering said spring and having a corrugated surface.

Removable Front for Street Cars—Preston W. Lupher, Pittsburgh, Pa. No. 508,892.

A detachable weather guard for street and other railway cars, consisting of a frame fitted with glass and constructed to conform to the contour of the overhanging portion of the roof, an outwardly flaring plate arranged at the base of the frame adapted to fit neatly above the apron of the platform, and means substantially as described for attaching the said guard in position.

November 21.

Electric Railway Conduit—Granville T. Woods, New York, assignor to the Universal Electric Company of the City of New York. No. 509,065.

Comprises in an electric railroad system, an insulated lead or leads of the main circuit, a series of boxes having interior contact devices with which the main circuit is connected, each box being charged with oil or other insulating fluid in which the contacts are immersed, and having a porous medium or portion through which the oil exudes and coats the exterior of the box and its connections, and a switch arm carried by the box and controlling the inclosed main circuit contacts, and adapted to be operated by a contact brush or device carried by the passing car.

Electric Railway—John H. Dale, New York, assignor to the Universal Electric Company of the City of New York. No. 509,072.

Comprises in an electric railway a fixed closed box, its contained contact with which the insulated lead of the circuit is connected, a shaft partly inclosed within and having its bearing in the box, its contact within the box, a spring within the box and acting upon the shaft to maintain its normal position, and a laterally projecting switch contact arm adapted to be operated by and make contact with the contact shoe of a passing car.

A Trolley Mechanism—James T. Fuller, Calvert, Texas. No. 509,123.

A trolley pole having a yoke pivotally mounted thereon and provided with wings adapted to engage with said pole and limit the pivotal motion of said yoke.

Supply System for Electric Railway—John C. Henry, New York. No. 509,312.

Embraces in an electric railway a track composed of insulated sections, continuous line conductors, branch circuits from said line conductors including the primaries of converters, and local circuits from the track sections including the secondaries of said converters, and adapted to be completed on the passage of the car.

November, 28 1893.

Conduit Electric Railway—Adolph Worner, Buda-Pesth, Austria-Hungary, assignor to Siemens & Halske, Berlin, Germany. No. 509,421.

Embraces a subway including a series of yokes, each made in a single piece and comprising top horizontal bearing portions having adjacent vertical flanges, a traction and a guard rail mounted and secured on the said bearing portion respectively and provided with under shoulder to engage the said vertical flanges of the yoke; together with current conductors located oppositely in the same horizontal plane in said subway.

Conduit Electric Railway—Edward H. Johnson, New York. No. 509,622.

A conduit for electric railways, having a conductor chamber, the diameter of which increases continuously from its surface opening to its bottom, and said opening being the full width of the chamber at that point.

Car Fender—Ivory Bean, Brooklyn, Mass. No. 509,646.

A car fender composed of a series of bars shaped to form a forwardly extended crane, and a series of independently yielding wings or plates attached at their upper end to the frame and extended downwardly to a point just above the track, each of said wings or plates being adapted to yield at its lower end, while its upper end remains in a fixed position.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. The Street Railway Publishing Company, Havemeyer Building, New York.

WHAT IS "SHORT LAP" BELTING?

In the broad sense of the term, "short lap" would seem to indicate two short laps joined together. This is, however, erroneous as applied to belting. Most belt users are, doubtless, aware of this, but in order to avoid any misconception of the term, the Chas. Munson Belting Company makes the following explanation: The cut shows the part of the hide used in the construction of the company's Eagle belt. It will be apparent at a glance that these centers do not embrace any portion of the shoulder which lacks firmness and substance, but consist only of the best part of the hide, embodying uniformity in thickness and tensile strength. No centers exceeding four feet two inches long when cut from the rough part of the hide, as shown in the cut, are used. This represents the best stock obtainable for leather belting, and is called "short lap." A great deal of so called first class belting sold as "short lap," it is said, contains a large portion of the shoulder, which, aside from an inferior tannage, has other serious defects, caused by the inequality of substance and tensile strength, rendering the life of such a belt of very brief duration. This is one of the reasons why the Munson Eagle belt



has gained the reputation it possesses. It is strictly short lap, faultlessly constructed and guaranteed to give the best satisfaction.

The makers claim that ever since the introduction of the Munson belt there has never been a piece found in the belts longer than four feet two inches.

This company reports trade picking up wonderfully within the past two weeks, having received a number of large orders. The company's general trade is also picking up, and on account of the introduction of improved machinery and present capacity, it is in shape to conveniently increase its trade and execute all orders promptly. This company guarantees no delay in the prompt execution of orders, all of which have the proprietor's personal attention.

Comfort For Passengers.

Street car passengers now demand greater comfort, as well as greater speed, than formerly—much as it seems to be a necessity of the times in railroad travel.

The whole equipment of the railroads has been immensely improved within a very few years, and street and elevated cars are the next to demand reasonable comforts, such as comfortable seats, good light, speed, warmth and ventilation. Nothing is more conducive to the passengers' comfort than a comfortable and roomy seat; this the new Scarritt street car seat supplies. This seat faces in the direction the car travels; it is high backed, deep and spring seated, and the passenger enjoys a privacy which is impossible in old style seats.

The Lindell Railway, of St. Louis, has had in use for some time between 300 and 500 of these seats, and an extract of a letter from the general superintendent reads as follows: "Your seats are giving entire satisfaction, and I trust we shall always have the same favorable opinion that we now have." This seat is manufactured by the Scarritt Furniture Company, of St. Louis, at its car seat factory. It has equipped nearly 200 of the steam railroads of this country, as well as roads in ten foreign countries.

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	113	114
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	100	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	100	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	100	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	100	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	101	.....
" " " Debenture	1891	200,000	M. & N.	6	1901	113	.....
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	108	111
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	108	111

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Dec. 18. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	1,000,000	Quart.	3	.....	82½	87½
Union Pass. Ry. Co	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	17	17½

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry	1882	250,000	J. & J.	6	1912	107	108
" " " cons. mort	1892	500,000	.....	5	.....	107	107½
Union Ry. Co. 1st mort	.....	50,000	M. & N.	6	.....	102	105
City & Sub. Ry. Co. gen. mort	.....	1,500,000	J. & D.	5	1922	100½	101
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	105	107½
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D.	5	1942	100	100⅜
" " "	1891	1,250,000	M. & S.	6	1901	102¼	102½
City Pass. R. R. Co	1891	2,000,000	"	5	1911	109⅜	110

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. Dec. 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,400,000	J. & J.	4	1887	79	80
West End Com'n	50	9,085,000	J. & J.	3	1890–1892	52	53

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co. 215 Montague Street, Brooklyn, Dec. 18. Stock quotations are per cent values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broooklyn City R. R. Co	10	6,000,000	Q.—J.	2	Ex. rights	165	.....
Brooklyn Traction Co., pref	100	3,000,000	.....	...	1893	.....	70
" " common	100	6,000,000	.....	...	1893	16	.....
Coney Island & Brooklyn R. R. Co	100	500,000	Oct. 1.	4	.....	.....	165
Long Island Traction Co	100	30,000,000			1893	20	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co	1893	3,000,000	.....	...	.....	.....	.....
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	.....	102
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	.....	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	104	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st	.....	3,000,000	J. & J.	5	July, 1916	108	.....

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Dec. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	0	.....	.....	65
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	7

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 167 Dearborn Street, Chicago, Ill., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$7,000,000	Q.—J.	3	.....	327	329
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,000,000	J. & J.	4	.....	249	251
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	10,000,000	Q.—F.	1½	.....	148	148½

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	100	.....
Chicago Passenger	1883	400,000	F. & A.	6	1903	102	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	96	.....
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	96	.....
West Chicago Street	.....	4,160,000	M. & N.	5	.....	100	101
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	.....	100
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	101	101¼

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Dec. 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,750,000	Q.—J.	5	.....	100½	101
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	101¼	102
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	50	65
" " " Pref.	100	100,000	.....	6	.....	75	85
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	-	.....	21½	23

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1894	100	.....
" "	.....	50,000	J. & J.	7	July, 1895	101½	104
" "	.....	50,000	J. & J.	7	July, 1896	102½	105
" " extended	.....	100,000	J. & J.	4	.....	96	99
	.....	150,000	J. & J.	5	.....	99½	101
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	102	103½
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	110	112½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	105½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104¼	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	105	109
" " " "	.....	300,000	J. & J.	6	Jan. 1914	100½	101
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	.....
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	109	112

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Dec 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co	100	12,000,000	.....	....	1893	50	55
The Cleveland City Ry. Co	100	8,000,000	.....	....	1893	55	58

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	.05	1910	101	102⅛
" " City " "		2,349,000	.....				

DETROIT STOCKS.—Corrected by Cameron Currie & Co., Bankers and Brokers, 82 Griswold Street, Detroit, Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	100	110
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. Mackintosh & Co., Bankers, Holyoke, Mass. Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.	100	1,000,000	J. & J.	4	.....	225	250
Holyoke Street R. R.	100	250,000	J. & J.	4	.....	225	250
Northampton Street R. R.	100	50,000	.....	...	.....	100	125

LOUISVILLE STOCKS AND BONDS.—Corrected by Almstedt Bros. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref.	100	$1,000,000	A. & O.	5	Jan. 1891	84	85
Louisville St. Ry. Co., com.	100	5,000,000	.....	...	Jan. 1891	33	34

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	96	96½
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	111	112
Central Passenger Ry. Co.	1888	400,000	M. & N.	6	1908	111	112
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	90	100

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. Warren & Co., Bankers and Brokers, New Haven, Conn. Dec. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$400,000	J. & J.	4	.....	50	55
State Street Horse R. R. Co.	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	...	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.	100	140,000	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.	100	200,000	J. & J.	3	.....	125	.....

Bonds.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co.	1874	20,000	J. & J.	7	Jan., 1894	104	.....
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Horse R. R. Co.	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by George Le Sassier, 174 Common Street, New Orleans, La., Dec. 22. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.	100	1,200,000	Quart.	1½	1867	133½	137
Crescent City R. Co.	100	1,150,000	"	1½	.866	99½	101
Canal & Claiborne R. R. Co.	40	240,000	.....	2½	1888	43	45
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	127	132
Orleans R. R. Co.	50	185,000	"	2	1868	.....	62
St. Charles Street R. R. Co.	50	600,000	"	2	1863	75½	77½

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	105	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	100	.....
do do new	1886	40,000	M & N	6	1896	100	.....
N. O. City R. R. Co.	1879	416,500	J & D	6	1903	.....	118
N. O. & Carrollton R. R. Co.	1882	250,000	F & A	6	'97-'06	.....	.....
St. Charles Street R. R. Co.	1881	120,000	J & D	6	'92-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by Gordon Strathy & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, Dec. 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$2,000,000	M. & N.	4	May, '91.	162	163½

Bonds.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.	1885	£60,000	.....	5	1905	.....	.....

NEW YORK STOCKS AND BONDS.—Corrected by James McGovern & Co., 6 Wall St., New York, Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry	100	900,000	J. & J.	¾	.....	.....	30
Broadway & Seventh Avenue	100	2,100,000	Q.—J.	2½	.....	.....	180
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	135	.....
Central Crosstown	100	600,000	Q.—F.	1¾	.....	135	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	120	125
42d & Grand St. Ferry	100	748,000	Q.—F.	4	.....	300	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	.....	67
Eighth Avenue	100	1,600,000	Q.—J.	3	.....	240	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue	100	1,862,000	Q.—J.	1	.....	.....	102
Sixth Avenue	100	1,500,000	Q.—J.	1¾	.....	.....	215
Third Avenue	100	5,000,000	Q.—M.	4	.....	138	140
23d St.	100	600,000	Q.—F.	2½	.....	.....	300
Ninth Avenue	100	800,000	Q.—J.	1½	.....	123	.....
Union Railway Co.	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry	.....	700,000	J. & J.	7	July, 1900	.....	108
B'way & 7th Ave., 1st mort.	.....	1,500,000	J. & D.	5	June, 1904	100	.....
2d mort.	.....	500,000	J. & J.	5	July, 1914	100	.....
Broadway Guaranteed 1sts	.....	1,125,000	J. & J.	5	July 1924	100	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	90	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort.	.....	250,000	M. & N.	6	Nov., 1922	115	.....
Dry Dock, E. B'way & Battery. 1st mort.	.....	840,000	J. & D.	7	June, 1893	105	.....
Scrip (can be called at par)	.....	1,200,000	F. & A.	6	Aug. 1914	.....	.....
42d St. Manhat. & St. Nich. Av 1st mort.	.....	1,200,000	M & S.	6	Sept., 1910	108	.....
2d mort. income bonds	.....	1,200,000	J. & J.	6	1915	.....	65
Eighth Ave., Scrip	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.	.....	1,600,000	M. & N.	5	Nov., 1909	.....	102
Third Avenue	.....	5,000,000	J. & J.	5	Jan., 1937	105	.....
23d St.	.....	250,000	M. & N.	7	May, 1893	100	.....
Union Railway Co.	.....	2,000,000	F. & A.	5	Feb., 1942	.....	103

PHILADELPHIA SECURITIES.—Corrected by Huhn & Glendinning, 143 South Fourth st. (Bullitt Building), Philadelphia, Dec. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'	50	$500,000	Q.—J.	4	1858	265	270
Continental	50	1,000,000	J.—J.	6	1873	120	124
Frankford & Southwark	50	1,250,000	Q.—J.	5	1854	335	340
Germantown	50	1,500,000	Q.—J.	2¾	1858	108	112
Green & Coates	50	500,000	Q.—J.	3	1858	121	125
Hestonville	50	2,050,000	.....	...	1859	40	45
Lombard & South	25	500,000	A.—O.	8	1861	80	90
People's Traction Co.	50	10,000,000	.....	...	.....	28	29
Philadelphia City	50	1,000,000	J.—J.	7½	1859	150	153
Philadelphia & Gray's Ferry	50	617,500	J.—J.	3½	1858	75	79
Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	84	86
Ridge Avenue	50	750,000	Q.—J.	5	1872	225	235
Second & Third	50	1,060,200	Q.—J.	5	1853	205	215
Thirteenth & Fifteenth	50	1,000,000	J.—J.	9	1858	212	225
Union	50	1,250,000	J.—J.	9½	1864	185	200
West Philadelphia	50	750,000	J.—J.	10	1857	190	195
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	106¼	107
Baltimore Traction	25	5,000,000	.....	1	1889	16¾	17
Buffalo (N. Y.) Railway	100	6,000,000	.....	...	.....	40	55
Newark (N. J.) Passenger	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	16	17

Bonds.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	105	106
" " Imp.	1892	1,250,000	M.—S.	6	1901	104	105
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	105	106
Germantown, 1st mort.	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort.	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr 306 Times Bldg., Pittsburgh, Pa., Dec. 18. Stock quotations are prices pe share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	..	.....	20	20¾
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	60	60½
Pitts. & Birmingham R. R. Co	.....	3,000,000	.....	...	.....	14¾	15
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	55	58
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	17⅝	18
Pittsburgh, Allegheny & Man	.....	3,000,000	.....	1½	.....	37¾	38½
West End R. R. Co.	50	200,000	J. & J.	...	.....	.....	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	.....	3,000,000	.....	...	.....	21½	22½

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O.	5	1927	106	106¾
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	102	105
Pitts. & Birmingham Traction Co.	1893	.....	.....	7	.....	96	97
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	101	102
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	99	100
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	100	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1922	101	102½
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	90	92
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incl'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Incl'e Plane Co	1887	50,000	A. & O	5	1892	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS Bankers, Providence, Dec. 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	..	.....

BONDS.	Date of Issue	Amo'nt Out-stand'g	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	..	100
Newport St. Ry. Co.	.....	50,000	.....	5	1910	102½	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Dec. 18.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	25	35
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	43	48
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	20	35
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	25	35
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	.....	95
do do Common.	100	4,000,000	.....	...	1892	15	20
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	.....	100
do do Common.	100	3,000,000	.....	...	1892	20	30
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	39	40

BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	88	95
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	95	99
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	91	92
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	88	93
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	85	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	5	.....	.....	109
Central R. R. Co.	100	1,000,000	.....	...	.....	.....	.....
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	.....	90
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	50	.....
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	16¾	17⅞
Omnibus Cable Co.	100	2,000,000	Monthly	4	.....	55	66
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	.....	20

Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	.....	100
Market Street R. R.	.....	3,000,000	J. & J.	6	1913	119	120
Omnibus R. R.	.....	2,000,000	A. & O.	6	1918	110	111
Powell Street R. R.	.....	700,000	M. & S.	6	1912	.....	118
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	.....	115
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	92	.....
Cal. St. Cable R. R.	.....	.....	.....	5	.....	.....	103

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., Dec. 18. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	50	50
Citizens'	100	1,500,000	Oct. '92	4	1887	76	86
Jefferson Avenue.	100	112,000	Dec. '88	2	1885	125	150
Lindell	100	2,500,000	.....	...	1890	63	65
Missouri.	100	2,000,000	Q.—J.	2	1891	180	200
People's.	50	1,000,000	Dec. '89	50c	1889	15	25
St. Louis.	100	2,000,000	J. & J.	3½	1890	155	160
Fourth Street & Arsenal.	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	.....	...	1890	150	200
St. Louis & Suburban.	100	2,500,000	.....	...	1891	30	40
Southern, Pfd.	.....	800,000	.....	...	.....	90	92
" Com.	.....	700,000	.....	...	.....	82	85

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	95	98
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	102	103
Fourth St. & Arsenal.	1888	50,000	J. & J.	6	1898–1903	.....	100
Lindell	1890	1,500,000	J. & J.	5	1895–1910	96	98
Missouri Cable.	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	85	90
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable.	1889	800,000	J. & J.	6	1889–1914	90	95
St. Louis Cable.	1890	1,500,000	M. & N.	5	1900–1910	99	102
Union Depot.	1890	4,000,000	A. & O.	6	1900–1910	104	105
Southern.	1884	200,000	M. & N.	6	1904	100	102
Southern.	1889	300,000	M. & N.	6	1909	100	105
St. Louis & Suburban.	1891	1,400,000	F. & A.	5	1921	95	97
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	70	75

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Nov. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	255	335
Metropolitan R. R.	50	750,000	Q. J.	2	1864	80	90
Columbia R. R.	50	400,000	Q. M.	1	1870	.....	75
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	.....	25
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	.....	25
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	30
Rock Creek R. R.	100	401,700	.....	...	.....	.....	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'ton & Geo'town conv't.	'83–'91	3,000,000	J. & J.	6	1899-1929	150	155
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	.....	100
Capitol & North O St. R. R.	1921	240,000	J. & J.	6	1921	90	103½
Metropolitan R. R. convert.	1901	200,000	J. & J.	5	1901	100	.....
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....
				6			

Financial.

THE Fort Lee (N. J.), Leonia & Hackensack Electric Railway Company has been placed in the hands of a receiver by Chancellor McGill. The railroad company has laid about a mile of track.

$ $ $

THE Lynn (Mass.) & Boston Railroad Company has asked permission to lease all the rights, franchise and property belonging to the Boston & Revere Electric Street Railway Company.

$ $ $

THE directors of the West End Street Railway Company, of Bos-

ton, have declared a dividend of 3 per cent. on common, and 4 per cent. on preferred, payable January 1. This is a reduction of 1 per cent. on common.

$ $ $

THE Sioux City street railway companies, it is reported, will combine. A new company has been organized in that city by John Pierce, A. E. Pierce, Peter and Chrys Moller and H. A. Johns. The company is capitalized at $1,000,000, with offices in New York and Sioux City.

$ $ $

THE Connecticut State Board of Equalization has increased the value of the following New Haven street railway stocks for taxation as follows: Fair Haven & Westville Horse Railroad Company, from $25 to $40 per share; State Street Horse Railway Company, from $25 to $30.

$ $ $

CHARLES GREEN, president of the People's Railroad Company, of St. Louis, has issued a call for a meeting of the directors of that corporation to authorize the issue of $150,000 gold bonds. The object of this is to convert the Fourth Street & Arsenal Street Railroad from horse cars to an electric line.

$ $ $

THE Union Street Railway Company, of New Bedford, Mass., appeared before the railroad commissioners December 18, on a petition for permission to increase the capital stock of the company to the sum of $240,000, and for permission to issue $500,000 of first mortgage or consolidated mortgage bonds.

$ $ $

THE Paterson (N. J.) Railway Company submits the following statement of its operations for November: Gross earnings, 1893, $18,680.51; 1892, $20,950.26; decrease, $2,269.75. Operating expenses, 1893, $11,838.71; 1892, $12,927.41; decrease, $1,088.70. Net earnings, 1893, $6,841.80; 1892, $8,022.85; decrease, $1,181.05.

$ $ $

THE Columbus (O.) Street Railway Company submits the following statement of its operations for November: Gross earnings, 1893, $41,150.25; 1892, $37,004.27; increase, $4,145.68. Operating expenses, 1893, $24,182.41; 1892, $23,388.86; increase, $793.55. Net earnings, 1893, $16,967.84; 1892, $13,615.71; increase, $3,352.13.

$ $ $

THE Pittsburgh (Pa.) & Birmingham Traction Company submits the following statement of its operations for October: Gross earnings, 1893, $25,123.78; 1892, $29,681.61; decrease, $4,557.83. Operating expenses, 1893, $13,578.07; 1892, $13,295.42; increase, $282.65. Net earnings, 1893, $11,545.71; 1892, $16,386.19; decrease, $4,840.48.

$ $ $

THE Lynn & Boston Street Railway Company reports for the year ended September 30 as below, the returns including the East Middlesex road from May 1, 1893: Gross earnings, $1,136,653; operating expenses, $815,838; net earnings, $320,815; charges, $224,977; balance, $95,838; dividend (8 per cent.), $80,000; surplus, $15,838; total surplus, $77,748.

$ $ $

THE North Shore Traction Company, of Lynn, Mass., submits the following statement of its operations for October: Gross earnings, 1893, $94,852.75; 1892, $87,975.07; increase, $6,867.68. Operating expenses, 1893, $62,868.09. Net earnings, 1893, $31,974.66. We are unable to give the operating expenses and net earnings for 1892, as the various companies now comprising the system were operated separately.

$ $ $

THE following is an abstract of the showing made by the Lowell (Mass.) and Suburban Street Railway Company to the railroad commissioners: Gross income, $272,961.50; operating expenses, $185,382.73; taxes, $4,522.17; interest, $45,021.85; dividends, $21,000. Surplus for year, $21,556.92; total deficit, $8,827.19; capital stock, $400,000; funded debt, $905,000; unfunded debt, $365,255.43; cash assests, $65,539.69; total property assets, $1,670,255.43. Miles run during year, 1,276,257; passengers carried, 5,573,627.

$ $ $

THE annual report of the United Electric Railway Company, of Nashville, Tenn., submitted December 12, 1893, showed that the company had a satisfactory business during the past year. The aggregate number of passengers hauled, from November 30, 1892, to November 30, 1893, was 6,481,193 as against 6,616,230 for the preceding twelve months. The expenses were reduced over $5,000 as compared with last year, and the percentage of operating expenses to gross earnings is estimated to be 59.91 per cent.

$ $ $

THE agreement of consolidation between the Houston, West Street & Pavonia Ferry, the Broadway and the South Ferry railroad companies, of NewYork city, was filed December 14 with the county clerk. The name of the new company will be the Metropolitan Street Railway Company. The capital stock of the new company is to be $8,200,000. The directors of the company are: Herbert A. Vreeland, Daniel B. Hasbrouck, Thomas F. Ryan, Charles E. Warren, R. Somers Hayes, Albert W. Fletcher, Hans S. Beattie, Henry A. Robinson and Ralph L. Anderton, Jr. Mr. Vreeland is president, Mr. Hasbrouck, vice-president; Mr. Robinson, second vice-president; Mr. Beattie, treasurer, and Mr. Warren, secretary.

$ $ $

THE annual meeting of the Philadelphia Traction Company was held November 28, at the office of the company, 41st and Haverford Streets. W. L. Elkins presided. The annual report of the company shows the following: Receipts, $4,986,838.55. Operating expenses, $3,310,498.24; rentals, $1,283,590.65; total, $4,594,088.89. Balance, $392,749.66. It also announced a cancellation of thirty-five collateral trust bonds. The annual election of directors, resulted as follows: P. A. B. Widener, William L. Elkins, Thomas Dolan, James McManes, Joseph B. Altemus, George W. Elkins. After the meeting the directors met and organized by electing P. A. B. Widener, president; William L. Elkins, first vice-president; George D. Widener, second vice-president and D. W. Dickson, treasurer. The Board adopted a resolution declaring a dividend of $1.50 per share, payable December 11, 1893.

$ $ $

THE annual report of the Union Street Railway Company, of New Bedford, Mass., for the year ending September 30, shows the total income from the road to be $182,463.90. The total operating expenses and taxes were $134,587.86, leaving a net income of $47,876.04. The total interest accrued during the year was $7,087.46, leaving, after paying out $18,200 as a 7 per cent. dividend, a surplus of $22,588.58. A year ago the surplus was $8,435.08. The income of $182,463.90 is made up from the following sources: Passengers, $180,673.33; sales of manure, $540.03; advertising, $615; sale of old iron, $372.62; rents, $16.12; pigs sold, $233.76; miscellaneous, $13.04. The expenses of $134,587.86 are itemized as follows: Salaries of general officers and clerks, $5,511.54; general office expenses and supplies, $1,253.03; legal expenses, $370; insurance, $3.584.81; lighting, $447,43; miscellaneous operating expenses, $4,144.65; repairs of road bed and track, $2,125.85; repairs of electric line construction, $548.04; removal of snow and ice, $1,189.73; repairs of buildings, 1.794.05; repairs of cars and other vehicles, $3,923.02; repairs of electric equipment of cars, $917.39; renewal of horses, $4.296.69; harnesses, horse shoeing and veterinary care, $416.93; sundry stable expenses, labor in stable and shops, $16,704.10; provender, $24,747.04; electric motive power, $10,286.88; wages in conducting transportation, $45,200.18; damages for injuries, $379.81; bedding, $854.67; repairing registers, $113.15; repairs of electric station equipment, $78.11; miscellaneous electric expenses, $98.46; taxes, $5,602.30.

$ $ $

J. & W. SELIGMAN & COMPANY, who are financiering the consolidation of the Brooklyn Traction and Long Island Traction Companies, in a recent interview with a Boston News Bureau representative said: "Now that the stockholders of both companies have agreed to the consolidation it will be rapidly pushed to completion. Eventually the consolidation will include every road in Brooklyn, similar to the West End Company, of Boston. The Brooklyn and Long Island Traction companies now represent over three-quarters of the Brooklyn roads, and the DeKalb Avenue Company, the next largest road, of which Gen. Louis Fitzgerald is president, will, in all probability, come in under the new plan. The capital stock of the Long Island Traction Company will be increased from $30,000,000 to $42,000,000 (which will cover the $20,000,000 bonded indebtedness of the Brooklyn Traction Company), and this capital stock is large enough to include any other companies that may be united with the Long Island Company. There will be no preferred stock, and no bonds, with the exception of the bonds issued to cover the indebtedness of the Brooklyn Traction Company and 5 per cent. bonds to be exchanged for the preferred stock of the Brooklyn Traction Company. By operating the roads under one management a considerable saving can be made in operating and administrative expenses."

$ $ $

THE Broadway & Seventh Avenue Railroad Company, of New York, has recently issued $12,500,000 first consolidated, 5 per cent., fifty year bonds, principal and interest payable in gold, secured by mortgage to the New York Guaranty & Indemnity Company, trustee. The bonds are sold by the Central Trust Company and the New York Guaranty & Indemnity Company, at 98½ per cent. and interest. Of the total amount of bonds $4,850,000 are to be held by the trustee, for the purpose of acquiring all underlying bonds upon the railroad lines.

This mortgage is a first lien upon the entire line of cable railroad from 59th Street through Seventh Avenue and Broadway to the Battery, and upon the power house properties, consisting of the block of land bounded by the Sixth and Seventh Avenues and 50th and 51st Streets, and the property on the northwest corner of Broadway and Houston Street, and upon the other lines of railroad of the Broadway & Seventh Avenue Railroad Company, and upon all the personal property and equipment of said railroad company, subject only to unmatured underlying liens upon the railroad lines, to the amount of $4,850,000, and to real estate mortgages to extinguish which $1,125,000 in cash is now on deposit with the trustee of the mortgage. The titles to the power house properties have been insured by the Title Guarantee & Trust Company to the amount of $4,000,000. The president of the Broadway & Seventh Avenue Railroad Company certifies as to the present earning capacity of the road as follows: "In relation to the earning capacity of the Broadway & Seventh Avenue Railroad Company to meet the interest on the issue of $7,650,000, 5 per cent. bonds, which you have purchased, I beg to state that the net earnings of the company, after deducting interest on underlying bonds, all operating expenses, liabilities, and rentals of every kind, are at present not less than two and a half times the amount necessary to pay the interest upon the bonds above referred to."



Snow Sweeper with full length cab, the motorman operating same on the inside. Same as built by us for Scranton Traction Co.

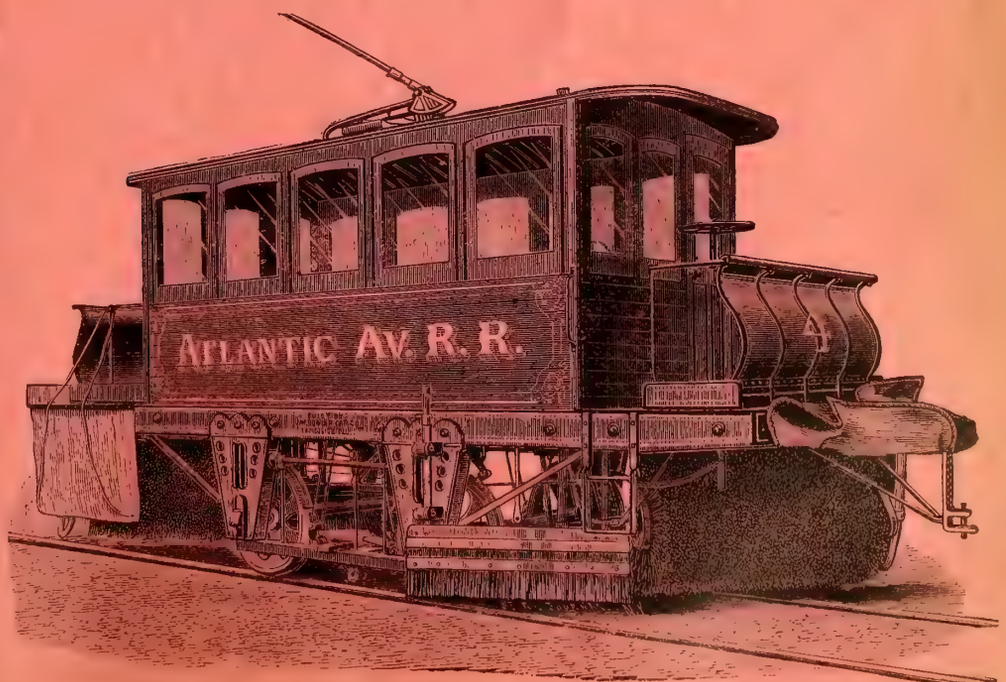
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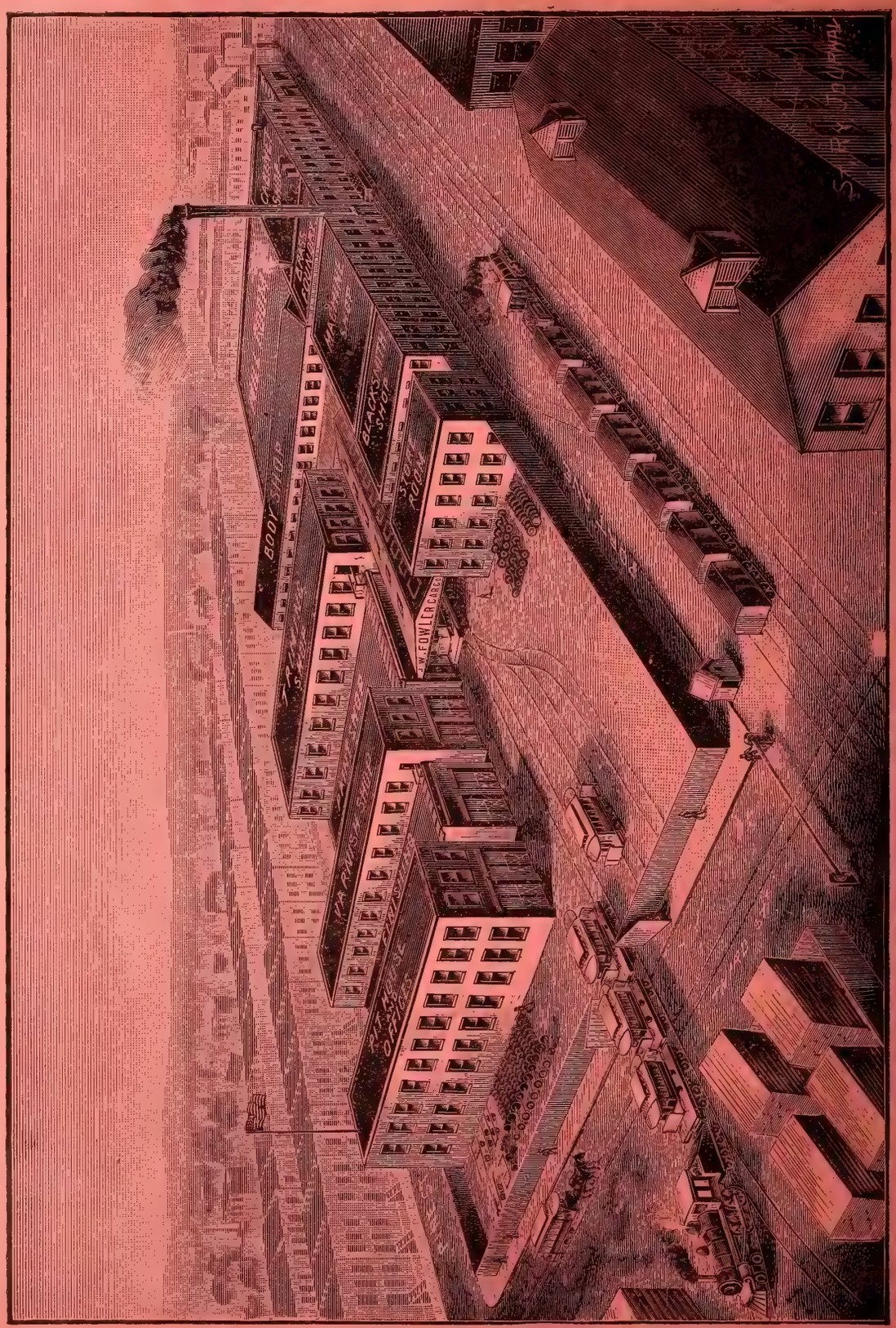
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A New Departure for the Walker Manufacturing Company.

One of the most important events which have taken place in the electrical world during the past year has just been consummated, and no doubt will cause more general comment than anything which has occurred within the past two or three years.

The formal announcement has just been made that the immense works of the Walker Manufacturing Company, of Cleveland, O., which has been actively engaged in the manufacture of cable railway machinery, and which has been described in former issues of the STREET RAILWAY JOURNAL, is now making the necessary additions to its plant for the manufacture of the latest and most powerful types of generators and motors for electric railway and power transmission purposes ever constructed, not only in the United States, but in foreign countries. The Walker Manufacturing Company's facilities for large work are of the best, and the company has produced some of the largest pieces of machinery ever made in this country. It has cast safely and with ease a forty-two ton casting, and has a capacity to make a sixty ton casting, if needed; from this, some idea may be gained of its possibilities of handling the largest generators that may be required.

The plant, with its many additions, now occupies fully thirteen acres of ground. The location in Cleveland is unsurpassed, that city possessing great natural advantages for manufacturing. The buildings are of brick, fronting upon Waverly Avenue, and occupy a commanding view of Lake Erie. The idea which one gets upon a survey of the Walker Manufacturing Company's works is, immensity; and this idea is fully sustained by the modern machinery with which the plant is equipped.

The machine shop, which is said to be the finest in the United States, is 171 ft. wide, divided into three bays, each 57 ft. In length, two of the bays are 280 ft., and the third 430 ft. From the floor to the highest part of the roof is 54 ft.; msssive wrought iron pillars support the roof which is of iron and glass, thus affording plenty of light. In each bay is a thirty ton, rope power, traveling crane manufactured by the Walker Manufacturing Company for its heavy work.

In Bay A most of the fitting and erecting is done. In this bay are arranged all the drill presses and similar tools used in fitting and finishing work. Large pits, walled and paved with bricks, are arranged for erecting work in them that would otherwise be inconvenient to get at. A thirty ton crane travels the entire length of this bay. In Bay B are arranged all the large lathes, planers and floor boring machines. One of the planers is 10 × 25 ft., and can use four tools if necessary. The floor boring and milling machine has a capacity of fourteen feet horizontal and a six foot vertical lift and a six foot feed horizontally. The floor bed outside of the machine proper is 20 × 20 ft. Numerous lathes, planers and shapers are found in this bay. A thirty ton crane travels the entire length of this bay also. In Bay C are boring mills of the following sizes: 7 ft., 10 ft , 14 ft., 16 ft. and 16 to 24 ft. capacity. Horizontal boring and other machines, also a ten foot Gleason gear planer capable of cutting spur or bevel gears thirty inches face. The immense pit lathe with which all the large gears, belt and rope pulleys have been turned is in this bay. The large girders of the lathe are ninety feet long. All the driving gears of this powerful tool are of cast steel. Two thirty-two foot diameter by eight feet six inches rope pulleys, each 104 tons, have been turned in this lathe at one time. A depressed railroad track from the L. S. &. M. S. R. R. runs across this bay, so that cars and locomotives can run into the shop. Two immense platform scales are also arranged at this point for weighing shipments. Work is transferred from machines, scales, to or from railroad cars, with another thirty ton crane which travels the entire length of the bay, 430 ft.

In the matter of complete cable plants the company has supplied fully twenty different roads, among which are included roads in Australia and England.

Although it may be an old story by this time, the capacity of the works for turning out spur gearing is worthy of repetition. A machine cut spur gear of 192 teeth, claims the distinction of being the giant wheel of its kind ever placed in use, as will be seen by the following dimensions: 30 ft. 6 ins. pitch diameter; 30 ins. face, 6 ins. pitch; 27 ins. bore; diameter of hub, 9 ft. 2 ins., weight of hub, 15 tons; weight of gear, 65.75 tons. This wheel was shipped by the Walker Company to the diamond mines of South Africa.

The metal for both foundries is supplied from four Walker improved cupolas of the following dimensions: Two, 60 ins. in diameter; one, 72 ins. in diameter; one, 84 ins. in diameter, affording a capacity of 80 tons of metal per hour.

The cupolas are built upon a scientific plan of economy, and melt an average of 13.10 lbs. of iron per pound of coke. The air is supplied from a three cylinder, vertical blowing engine. Hydraulic power is used for breaking metal and elevating all the necessary coke, iron and lime stone. The elevator will raise a load of six tons, the power being developed in a fourteen inch accumulator of fourteen feet stroke, with an average pressure of 1,000 lbs, to the square inch. The ovens are 24 × 30 ft., 20 × 30 ft., and 18 × 25 ft., respectively. They are, of course, of the latest design, and it is almost unnecessary to add that gearing and crank handles serve to operate the carriages. Large casting pits are located at various parts of the foundry floor, ranging from twenty-four to twelve feet in diameter, and reaching a depth of twenty-five feet. The capacities of the crane ladles vary from three to twenty five tons.

Inasmuch as a good share of the work done in constructing electrical machinery consists in castings, the foregoing description of its foundry will indicate the superior facilities of the Walker Manufacturing Company in its new department.

The type of motor to be offered by the Walker Manufacturing Company will, it is believed, elicit marked commendation, and will admittedly be a distinct advance on existing machines. In the past there has been a somewhat universal feeling that the weight of the apparatus has been greater than either strength or electrical efficiency demanded.

This imperfection in other machines results very largely from an improper distribution of the metal. With the new generators and motors of the Walker Manufacturing Company, particular care has been used in designing the castings, so that the maximum of strength and electrical efficiency, with the minimum of weight, may be obtained. It is confidently believed, that as regards these three important features—lightness, efficiency and strength—the Walker Manufacturing Company's motor will be appreciated by those interested in electrical power and traction.

H. McL. Harding, of New York, and J. L. Barclay, of Chicago, are interested with the Walker Manufacturing Company in this department. Their continuous connection with the business of selling and manufacturing electric railway appliances from the very inception of the industry, renders them well fitted for what they have undertaken. Having been connected with the Sprague Company, in 1887, and afterwards with the Westinghouse Company, their exceptional and rare experience has enabled them to know thoroughly the faults of existing machinery, and is a practical assurance that the new type to be manufactured by the Walker Manufacturing Company will come as near perfection as human ingenuity and experience can produce. From the facts just stated, it is quite apparent that the machinery now being manufactured will not in any way be experimental.

John Walker, the founder, vice-president and general manager of the company, has had an exceptional and uniformly successful experience as a practical and mechanical engineer. He is a native of England, but has been a resident in this country for twenty-five years. Mr. Walker has taken out sixty-two patents for valuable machinery and mechanical devices, but his fame may be said to have been made upon his invention of differential drums for cable roads.

J. B. Perkins, president of the company, is one of the best known business men in Cleveland and elsewhere. His great wealth has made him a prominent factor in financial circles, while his executive abilities have long been recognized in the many enterprises with which his name has been associated. W. H. Bone and Z. M. Hubbell, respectively manager and treasurer of the company, have occupied their present positions for several years.

In the electrical power and traction department, Mr. Harding will be in charge of the Eastern business, with headquarters in New York. Mr. Barclay will have the management of the Western business, located in Chicago.

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Railway Statistics.

This topic is discussed at considerable length in the Seventh Annual Report of the Interstate Railroad Commission, just issued. The total railway mileage on June 30, 1892, was 171,563.52 miles, an increase of 3,160.78 miles; the total number of railway corporations was 1,822, being a net increase of 37 during the year; 899 maintained independent operating accounts, and 712 were independent operating companies. Of the 761 subsidiary roads, 320 were leased for a fixed money rental and 186 for a contingent money rental; 9 roads were abandoned. There were 19 mergers, 17 reorganizations and 16 consolidations. The capitalization of roads reported was $10,226,748,134. There were 560,958,211 passengers and 706,555,471 tons of freight reported as carried during the year ending June 30, 1892. The gross earnings reported were $1,171,407,343, and the operating expenses were $780,997,996, leaving net earnings of $390 409,347, to which add $141,960,782 as income to railways from investments. After payment of $416,404,938 as fixed charges, $97,614,745 was paid in dividends, and $4,314,390 in other payments, leaving a surplus of $14,036,056. The passenger revenue for the year was $286,805,708; and freight revenue amounted to $799,316,042. There were 821,415 persons employed in railway service at the end of that year, of whom 2,554 were killed in accidents and 28,267 were injured. 376 passengers were killed, and 3,227 were injured. Earnest recommendation is made for an amendment providing a penalty for the failure of carriers to file their annual reports within a specified time.

Of Interest to Travelers.

The Baltimore & Ohio Railroad announces that it has placed on sale round trip tickets at reduced rates to the winter resorts in Florida and the South, and also to such points of interest as Luray, Natural Bridge and Gettysburg. This company has also arranged to place on sale excursion tickets to San Francisco and other points in California, on account of the Mid-Winter Fair, at unusually low rates. Excursion tickets are now on sale to Baltimore and Washington via the famous Royal Blue line.

With its vestibuled train service, via Washington, to Cincinnati, St. Louis and Chicago, the Baltimore & Ohio is in the best of condition to handle Western and Southern travel. That the line is a popular one, is attested by the immense World's Fair business handled this summer.

Those contemplating a trip West or South this winter should write to C. P. Craig, general Eastern passenger agent, 415 Broadway, New York, for rates and other information.

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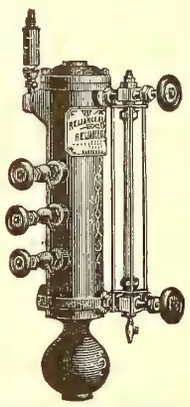
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THE STREET RAILWAY JOURNAL

Vol. X. *NEW YORK & CHICAGO, FEBRUARY.* *No. 2.*

The Electric Road at Ashland, Wis.

The energy of a gas company was never more strikingly illustrated than in the case of the Ashland Company, which is a gas, electric lighting and electric railroad company at one and the same time. The three interests are directed successfully in conjunction, and the road, though but small, is an excellent example of what can be done by American energy.

The power house illustrated is of brick and houses both the lighting and street railway plants. The boilers supplying the steam are each eighteen feet long by five feet six inches in diameter, and are of the return tubular type. The two engines, which are run non-condensing, are compound tandem Ideal engines, working under an initial pressure of 120 lbs., each developing 90 H. P. at one-quarter cut-off. The generators are two in number, and are directly belted to the engines. One generator only is used at a time. These machines are of the D 62 General Electric type, with the series coil wound next the core, and are shown in the background of the cut. The lighting plant is shown in the foreground, and consists of General Electric alternators and arc machines.

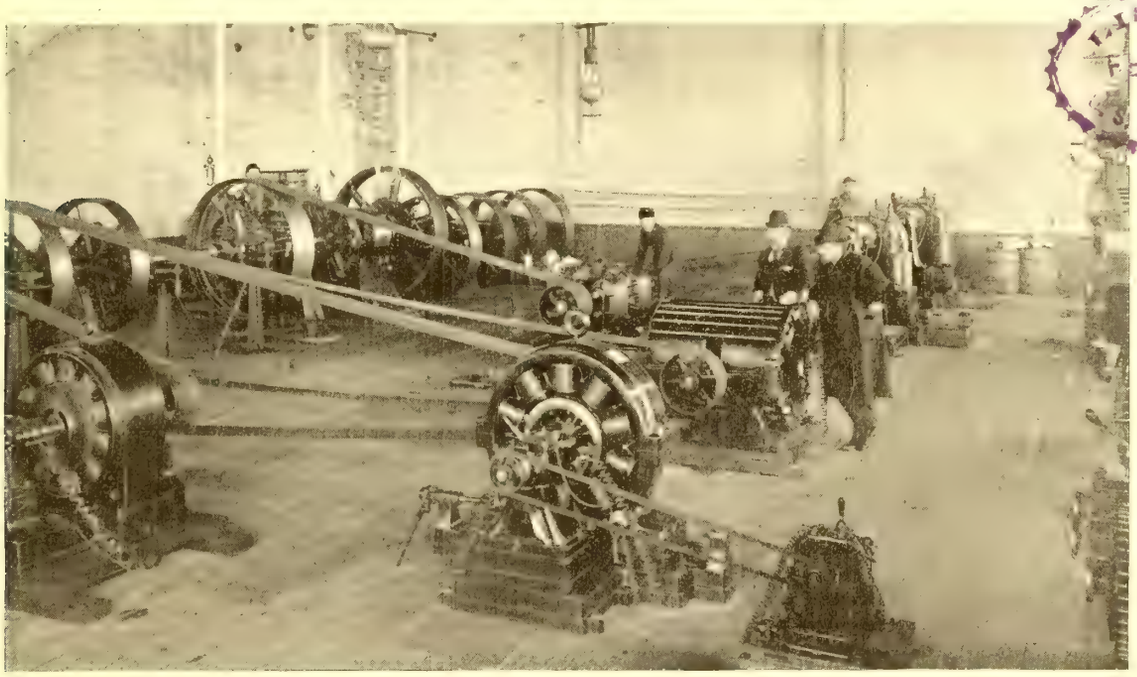
The rolling stock consists of six sixteen foot car bodies mounted on McGuire 19 A trucks, with six foot wheel base, four feet eight and a half inches gauge; car wheels thirty inches in diameter, with three-quarters of an inch flange and two and a half inches tread. Five are operated regularly, the sixth being reserved for special occasions. All cars are cleaned and oiled at night, and made ready for the next day's service. Each car is equipped with two W. P. 30 motors, controlled by the type 51 rheostat, no departure being made in the use of the rheostat. No armature has been burned out since the road was started. The cars are heated by Garland stoves.

The road is about 35,000 ft. in length, laid down in T rail throughout. 8,000 ft. is laid wiith sixty pound Shanghai type of rail from the Illinois Steel Company, the remainder being laid with forty-eight pound T rail from the same source. The 8,000 ft. of line referred to is double track, laid in the business portion of the town, the pavement being of wooden blocks.

The rails are bonded with No. 4 galvanized iron wire and channel pins, two bonds to each joint, but no supplementary wire is used. Every two rail joints are cross connected, except on the double track, where the rails are tied together with flat tie bars. The rail circuit is in excellent condition.

The overhead trolley wire is suspended from octagon cedar poles in the business center and from ordinary round cedar poles elsewhere, the cross suspension method being employed. The overhead line devices are all of the General Electric well known type. The curves on the single track are constructed of modified devices to allow of the use of two trolley wires over a portion of the single track. A double trolley wire is used from the end of the double track to the end of the first turnout, a distance of about one mile. This double trolley wire acts in the capacity of a feeder, doing away with the use of two overhead switches, and still supplying a sufficient area of copper for the 8½ per cent. grade, and the other small grades at a distance from the station. The lightning arresters are grounded in an artesian well.

The entire installation was effected by the Northwest General Electric Company.



LIBRARY, FEB 5 1894 U.S. PATENT OFFICE.

INTERIOR OF ELECTRIC POWER STATION—ASHLAND, WIS.

Terminal and Coaling Station of the Second and Third Avenue, New York, Elevated Railways.

The Manhattan Elevated Railway Company has recently completed a terminal station (Fig. 1) extending from Second to Third Avenues on 129th Street, with side tracks and appliances for delivering coal and water aboard the tenders of the 200 locomotives belonging to the eastern division of the elevated system, which embraces the Second and Third Avenues and the suburban lines which terminate at this point. The principal interesting features of the station are the fuel handling devices for unloading, weighing, storing and placing of the coal upon the locomotive tenders, together with the operating steam plant, all of which have been designed by Lincoln Moss, principal assistant engineer of the Manhattan Elevated Railway Company, and erected under his supervision. The amount of coal annually consumed on the entire elevated system is about 200,000 tons, of which the locomotives of the eastern division require about 2,000 tons per week, so that the handling of the vast weight becomes a matter of considerable moment.

The 129th Street station extends for a considerable distance along the water front of the Harlem River, and to this point the coal is delivered in barges (Fig. 2). The unloading devices are mounted on a steel structure, and consist of a traveling crane with a hoisting engine and an automatic steam shovel, together with hoppers, transfer cars and tracks. The steam shovel, cars and tracks were furnished by the C. W. Hunt Company, of New York, dealers in coal hoisting machinery. The top of the crane is 83 ft. above the dock, the reach of the arm in front is 40 ft., and the total hoist is about 70 ft. The crane, which contains a large hopper, and the operating mechanism, is mounted on wheels, and has a movement of 100 ft. along the top of the structure. A Lidgerwood hoisting engine, having duplicate 10 × 10 in. cylinders, is mounted on the outside of the derrick to assist in balancing the weight of the arm and load, but in addition the hoist is anchored to the structure. The main steam pipe, which extends the whole length of the run, is provided at intervals with short stand pipes having ball and socket joints and clamps by which they may be readily connected with the supply pipe leading to the hoisting engine. The engineer's cab is located at the front right hand corner, in a position from which he can watch the shovel and the signals of the attendants on the barges, and which is provided with levers for operating the throttle valve, piston and brake. The automatic shovel is of the standard size, and of about one ton capacity (Fig. 3.) It is operated by means of a chain which embraces a sprocket pulley on the shovel and terminates in a bob at the arm weighing about 800 lbs., which on being released takes up enough slack in the chain to close the shovel when the hoisting engine is started. In the process of hauling in the slack of the chain the bob returns, and the jaws of the shovel are drawn together enclosing a ton of coal. The shovel is then lifted, and as-

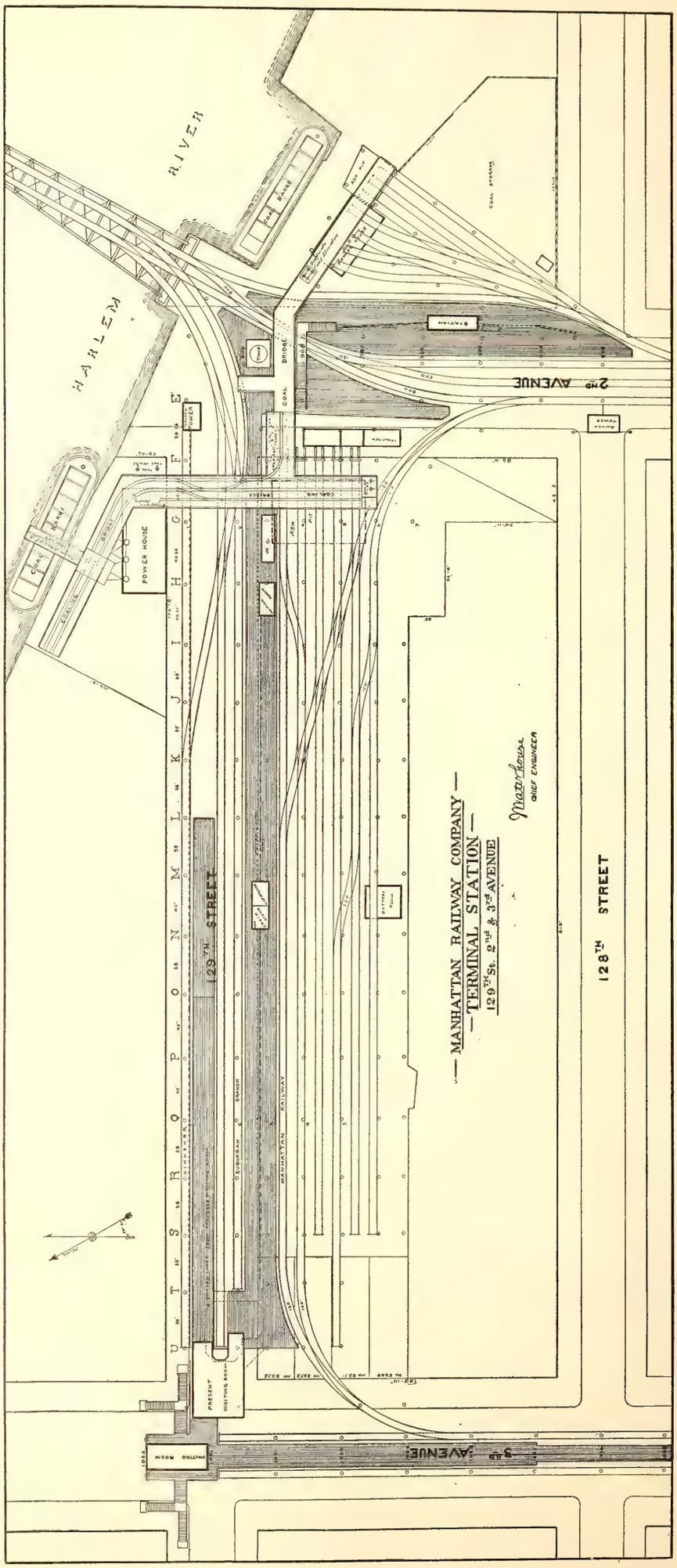


FIG. 1.—GROUND PLAN OF 129TH STREET TERMINAL STATION OF SECOND AND THIRD AVENUE ELEVATED RAILWAYS, NEW YORK.

cends the incline until it is brought over the hopper, when a trip unlocks the jaws, and the load falls into the hopper from which it is drawn into the transfer cars, and the shovel immediately returns for another load. The device, when starting on a fresh cargo, is capable of unloading

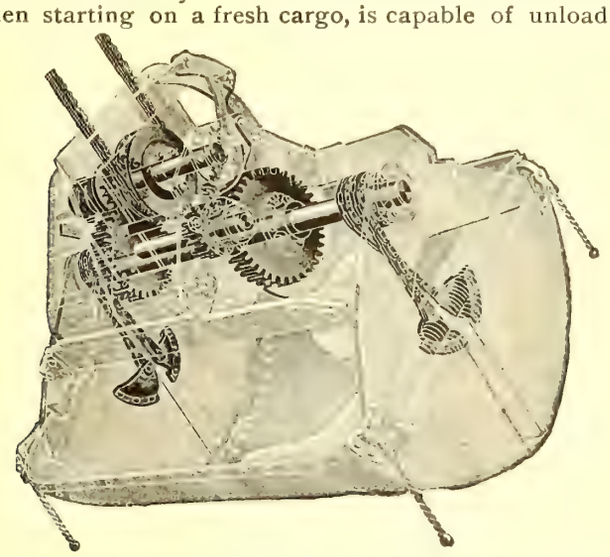


FIG. 3.—COAL SHOVEL—ELEVATED RAILWAY TERMINAL STATION, NEW YORK.

about sixty tons of coal an hour, and its average work at this station is about 300 tons per day of ten hours.

Besides the steam shovel above described there are six auxiliary hoists for use when, for any cause, the shovel is idle. The principal one of these is located at the left side of the structure shown in Fig. 2, and is operated by a hoisting engine located in the power plant directly underneath. With this hoist two ordinary dumping coal buckets are employed which are operated by wire ropes, one ascending as the other descends, and the load is dumped into rolling chutes, from which the coal is drawn into the same transfer cars as are employed with the main hoist. A second hoist of the same description is provided at the south end of the structure, by which coal is lifted from the storage bunkers for the use of the Third Avenue engines, and a third, which is of the ordinary jib type, is located on the dock to the east, and is employed for hoisting coal into the storage bunkers under the Second Avenue structure.

The power plant from which all the hoists are operated, which also supplies power for pumping purposes and steam for heating all the terminal station offices, and for protecting from frost the numerous water pipes and drip pans, is located in an iron, three gable, one story structure directly on the wharf at the angle of the elevated structure, and which rests on a pile foundation. This is one of the most compact steam plants of equal capacity that we have ever visited. The boilers are three in number, of the Scotch marine type, and are rated at 200 H. P. each capacity, under a steam pressure of 130 lbs. per square inch (Figs. 4 and 5). The boilers are 10 × 10 ft., and rest on independent pedestals, so that all the parts of the surface are readily accessible, and are covered with asbestos plaster and planished iron, while all the steam and water pipes on the structure are double covered by sectional asbestos covering manufactured by the H. W. Johns Manufacturing Company. The outer shell of the boilers is three-fourths of an inch thick, with double covered butted joints and sextuple rivets. They are each provided with two corrugated fire flues thirty-six inches in diameter, with three-eighths of an inch shell, the corrugations having been spun in after the sheets were



FIG. 2.—COALING STATION OF SECOND AND THIRD AVENUE ELEVATED RAILWAYS, NEW YORK.

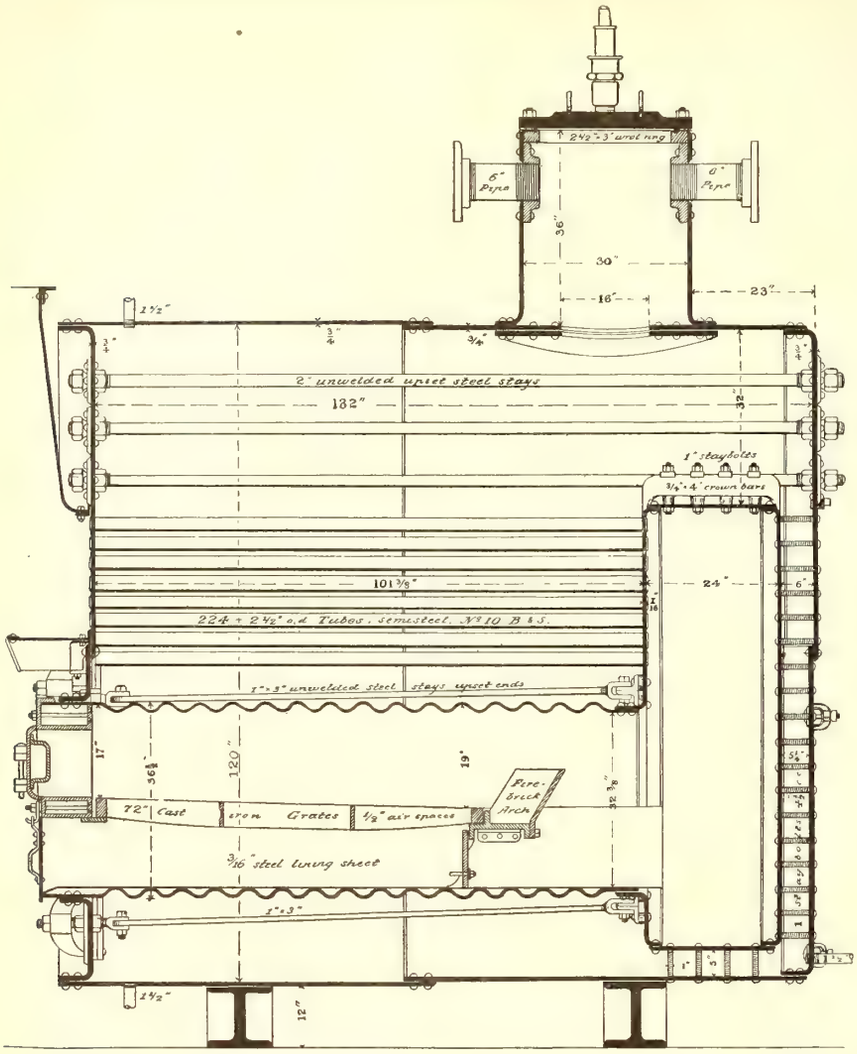


FIG. 4.—SECTION OF BOILER EMPLOYED AT TERMINAL STATION—SECOND AND THIRD AVENUE ELEVATED RAILWAYS, NEW YORK.

welded. The flues are slightly tapering to facilitate removal when necessary, and the grate bars are placed midway of the flue. There is provided an ash chamber underneath from which the ashes and cinders are readily removed. There are 224 two and a half inch return tubes in each boiler, which lead into individual flues leading to the three smokestacks, which are shown in the rear of the hoist in Fig. 2. The fuel, which consists of broken coal, is brought in by means of a portable bunker having a slanting side, from which it is readily shoveled into the furnaces, leaving the floor clean at all times. Each boiler is provided with a duplex and independent system of water and steam pipes and safety appliances. There are two Blake feed pumps of the vertical marine type, and six injectors. The feedwater is drawn from a hot well and led through a reheating apparatus. Each boiler can be used independent of each other, and one is always kept in reserve. There is also a Wainwright surface condenser which can be used when necessary. These boilers have proved themselves to be excellent steamers, and produce a very dry steam, so that it is not visible when escaping from the safety valve.

The engine equipment of the station (Fig. 6) is located near the boilers, and embraces, besides the boiler, pumps and condenser, two automatic Knowles duplex, compound, condensing pumps, having a capacity of 3,000 gals. a minute each. These pumps are provided to supplement the pressure in the city mains, from which the supply of water is drawn, and is then forced against an air cushion into steel storage tanks located on the structure, under a pressure of from forty to 150 lbs., and from which water is drawn directly into the locomotive tanks. An air compressor is also provided for increasing the tank pressure when necessary. The pumps may also be used for fire purposes should occasion require. In addition to the station equipment there are four hoisting engines located at different points, as noted above, and two steam capstans for moving the shovel crane back and forth along its run.

Fig. 7 illustrates the coaling and watering station for the Third Avenue locomotives. The coal is first drawn by an attendant from the elevated bunkers into balanced tilting hoppers which hold about one-fourth of a ton each, and by which the weight is tallied, and from which it is readily dumped by the firemen into the tender. Each locomotive takes on 560 lbs. for a round trip of nearly seventeen miles. So perfect are the coaling arrangements, that after the steam shovel stops at night only one man is required at the station to coal all the locomotives of the Third Avenue line that require fuel before 5:30 the next morning. As the

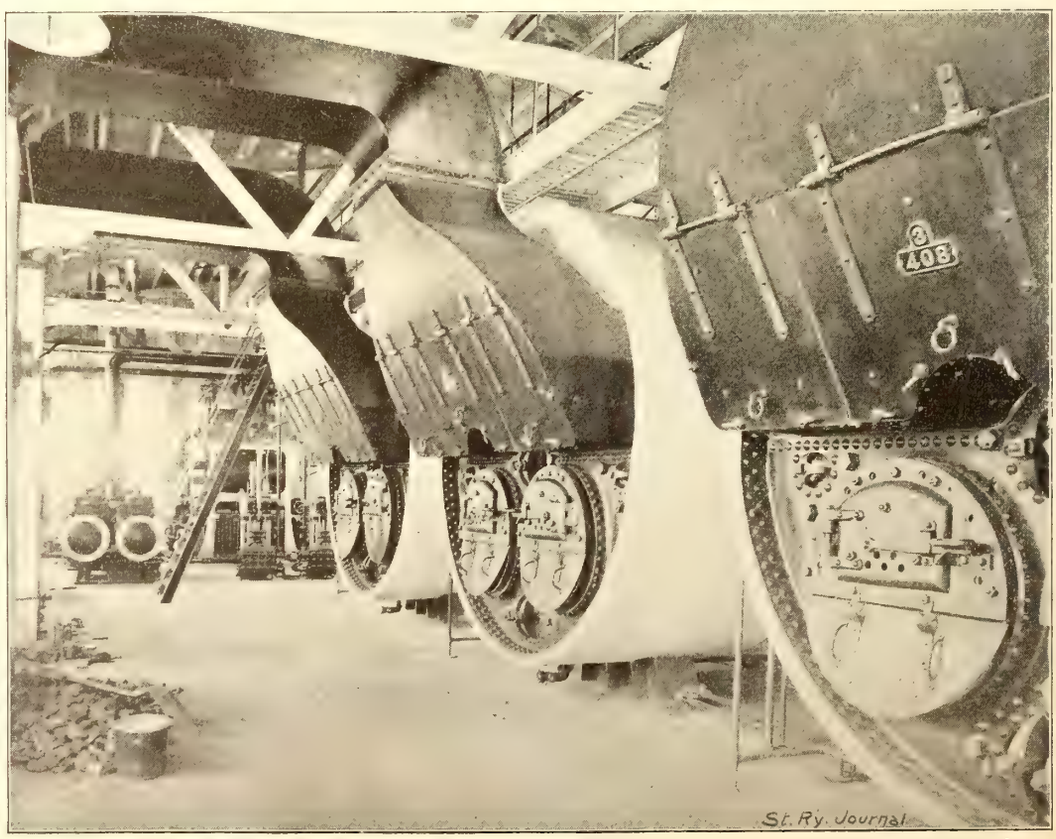


FIG 5.—SCOTCH MARINE BOILERS EMPLOYED AT TERMINAL STATION OF SECOND AND THIRD AVENUE ELEVATED RAILWAYS, NEW YORK.

locomotives come in for fuel and water the fires are raked and the ashes dumped into flues leading into fireproof chambers beneath, when they are carted away.

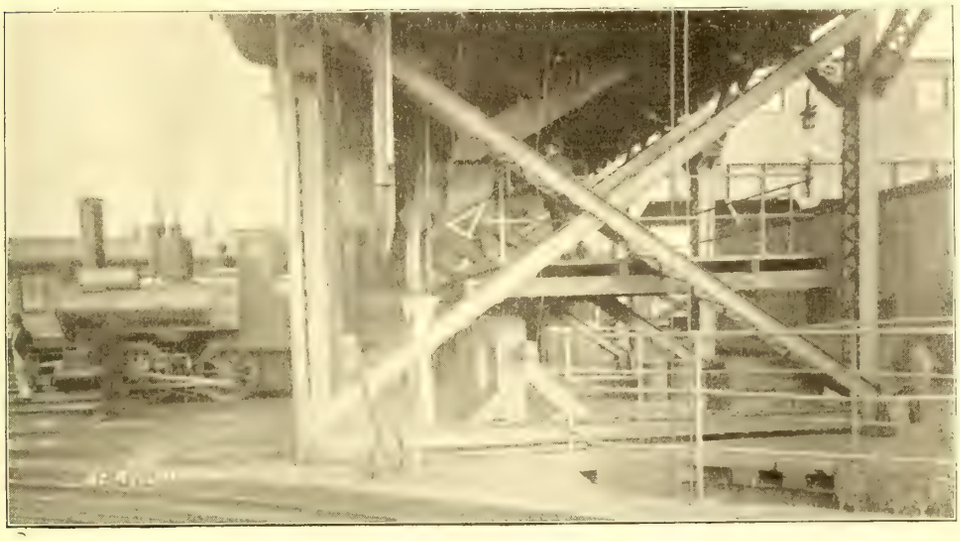


FIG. 7.—COALING CHUTES FOR THIRD AVENUE LOCOMOTIVES—NEW YORK. ELEVATED RAILWAY.

storage bunkers, having a capacity of from six to seven thousand tons, or a thirty-day supply, which can be drawn upon when, for any reason, the daily supply is interrupted. The coal for the storage bunkers on the Second Avenue side is transferred from the barges by means of a jib hoist and dumping buckets and an overhead single rail, circular track, upon which runs a two-wheeled trolley hoist, to which the loaded buckets are hooked and pushed by hand to any point where the coal is to be dumped. White ash coal only is employed on the locomotives of the elevated lines, the grade being known as broken coal. The Philadelphia & Reading Coal & Iron Company has the contract for the entire supply for the elevated system. This is brought by rail from the Lehigh mines to Port Reading, near Communipaw, where it is transferred to barges, which are towed directly to the landing on the Harlem River, as noted above. The coal

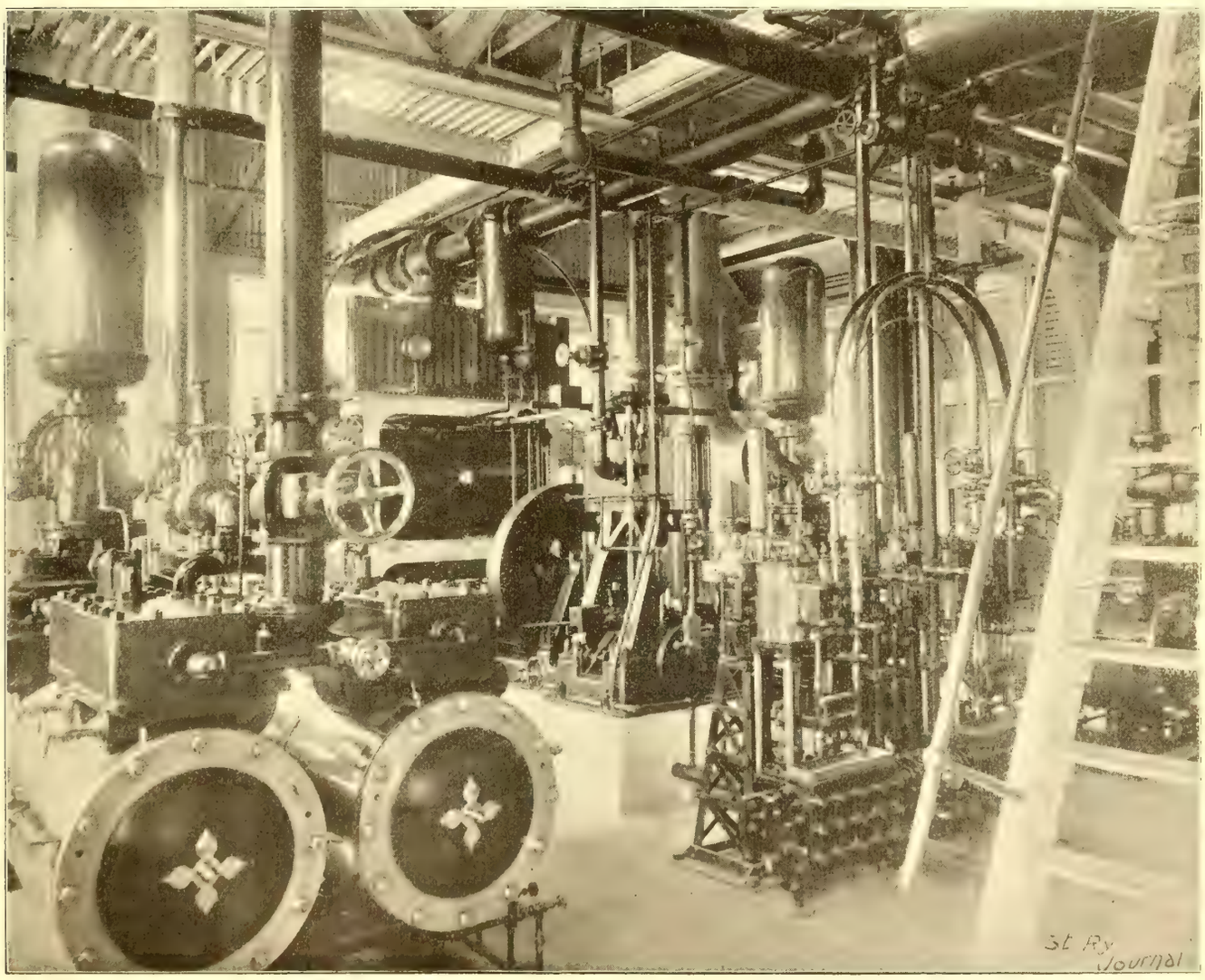


FIG. 6.—ENGINE AND PUMP ROOMS—TERMINAL STATION OF SECOND AND THIRD AVENUE ELEVATED RAILWAYS, NEW YORK.

The entire structure is provided with facilities for coaling ten locomotives at a time. The locomotives of the Second Avenue and suburban lines are coaled from the south end of the station (Fig. 8), the arrangements being similar to those provided for the Third Avenue engines.

Located beneath the elevated structure are extensive

costs, delivered, $3.55 per ton, and the average weight consumed per train mile is 38.83 lbs., costing 7 cts., an unusually economical result.

This coaling station, together with others for the West Side lines, as well as the many other facilities for the economic operation of the entire railway system,

under the control of the Manhattan Elevated Railway Company, which embraces 102 miles of track, is a credit to the good judgment and ability of the general manager, Col. F. K. Hain.



FIG. 8.—COALING STATION FOR SECOND AVENUE LOCOMOTIVES—NEW YORK ELEVATED RAILWAYS.

This system carries daily an enormous traffic, with few delays, and has the enviable record of never having killed a passenger.

The Government Tramways of New South Wales.

By Geo. Macoun, Government Accountant for Tramways, New South Wales.

The keen interest exhibited by street railway men in the various systems of tramway traction, be the motive power electricity, cable or steam, has induced the writer to attempt to place before American readers of the Street Railway Journal, some description of the steam tramways operated for the state by the Railway Commissioners of New South Wales. At the present time there are eighty-nine miles of street railways, all single track, open for traffic in the whole of the colony, while there are eleven and an eighth miles under construction, four and three-quarters miles cable and one and an eighth miles steam in Sydney, and five and a quarter miles steam in Newcastle.

The existing roads are as follows: Sidney city and suburban lines sixty-eight miles; North Sidney lines six and a half miles; Ashfield to Enfield two miles; Newcastle and Plattsburg seven and a half miles, and Kogarah to Sans Souci five miles.

With the exception of the North Sidney lines, which consist of four and a quarter miles cable road and two and an eighth miles electric, these roads are operated by steam motors. This paper has reference only to the Sidney city and suburban steam lines.

Sidney City and Suburban Steam Lines.—The inception of tramways in the city of Sidney dates back as far as September, 1879, the International Exhibition year. At that time, in consequence of the main railway terminus being at Redfern, one and a half miles distant from the center of the city, it was found necessary to lay down what was intended as a temporary tram line between Redfern and Hunter Street to provide complete means of transit to the Exhibition grounds for the large number of visitors. For the operation of this road four motors and six cars were imported from America, and so successful was the net result for the first year's operations that the Government was almost inundated by deputations from the various suburbs, urging the extension of the tramway in their directions.

The Redfern line having returned a profit of 33 per cent. in 1879, it appeared to be good business to extend the steam system in all directions as an improved means of communication between the city and suburbs, a substitute for the ordinary omnibus in vogue being badly wanted. Consequently for a time there was a boom in tramway construction. In the roseate view taken of the profits, however, the probable cost of the heavy repairs and renewals afterwards to be encountered was quite overlooked.

At first the extensions promised well. Over 8 per cent. clear profit was realized after payment of working expenses, and the 4 per cent. interest at which the tramway capital had been raised. After a little time, however, when renewals, heavy repairs, etc., began to get in their work the aspect of affairs underwent an alarming change, and year by year the returns became more and more unsatisfactory, until 1884, when they may be said to have reached zero. The dead loss was then 3.24 per cent. on the capital invested. A more or less unsatisfactory state of things continued until 1888 when, in accordance with the Railways Act of that year, the management of the tramways, in conjunction with the railways, was removed from political control and placed in the hands of an independent board of three commissioners. A change for the better soon ensued, and the net returns have gone on steadily increasing, until the surplus for the last financial year has reached the handsome result of 5.94 per cent. on the capital invested. Not only has this vast improvement been effected, but the value of the property has been considerably augmented, inasmuch as 60 per cent. of the cars, several motors, and eleven and one-fifth miles of track, have been renewed out of working expenses, while the public have been given many direct benefits in the shape of reduced fares, increased service, thoroughly watered streets, and greatly improved waiting room accommodation at the principal stopping places.

As the system of control is somewhat different from American methods, a few words as to the management will not be out of place, before referring to the various



FIG. 1.—STANDARD CAR FOR SEVENTY PASSENGERS—GOVERNMENT STEAM TRAMWAYS, NEW SOUTH WALES.

matters of detail. The supreme rulers are the Railway Commissioners, E. M. G. Eddy, chief, W. M. Fehon and C. Oliver, who are placed practically in unlimited control, and who exert a very close and searching command of the whole service. The department is divided into three branches; the traffic, locomotive and permanent way. The executive officers in charge, respectively, being designated the tramway manager, the locomotive superintendent, and the tramway engineer. Each reports directly to the commissioners and is responsible only for matters appertaining to his own branch. Monthly committee meetings of the heads of branches presided over by a railway commissioner are held, when the expenditure, staff changes, and other matters affecting the welfare of the service are reviewed, discussed and disposed of. No special expenditure may be incurred without the commissioners' sanction having first been given. Heads of branches may fine, disrate or dismiss an employe, but action in this direction must be reported to the commissioners for confirmation. Any employe dissatisfied with the decision of his officer has the right of appeal to the commissioners.

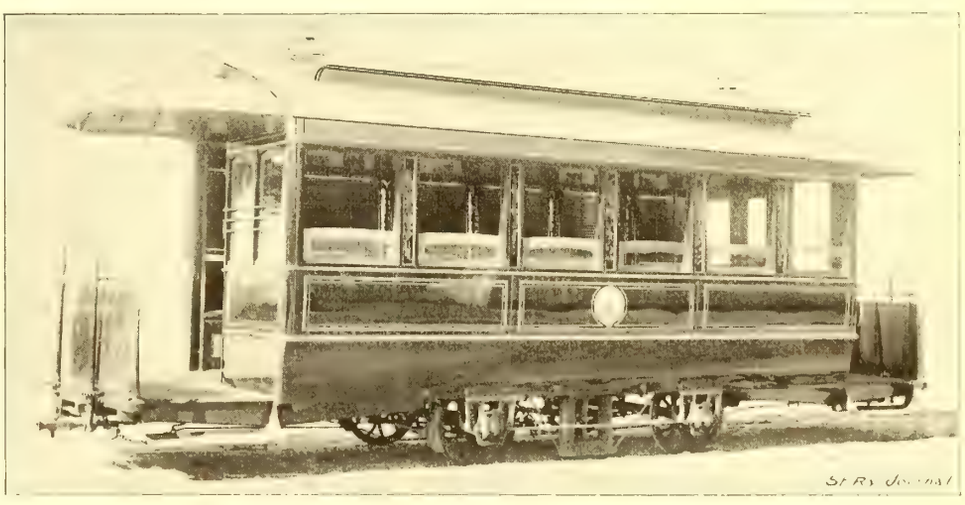
Track.—As already stated, the Sydney city and suburban lines embrace sixty-eight miles of track, fifty-six miles of which is double track and twelve miles single. The gauge is four feet eight and a half inches. The steepest gradient is one in seventeen, or, say, 6 per cent., while fully one-third of the track is constructed on grades ranging from 3 per cent. to 5 per cent., the latter predominating. The aggregate of level track is but three miles. The curves are numerous, ranging from eighty-five to 196 ft. radius. A distance of a little over ten miles of track is wood blocked, the remainder of the street surface construction being macadam. Most of the road was originally laid with forty-two pound iron rails on sleepers bedded in concrete, but recent practice in relaying on macadam roads is to use sixty pound and seventy-one and a half steel T rails on sleepers 8 ft. × 9 ins. × 4½ ins., spaced two feet four and a half inches apart, with ordinary blue metal ballast in place of concrete, the old rails removed being used as guard rails.

The main trunk line starts from Bridge Street yard, the terminus for all the lines, and is continued along Phillip Street and Elizabeth Street to the railway station, a distance of one and three quarters miles. At Liverpool Street, one mile from the city terminus, the eastern suburbs section branches off, and this again has five diverging lines, while at a point near the Redfern railway station the southern sections, consisting of two principal lines, branch off, and these latter have also five feeders.

Rolling Stock. — The stock consists of 105 motors, all with four wheels coupled. About 80 per cent. have 11 × 16 in. cylinders, and the remainder have 10 × 16 in. cylinders; ninety-two were built by the Baldwin Locomotive Works, of Philadelphia, three by English manufacturers and ten by local makers, the latter being in no way inferior to the imported engines. The car equipment consists of 202 vehicles, almost entirely of the description known here as the "standard" car; that is, seating seventy passengers, with cross seats and sliding doors, eight wheels mounted on double bogies, having a total weight of five tons, and measuring thirty-five feet in length. Thirty seats are reserved for smokers, fifteen at each end, the compartments being separated by glass partitions. The average life of a tram car, so far, is a little under ten years. This refers to the double decked type of car, the use of which has been abandoned, but the single deck, "standard" cars, constructed of thoroughly seasoned timber, supplied by the Commissioners to the builders, promise much better results. No advertisements are allowed in the cars, as a trial in this direction some time ago gave unsatisfactory results. No covering is provided for the seats, the interior being wood finish throughout. All the stock is fitted with the Eames vacuum brake. The car wheels are cast steel, and were supplied by Hadfield, of Sheffield. They are twenty-four inches in diameter, and give an average life of 26,000 miles, which, considering the heavy brake work encountered, is good service. The motor wheels have Vicker's tires, which give an average life of 43,661 miles and 1,712 miles per one-sixteenth inch of wear to first turning. The average number of motors in daily use is sixty-seven, and the corresponding number of cars 160. On special occasions, such as public holidays, the whole of the stock, with the exception of about 3 per cent. of the motors and 2½ per cent. of the cars, is available for traffic.



FIG. 2.—STEAM MOTOR—GOVERNMENT TRAMWAYS, NEW SOUTH WALES.



FIG, 3.—CABLE TRAIL CAR—GOVERNMENT TRAMWAYS, NEW SOUTH WALES.

Tram Service, etc.—The cars are run in trains of one, two, three and four cars to the motor. The requirements of the various suburbs are met by a carefully prepared time table. The average speed, including stoppages, is about nine and a half miles per hour. The total engine mileage per motor per annum is 18,650, or per motor continuously in steam, 29,883 miles. The fuel used is gas coke, delivered on the tramway premises at a total cost of 12*s.* 3*d.* ($2.94) per ton of 2,240 lbs. The average consumption of fuel per train mile is twenty-five pounds.

The principal lubricant is castor oil, obtained at a cost of just under 2*s.* (48 cents) per gallon.

With the exception of three small sections worked by a motor and car each, all of the cars are run right through between the branch termini to the city terminus at Bridge Street. This naturally produces a somewhat congested traffic along the main trunk line in Elizabeth Street and at the terminus. This will be readily understood when it is mentioned that the total number of ordinary cars running in and out of the Bridge Street yard daily is 1,164, while on holidays this number is largely increased. On the other hand the advantage this system gives to the public by enabling passengers to complete their journeys to and from the city without transfer is considered a fair offset against the inconvenience in working it occasionally creates. As indicating the heavy nature of the traffic along the main trunk line between the city terminus and Liverpool Street, it may be stated that a careful calculation shows the total weight, rolling stock and passengers, moved over this track to average 35,000 tons daily. The effect of this on the permanent way may be gauged from the fact that at a point in this section on a gradient on a severe curve, seventy-one and a half pound steel T rails have been completely worn out after but three years' service. The costly nature of the steam motor service may also be realized when it is mentioned that each motor absorbs within a period of four and a half years, for maintenance alone, a sum equal to its original capital cost.

How important a factor in the development of the suburbs of a city is an efficient tramway system may be well understood, but additional evidence of an interesting nature in support of this is furnished in the case of the Sydney tramways. The total number of suburbs served by the city and suburban lines is twenty-three, and according to figures recently published by the government statistician the total capital value of the ratable property in all the suburbs of Sydney had increased within the nine years ending 1891, by the enormous sum of £31,425,093, or 159.12 per cent.

The unit of comparison is the "train mile." A train mile represents an average of one motor and two and a third cars, affording seating accommodation for 164 passengers moved one mile, and weighing, empty, about twenty-six tons, or 58,240 lbs. This explanation is necessary as absurd deductions are apt to be drawn when cost per "car mile" or per "train mile," are instituted unless the exact value of the car mile or train mile under consideration is clearly understood.

Employes.—Running men are paid at the following rates per day: Drivers 11*s.* to 14*s.* ($2.64 to $3.36); firemen 7*s.* 6*d.* to 9*s.* ($1.80 to $2.16), and cleaners 4*s.* 6*d.* to 7*s.* 6*d.* ($1.08 to $1.68). The day's work represents nine and a sixth hours, the motors being worked in two shifts; overtime is allowed for any time worked in addition to the ordinary shift. Sufficient staff is employed to permit of each man having one day off per week. Workshop hands work at the rate of eight hours per day and are paid: Fitters 10*s.* to 13*s.* ($2.40 to $3.12); turners 10*s.* to 11*s.* 6*d.* ($2.40 to $2.80); blacksmiths 10*s* to 12*s.* ($2.40 to $2.88); boilermakers 9*s.* 4*d.* to 11*s.* ($2.24 to $2.64); car builders 10*s.* to 11*s.* ($2.40 to $2.64); carpenters 9*s.* to 10*s.* ($2.16 to $2.40); painters 8*s.* to 12*s.* ($1.92 to $2.88), and laborers 6*s.* 6*d.* to 7*s.* ($1.56 to $1.68). Apprentices, not bound, 10*d.* ($.20) per day for the first year up to 5*s.* ($1.20) per day in the last year of apprenticeship. Traffic employes receive per day: Foremen 12*s.* ($2.88); conductors 8*s.* to 9*s.* ($1.92 to $2.16); assistant conductors 5*s.* to 7*s.* 6*d.* ($1.20 to $1.80); switchmen 8*s.* ($1.92), and car cleaners, etc., 6*s* 6*d.* to 7*s.* ($1.56 to $1.68). Permanent way men are paid: Gangers 9*s.* ($2.16), and laborers 7*s.* 6*d.* ($1.80) per day of eight hours.

Drivers, firemen and conductors are granted six good conduct holidays per annum in addition to days in lieu of the proclaimed government holidays, allowed to all employes, upon which they may have been at work, so that all round the men enjoy from eleven to seventeen holidays each per annum on full pay. Conductors are allowed two suits of uniform a year and one waterproof overcoat every two years. Any employe incapacitated from work by accident is, after examination by the departmental medical officer, allowed half pay until recovered, and if the injury sustained was the result of circumstances entirely beyond his control, or due to defect in machinery or plant, full pay is granted. The wages staffs are paid once a fortnight, while salaried officers and foremen receive payment once a month. A signed receipt for each payment is taken in terms of the Government Audit Act.

Under the provisions of the Railways Act all officers and servants appointed after October 22, 1888, must insure their lives and hold their offices on the express condition that a deduction will be made from their salaries or wages for the payment of the premium on the policy to keep their lives insured, should they fail to pay the necessary premium to the insurance company. The insurance may be effected with any one of nine life insurance companies, carrying on business in New South Wales approved by the commissioners. The policies are lodged with the railway commissioners and are unassignable either at law or in equity. The insurance is by way of endowment and is payable when the assured attains the age of sixty years, or sooner in the event of death. The amount of the insurance is determined by the following scale: Wages staff, receiving 7*s.* 6*d.* ($1.80) per day or less, insurance £50 ($240); from 7*s.* 6*d.* to 12*s.* ($1.80 to $2.88) per day, £100 ($480); above 12*s.* ($2.88) per day, £150 ($720). Salaried staff, in receipt of less than £100 ($480) per annum, £50 ($240); from £100 to £200 ($480 to $960) per annum, £100; and so on to a maximum insurance of £500 ($2,400), for officers receiving over £550 ($2,640) per annum.

Workshops.—The principal workshops and running sheds are at Randwick, a distance of four miles from the city, and with yard cover about nine acres. Here all the repairing work demanded by motors, cars and the permanent way is executed. Occasionally new cars are built, and all points and crossings used by the department are made. The main shops consist of five large galvanized, corrugated iron buildings as follows:

No. 1 building, 300 × 40 ft., subdivided into machine and fitting shops. A liberal equipment of the best machine tools and other facilities for the efficient and expeditious performance of the work is provided.

No. 2 building, 300 × 50 ft., with three roads and engine pits throughout, is used as a running shed for stabling twenty-five engines by night and for effecting jobbing repairs to engines by day.

No. 3 building, 300 × 40 ft., is used as a carriage and wagon repairing shop. Here the work of repairing and renewing the cars and trucks and the woodwork of the motors, etc., is performed.

No. 4 building, 300 × 50 ft., embraces the smith and boiler shops. The smiths' shop is 150 × 50 ft., and contains fourteen smiths' fires, seven on each side; adjoining is the boiler shop of equal dimensions with four smiths' fires, punching and shearing machines, plate rolls, etc.

No. 5 building, 300 × 30 ft., is used as a paint shop. There are two pits of forty-six feet each, the total accommodation being equal to fourteen cars.

In addition to these buildings there are the pattern makers' shop, an iron building 28 × 16 ft., a tinsmith's shop of similar construction, 70 × 15 ft., and the brass foundry, a small brick building wherein all brass, copper and lead castings required in the workshops are made.

The number of engines constantly undergoing general overhaul, and other repairs of lighter nature at Randwick workshops varies from twelve to twenty, and similarly the number of cars is nine. The total day staff engaged in these shops is 255.

Not only is the repairing work demanded by all the branches of the C. & S. lines performed at Randwick, but so also are all the important repairs of stock and plant for all the street tramways throughout the colony.

A night staff is also engaged in the Randwick running sheds cleaning and effecting running repairs to the engines in active service. The sheds are illuminated by electric light, the engine pits being fitted with portable electric lamps. The motors have their fires banked at night, a sufficient number being blown down nightly to to ensure every boiler being washed out with hot water once in seven days.

The expenditure is dealt with under a simple, yet

comprehensive, system of shop orders, which will show with accuracy the cost of repairs to each head of service without calling for the use of an expensive clerical force. Standing shop orders exist for all the regular work, and special shop orders are issued for all work not included in the standing shop orders. The record of cost is kept in a journal, the heading showing the number with particulars of the work dealt with, one page being used for the labor incurred in each shop and the other for materials and total. This book is indexed so that any order can be readily referred to. In many establishments it is considered sufficient to add an all round percentage on the direct cost of a job to cover shop charges, but as this undoubtedly produces erroneous results the practice here is to add to the direct wages the percentage cost thereon of the shop charges of each shop, the rate being determined by the proportion of the actual shop charges to direct wages as incurred during the previous twelve months. These percentages run: Fitters 13 per cent., turners, 38 per cent, boilermakers 25 per cent., blacksmiths 32 per cent., plumbers and tinsmiths 13 per cent., painters 15 per cent., car repairers 18 per cent., patternmakers 16 per cent. and foundry 28 per cent.

Rate of Fare.—On the first section for all trams starting from the city terminus, the rate of fare is two pence and thereafter one penny sections prevail, the average rate throughout the whole of the lines being .77*d.* (1.54 cents) per mile; fares are paid by one penny tickets and by cash, but in order to confine the revenue to the former channel as much as possible, the rate is lower than when cash was tendered. Bell registers of the Hornum patent, of New York City, are supplied to the conductors in pairs, one for recording tickets received, and the other for cash fares. Immediately on collecting a fare the conductor sounds the bell of the register required, one stroke for each penny received, and then destroys the value of the tickets by tearing them in halves in front of the passengers. The half tickets in collection bags, with cash and bell registers, are handed in daily at the termination of each shift to the receiving clerk at Bridge Street terminus. The revenue value of the tickets is ascertained by weighing them on very delicate scales, and the results are checked with the registers, while the cash is counted and also compared in similar manner. The half tickets are afterwards destroyed in a furnace specially constructed for this purpose. Numerous agencies exist for the sale of tickets in the city and suburbs, so that they can be purchased with the same facility as postage stamps.

Members of Parliament, police constables in uniform, transit officers and employes going to and fro from duty, are carried free.

Capital and Revenue.—At the close of the financial year on June 30 last, the total capital cost of the city and suburban tramways was £947,775, while the gross revenue for the year amounted to £271,041, the net return after paying working expenses being 5.94 per cent. on the capital invested. The total number of passenger fares collected during the year was 63,588,885.

The total cost of operating expenses was 30.67*d.* (61.34 cents) per train mile, *i. e.*, twenty six tons of rolling stock with accommodation for 164 passengers moved one mile.

Subjoined is a schedule of details of the working expenses for the last financial year with the cost per train mile, but for a proper comparison of this unit with the average American car mile, cost a little less than one eighth of the figures shown must be taken:

SYDNEY CITY AND SUBURBAN TRAMWAYS.

Schedules under working expenses for the year ending June 30, 1893.

HEAD OF SERVICE.	Total Cost.	Cost per Train Mile.
PERMANENT WAY BRANCH.		
Tramway engineer, clerks and office expenses	£1,014	£ 1.45
Maintenance and renewals of permanent way; wages £23,138, materials £14,096	37,234	5.315
Repairs of bridges, culverts, etc	45	.006
Repairs of waiting sheds and buildings	272	.039
Sundries	65	.009
Total permanent way branch	£38,630	£5.514
LOCOMOTIVE BRANCH.		
SUPERINTENDENCE, ETC.		
Locomotive superintendent, clerks and office sundries	£1,925	£ .275
RUNNING EXPENSES.		
MOTORS.		
Locomotive foremen, inspectors and timekeepers	£ 1,729	£ .247
Locomotive drivers and firemen	45,079	6.435
Locomotive cleaners, coalmen and laborers	9,164	1.308
Locomotive sundries	2,352	.336
Coke, wood, etc	10,737	1.532
Water	1,644	.234
Oil, tallow, waste	2,716	.388
Stores for cleaners	551	.079
Total	£73,972	£10.559
CARS.		
Greasing and oiling, wages £256, Stores £213	£ 469	£ .067
Total running expenses	£74,441	£10.626
MAINTENANCE EXPENSES.		
MOTORS.		
Repairs and renewals; wages £21,448, materials £5,043	£26,491	£ 3.781
CARS.		
Repairs and Renewals; wages £6,685, Materials £12,244	*£18,929	£ 2.702
WAGONS.		
Repairs and renewals; wages £72, materials £44	£ 116	£ .017
Total	£45,536	£ 6.500
Total locomotive branch	£121,902	£17.401
TRAFFIC BRANCH.		
Traffic manager and supervision staff	£ 1,958	£ .280
Clerks	1,209	.172
Staffmen, pointsmen and flagmen	6,085	.869
Conductors	23,915	3.414
Car cleaners, shunters and lamp trimmers	4,856	.693
Stores	2,414	.345
Advertising, printing and stationery	1,422	.203
Traveling and incidental expenses	328	.047
Sundries	3,747	.535
Total traffic branch	£45,934	£6,558
COMPENSATION.		
For personal injury	£ 1,670	£ .238
For damage to vehicles, etc	229	.033
	£ 1,899	£ .271
GENERAL EXPENSES,		
Proportion of salaries of commissioners, secretary, chief accountant and their office staff	£ 2,185	£ .312
Audit office	1,563	.223
Commission on sales of tickets	2,097	.299
Sundries	614	.088
	£ 6,459	£ .922
Grand total	£214,824	£30.666

*NOTE.—Includes cost of twenty renewal cars purchased from contractors.

The Offer of the Metropolitan Traction Company.

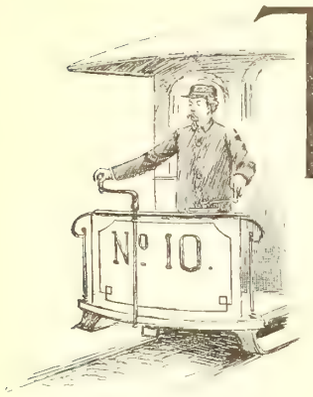
It has not yet been determined whether the Board of Railroad Commissioners, of the State of New York, are to act as judges in the $50,000 prize contest offered by the Metropolitan Traction Company, for a "working system of motive power for street railway cars demonstrated to be superior or equal to the overhead trolley," referred to in our last issue. As there mentioned, the Railroad Commissioners have doubted their power under the general railroad law to accept the proposition to act as judges. An application was therefore made to the Legislature for authority to act in this capacity. This request was referred to the Assembly Railroad Committee, which is expected to make a favorable report at an early date. In making this request, the commissioners spoke in the most commendatory terms of the proposal of the Metropolitan Traction Company, and expressed an earnest desire to extend the co-operation which was asked.

Cable Decision.

A decision has been made by the United States Court of Appeals for the Ninth Circuit, in favor of the Pacific Cable Railway Company, sustaining the Root track brake patent. This decision is final as far as this circuit is concerned.

THE TRANSFORMATION OF BALTIMORE.

PART I.



THREE years ago Baltimore, Md., had about as poor street railway accommodations as could be found in any large city in this country, but there has been a transformation that has hustled off the old cars, horses and tracks, and the city will now stand comparison with the most progressive in the matter of rapid transit. The features of advantage that present themselves most prominently are, first, the convenient distribution of the various lines throughout the thickly populated sections and their convergence at or near a common center in the business focus of the city; second, the high speed of transit made possible by the almost complete substitution of mechanical traction for animal power; third, the liberal system of transfers that is maintained by several of the most important lines. These are the factors that make the really excellent rapid transit accommodations of the city of Baltimore. The work of changing all the roads has been done quickly, but for the most part it has been done thoroughly, and with a view to durability and permanence rather than economy in first cost. Especially is this noticeable in roadbed construction and in rolling stock. The peculiar topography of Baltimore, with its somewhat violent undulations of surface, has familiarized Baltimore railway men with about all of the problems that arise from grades and curves, and the system of surface drainage, for which the city is notorious, has given considerable trouble and expense to the railways, particularly the cable roads, which have found it necessary, in many instances, to carry the drainage to cross streets beneath the cable conduits by means of inverted siphons. Work on the railways was prosecuted during the unusually severe weather of last winter under conditions that were as trying to the public as to the railways, but all the obstacles thus far encountered have been satisfactorily disposed of, saving only the exactions of a captious municipal government, bent on harassing the railway companies by unreasonable tax assessments and car fender ordinances.

There are many features of the rapid transit system of Baltimore that would be of much interest to railway men, such as the heavily built suburban roads, the section of elevated structure in the heart of the city, the two heavy iron viaducts that span Stony Run, the heavy grading on the York Road, the complications of cable crossings, and numerous striking engineering features. The limits of this article, however, preclude extended treatment of details, and only a superficial view of the work that has been done during the past two years will be attempted. First of all, a few general facts about Baltimore railways may be of interest. By numerous consolidations the number of companies has been reduced to five from about four times that number, which were in independent operation a few years ago. This consolidation of interests has had no tendency towards creating a monopoly of business prejudicial to public welfare; on the contrary, the principal lines are well paralleled by competing roads, which furnish a stimulus that always improves service and facilities. The five operating companies and the track mileage of each, are as follows:

Companies.	Miles.
Baltimore Traction Company	75
City & Suburban Railway Company	61
Baltimore City Passenger Railway Company	46
Lake Roland Elevated Railway Company	22
Central Passenger Railway Company	13
Total	217

On thirty-eight miles of this track the cable is used; on 143 miles electricity is the motive power, and the remaining thirty-six miles are still operated with horses, but the change to electricity on the horse roads has been planned for early execution, and much of the work is already under way. The progress of the transformation from horses to mechanical traction is best indicated by the following chronology of changes, showing the date on which each line commenced operating with its new power and equipment:

August 16, 1890.—North Avenue Electric Railway, from Division Street west to 10th. (Now part of the Lake Roland Elevated Railway.) Electric.

May 23, 1891.—Druid Hill Avenue line of the Baltimore Traction Company. Cable.

May 28, 1892.—Baltimore & Curtis Bay Railway. (Now part of Traction Company system.) Electric.

July 25, 1892.—Pikesville division of the Baltimore Traction Company. Electric.

August 30, 1892.—Gilmor Street line of the Baltimore Traction Company. Cable.

September 17, 1892.—Central Passenger Railway. Electric.

April 23, 1893.—Lake Roland Elevated Railway, North Avenue to Roland Park. Electric.

April 26, 1893.—York Road line of the City & Suburban Railway. Electric.

May 6, 1893.—Lake Roland Elevated Railway, to City Hall and to Walbrook. Electric.

May 15, 1893.—Cary Street line of Baltimore Traction Company. Electric.

May 22, 1893.—North Avenue line of City & Suburban Railway. Electric.

May 23, 1893.—Blue line of Baltimore City Passenger Railway. Cable.

July 23, 1893.—Red line of Baltimore City Passenger Railway. Electric.

July 23, 1893.—South Baltimore division of Cary Street line of Traction Company. Electric.

July 30, 1893.—Wilkins Avenue line of City & Suburban Railway. Electric.

August 9, 1893.—Highlandtown line of City & Suburban Railway. Electric.

August 20, 1893.—White line of Baltimore City Passenger Railway. Cable.

September 3, 1893.—Maryland Avenue line of City & Suburban Railway. Electric.

September 20, 1893.—Linden Avenue line of Baltimore Traction Company. Electric.

October 4, 1893.—John Street line of City & Suburban Railway. Electric.

The aggregate cost of the rapid transit improvements that have been made in Baltimore, during the past three years, exceeds $10,000,000, and the work yet to be completed in track laying, equipment and power plants will involve the expenditure of several millions more.

It is too early to present any statistical evidences of the benefits resulting from these extensive improvements. Traffic figures, if accessible, would not make an accurate showing, inasmuch as traffic has been seriously interfered with by construction work during the past two years, and few of the lines have yet been in operation long enough with their new power and equipment to reach their normal conditions of traffic. Furthermore, for reasons of policy, the railway companies carefully guard their traffic figures and refer to the park tax payments as indicative of their business. In this city, the street railways pay into the city treasury 9 per cent. of their gross receipts, as a tax for the maintenance of the public parks. While this tax affords a means of ascertaining the gross business of each company, it is obviously impossible to calculate therefrom the number of passengers carried by each company, as half fares, transfers and other disturbing factors destroy the accuracy of such figures. Such

an estimate, however, is added to the following statement of park tax payments during the past two years, for what it is worth:

Companies.	Park tax payments. 1892.	1893.
Baltimore City Passenger Railway Company....	$70,421	$66,854
Baltimore Traction Company.....	61,672	89,025
North Baltimore Passenger Railway Company...	22,525	
City & Suburban Railway Company.....	25,266	30,111
Highlandtown & Point Breeze Railway Company	1,279	
Central Passenger Railway Company.....	10,221	18,763
Lake Roland Elevated Railway Company.....	1,944	8,171
Total.....	$193,328	$212,924
Indicating aggregate gross receipts of.....	$2,148,088	$2,365,822
Equivalent to passengers carried @ five cents...	42,961,760	47,316,450

CITY & SUBURBAN RAILWAY COMPANY.

The City & Suburban Railway Company, which has undertaken the introduction of electric traction upon a very comprehensive scale, was organized in June, 1892, by the consolidation of the York Road Railway Company, the Union Passenger Railway Company, the Baltimore & Hampden Railway Company, the Highlandtown & Point Breeze Railway Company, and the Baltimore, Catonsville & Ellicott's Mills Railway Company. Considerable new mileage has been added to these lines in the shape of extensions and feeders, and the entire system of sixty-one miles is now operated by electricity, with the exception of Catonsville line, which has not yet been changed. The suburban lines of this system constitute one of its interesting features, as they tap territory likely to furnish important traffic as the growth of the city extends its limits. The York Road line reaches to the county seat at Towson, eight miles from the City Hall; the Catonsville line runs to Catonsville, seven miles from the City Hall; the Hampden & Woodbury line extends to these important manufacturing suburbs, a distance of three and a half miles, while the Point Breeze line goes to Point Breeze, about five and a half miles southeast of the city.

The most interesting work undertaken by this company was the reconstruction of the York Road line, which follows the old York turnpike, an ancient toll road extending to York, Pa. This pike, which had its city terminus at North Avenue, was owned by the Baltimore & York Turnpike Company, a corporation whose interests were identical with those of the City & Suburban Railway Company. The double tracks of the horse line extended a mile and a half north of North Avenue, and a single track continued thence to Towson. The turnpike followed the rolling contour of the country with no attempt at grading, and the grades ranged from 6 to 8 per cent Upon undertaking the change of motive power on this line, it was decided to reduce the grades throughout the entire distance from North Avenue to Towson, a distance of six miles. Work was commenced in September, 1892, by J. G. White & Company, who had the contract for grading and track laying on this division, and by April, 1893, electric cars were running through to Towson.

In reducing the grades of this line from a maximum of 8 per cent. to a maximum of 3½ per cent. (with the exception of one 5 per cent. in Towson), some heavy cutting and filling was necessary, and the turnpike was practically closed to travel during the work. The excavation amounted to 10,000 cu. yds. per mile, and above the city limits only the roadbed was carried to the new grade, the remaining portion of the turnpike being left at its original lines. The illustration, showing the work in progress, will give an idea of the extent of the changes in grade. For a considerable time during last winter the road was impassable, even for the horse cars that were operated on the old tracks, so the temporary expedient of steam traction, as illustrated in the accompanying view, was resorted to. A hoisting engine, mounted on a hand car and geared to its axles with sprocket wheels and chains, did service for a time as a locomotive and maintained occasional service on the road.



FIGS. 1 AND 2.—VIEWS ON THE LINE OF THE CITY & SUBURBAN RAILWAY—BALTIMORE

The first two miles north of North Avenue, to the city limits at Arlington Avenue, was graded to the full width of the street and was paved between the tracks and two feet outside, in accordance with the requirements of the city ordinances. This portion of the line is laid with seven inch Johnson girder rails, for one mile on two inch chairs, and for the balance of the way spiked to the ties. At Arlington Avenue, the line is swung to the east side of the road, and the construction is changed to Pennsylvania Steel Company's fifty-eight pound T rails, on 6 × 7 ins. × 8 ft. sawed Georgia pine ties, two feet centers. The double tracks are continued and the road is rock ballasted, a quarry having been purchased and a crushing plant erected for the contractor by the company. Wooden center poles are used, and the line was lighted by arc lamps placed at the tops of the poles, but it was found necessary to remove these because of their repeated destruction by boys. This construction continues to Towson, where the road terminates in a single track loop of about half a mile through the principal streets of the town. This loop is laid with Pennsylvania Steel Company's seven inch girder rails spiked to the ties.

This line runs through a charming country, admirably adapted for suburban settlement, and as Towson, the terminus of the line, is the seat of Baltimore County, the road is assured considerable through travel. The charge from the city to Towson is fifteen cents, three five cent

fares being collected at intervals. As the city end of the line passes the City Hall and through the principal business section, it will be seen that the road occupies a very valuable territory. The status of the ungraded portion of the turnpike is uncertain at present. The company has attempted to deed to the city and county its respective portions of the highway, but the gift has been rejected because of its ungraded condition. The suburban portion of the railway is a beautiful piece of work, and with the turnpike fully graded, this will be a charming rural highway.

On North Avenue, formerly the northern limit of the city, the City & Suburban Company has constructed an east and west line extending from Belair Road on the east to Madison Avenue on the west. This line is chiefly of value as a crosstown connection for the north and south lines of the company, three of which are crossed by it. By free transfers with the other lines of the same company, this North Avenue line is an important feeder. This line has its own tracks as far west as Guilford Avenue, where the Lake Roland elevated road comes in. Two squares further west, at St. Paul Street, both lines use the tracks of the Blue line of the Baltimore City Passenger Railway Company for one square. Thence for two squares west there is a piece of mutual track used by the City & Suburban, Lake Roland, and Traction companies. West of Jones' Falls, the troublesome creek which meanders through the city as a great open sewer, the North Avenue tracks are owned jointly by the City & Suburban and Lake Roland companies.



FIG. 3.—CHANGING GRADE, YORK ROAD—CITY & SUBURBAN RAILWAY.

The Maryland Avenue line of the City & Suburban system is one of its most important divisions, extending from Woodbury in the northern part of the city to the business center, and then striking east to the outskirts, a total distance of six and a half miles. The York Road line has the same general arrangement, striking west to the edge of the city, both lines using the same east and west tracks on Pratt Street in the business section. The Maryland Avenue line has one of the most striking engineering features of the system—a heavy iron viaduct, 1,100 ft. long, crossing Stony Run in the northern part of the city, by which the crossing of this ravine at a lower grade, with several bad grades and curves and about 1,100 ft. of additional track, are avoided. Starting at the intersection of Huntington Avenue and 11th Street, at the south end of this viaduct, the approach is graded for a distance of 425 ft.; then there are twenty-four 30 ft. spans of girders on steel bents and pedestals, then a single 250 ft. span, four 30 ft. girder spans on bents, and 425 ft. of grading, bringing the tracks to the intersection of Cedar and Remington Avenues, where they cross the Lake Roland tracks. The viaduct carries two tracks and the deck is 25 ft. wide over all. The 250 ft. span crosses the tracks of the Baltimore & Lehigh Railroad and the small stream which flows through the ravine, the greatest depth being 95 ft. below the top of the viaduct. The structure is heavily constructed throughout, being calculated for a live load of 30,000 lbs. on a four wheel truck of six and a half foot wheel base. This portion of the line, formerly the Baltimore & Hampden Railway, was operated by electricity nearly ten years ago. Two Daft motors were used, and the third rail which was used was supplemented at troublesome points by crude overhead conductors which can still be seen standing at several points along the line.

The John Street line, which extends from West North Avenue to the center of the city, has been rebuilt and newly equipped throughout, and the Wilkins Avenue line is an entirely new line of about one mile of double track, that has been built in the southeastern section of the city.

There is a great variety in the construction of the various lines of the City & Suburban Railway, although the character of the work cannot be said to have been sacrificed thereby. The rails used are chiefly six inch and seven inch girders on chairs. Most of the rails were supplied by the Johnson Company, and some from the Pennsylvania Steel Company and Wm. Wharton, Jr., & Company. Most of the specials were made by the Johnson Company. For about 4,000 ft. on Pratt Street the steam track of the Baltimore & Ohio Railroad is straddled, and a ten inch Johnson girder with electrically welded chairs, is used on this section. The subject of track construction has been given careful study, and curves and grades have been very carefully worked out with a view of obtaining the best possible results in operating.

The power arrangements of this system are incomplete. A temporary station at Waverly, on the York Road, supplies power for a portion of the line, and current is rented from other companies for the operation of some of the cars. The temporary plant at Waverly contains four 250 H. P. McIntosh & Seymour tandem compound engines, belted to four 200 K. W. General Electric (Thomson-Houston) generators, steam being furnished by six return tubular boilers. Plans are being prepared, however, for an extensive power plant which will be located on the water front and will have sufficient capacity to operate all the lines of the company.

The rolling stock of the company is new throughout. There are now in service 100 cars, sixteen and eighteen feet in length, for closed cars, and twenty-nine feet for open cars. They are of several types, and were furnished by the Lewis & Fowler Manufacturing Company, the J. G. Brill Company, the John Stephenson Company and the Laclede Car Company. The trucks are of various patterns, Brill, Bemis, Peckham and Baltimore Car Wheel Company. General Electric (Thomson-Houston) motors are used throughout, two twenty horse power to each car. The City & Suburban system shows good organization and management, and its service is excellent, which is the more noteworthy because of the temporary disadvantages to which it is subjected. The engineering and construction work of the company, which have been under the direction of the chief engineer, Frank H. Sloan, furnish many instructive examples for railway men, and it is regretted that more detailed consideration of these features must be omitted from this article.

LAKE ROLAND ELEVATED RAILWAY.

The Lake Roland Elevated Railway is the most recent organization in the rapid transit system of Baltimore. It was formed in June, 1892, by the consolidation of the North Avenue Railway Company and the Baltimore, Hampden and Lake Roland companies. The

North Avenue Railway was the first line operated regularly by electricity hereabouts, having commenced operations on West North Avenue in the upper part of the city on April 16, 1890. The inauguration of an extensive suburban real estate enterprise at Roland Park, about five miles north of the city center, necessitated a means of rapid transit to and from the city. The promoters of the Roland Park enterprise acquired control of the North Avenue Railway and the Baltimore, Hampden and Lake Roland companies, and made use of existing franchises to reach the center of the city by means of an elevated structure on North Street, a side street that is already obstructed by the tracks of the Northern Central Railroad. The present Lake Roland road, which was opened throughout for business on May 6, 1893, starts at the City Hall and runs north on North Street to North Avenue. The approach to the elevated structure, which begins within a few rods of the City Hall, is by an incline of 250 ft., rising on a 9 per cent. grade. Ninety feet of this approach is masonry, 16 ft. in width, and the iron work widens to 36 ft. The entire length of the elevated structure and approaches is 3,910 ft. It consists of lattice girder spans of from 40 ft. to 65 ft. in length, supported upon transverse plate girders 60 ins. deep, which rest upon steel columns standing on the curb line of the street. At Centre Street the line crosses the tracks of the Northern Central upon a bridge span of 156 ft., and again at Madison Street by a span of 196 ft. At the north end of the structure the street level is reached by an incline similar to that at the south approach, 240 ft. in length. On the elevated structure there are two tracks of 70 lb. T rails. Stations were planned for several points on the elevated road, but they have been built only at Centre and Madison Streets, the chief advantage of the structure being the speedy access to the center of the city, which it makes possible. The elevated line was built by the Pennsylvania Steel Company.



FIG. 4.—EXTERIOR OF POWER STATION—LAKE ROLAND ELEVATED RAILWAY.

The line follows North Avenue west to Oak Street, where it divides, one branch following North Avenue to Walbrook at the western edge of the city, a distance of nearly four miles, and the other running to Roland Park. Some distance above North Avenue the Roland Park line crosses Stony Run upon a steel viaduct 660 ft. in length, built by the Variety Iron Works Company, of Cleveland, O. There are two 130 ft. bridge spans in this structure, the remainder being in lattice girder spans of fifty-six feet. Fifty-eight pound T rails are used on this viaduct, and on both of the structures tubular center poles are used for carrying the trolley wires, the feed wires being placed underneath the deck.

The power house for both divisions of the road is located in the ravine traversed by Stony Run, near the point where the viaduct crosses, and near the tracks of the Northern Central and Baltimore & Lehigh Railroads. The building is a handsome stone structure with iron roof, measuring 56 × 130 ft. The building stands at the junction of Stony Run and Jones Falls, at a point where the foundations of the walls necessitated troublesome and expensive work. The power plant consists of two 750 H. P., tandem compound engines, built by the Corliss Steam Engine Company, of Providence, R. I., driving a single main shaft, from which four 400 H. P. Thomson-Houston generators are driven. There is also a 120 H. P. Ball engine and a Westinghouse alternating dynamo for the electric lighting service of Roland Park. The boiler room, which is separated from the engine room by a two foot wall, is 58 × 100 ft., and contains six vertical Corliss boilers eighty inches in diameter.



FIG. 6.—STONY RUN VIADUCT—LAKE ROLAND ELEVATED RAILWAY.



FIG. 5.—CAR HOUSE—LAKE ROLAND ELEVATED RAILWAY.

At Roland Park the car house and general offices of the company are located in a handsome stone building 112 × 203 ft. The building stands parallel with the line, and is reached by a short side street, as Roland Avenue in

this vicinity is designed to be a choice residence location, and it is, therefore, essential that the street shall not be obstructed by cars. The car house contains 1,640 ft. of track, with the necessary pits, machine shop, motor repair shop, paint shop, etc. While the terminus of the line is properly at this point, the road continues further for a distance of about two and a half miles to Lakeside, a beautiful park on the shores of Lake Roland, which was fitted up by the railway company as a pleasure ground. The length of the lines of this company is as follows:



FIG. 7.—STONY RUN VIADUCT—LAKE ROLAND ELEVATED RAILWAY

	Feet.
City Hall to North Avenue and Oak Street	9,534
Oak Street and North Avenue to Walbrook	19,100
Oak Street and North Avenue to Roland Park	18,900
Roland Park to Lakeside	11,100
Total	58,634

All of this is double track, with the exception of a portion of the Walbrook division. All the track put down by the present company was laid with duplex rails. The heavy cars of the company have made bad work with the roadbed, and on some portions of the line ties have been put under the chairs, while other sections where the line crosses private property have been relaid with T rails.

The rolling stock consists of twenty-five of the thirty foot double truck Pullman cars, which were used for a time on the Duquesne Traction Company's road in Pittsburgh, but subsequently replaced by smaller cars. These cars have been found too heavy for the Lake Roland road and will be replaced with eighteen foot cars of a very handsome pattern built by the J. W. Fowler Car Company, Elizabethport, N. J. The company also has eighteen twenty-eight foot open cars, built by the Lewis & Fowler Manufacturing Company. Edison and Thomson - Houston motors are used on the present cars. A second order for twenty-five cars was placed last month with the J. W. Fowler Car Company.

The line of this road is full of bad grades and curves, the operations of the line having been handicapped by mistakes in engineering and construction. From the City Hall terminus to Roland Park there is a rise of nearly 400 ft., and the line appears to have been located with little regard to grades and curves. The economy in first costs attempted by the promoters of this road appears to have been a pretty expensive kind of saving, but in spite of the disadvantages under which it has operated, the road has been very successful from the start and has succeeded in building up a large traffic in an entirely new field.

BALTIMORE CITY PASSENGER RAILWAY.

The Baltimore City Passenger Railway Company operates six different lines of railway, on three of which the cable has been introduced during the past two years, and the remaining lines are now being changed from horse to electric traction. The lines of this company tap the largest traffic producing sections of the city, and converge to the business center. Baltimore Street, the chief east and west thoroughfare of the city, is occupied by the



FIG. 8.—VIEW OF TRACK—LAKE ROLAND ELEVATED RAILWAY.



FIG. 9.—CITY HALL TERMINUS—LAKE ROLAND ELEVATED RAILWAY.

cable lines of this company, and all of its lines touch or traverse this street within the space of a few blocks east and west of Charles Street. At the present time the three cable lines of this company are of the most interest, as they are complete and in regular operation, while horses are still in use on the other lines. The White line extends from Patterson Park to the east, through Baltimore Street to the center of the city, and then strikes away to Druid Hill Park on the northwest. The Red line extends from the western edge of the city east through Baltimore Street to the business center, and then strikes away to the northeast. The Blue line runs north and south from Baltimore Street to the northern limits, serving as a spur or feeder for the other two lines. Roughly speaking, the cable system of this company resembles the letter K with a third leg bisecting the obtuse angle. Free transfers between the lines of this company are given at intersecting points, thus giving a very comprehensive service.

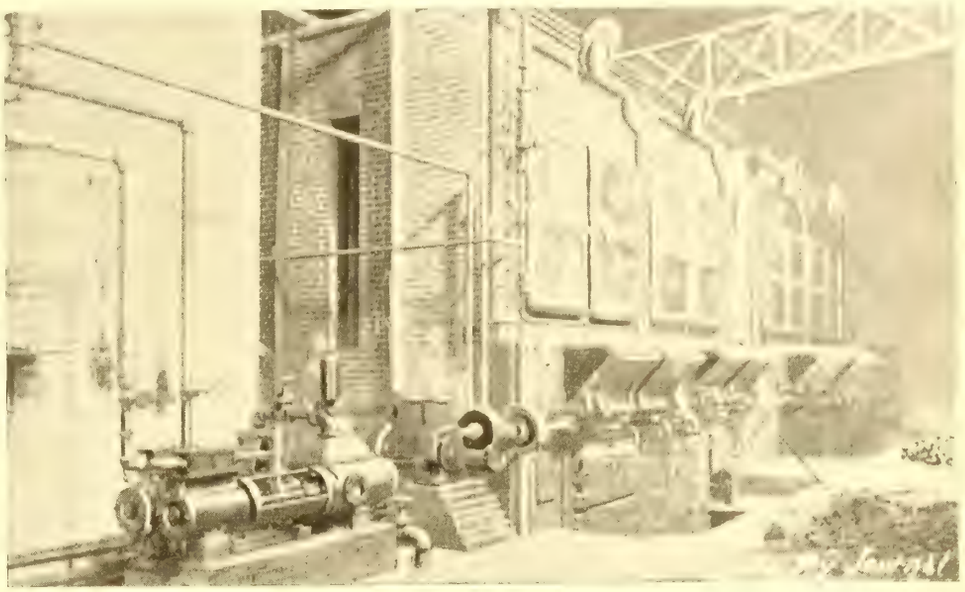


FIG. 11.—INTERIOR OF EUTAW STREET BOILER HOUSE—CITY PASSENGER RAILWAY.

There are three power houses for the cable system of this company, one on Eutaw Street, 500 ft. south of Baltimore Street, one on East Baltimore Street, and one on North Charles Street. Three cables are driven from the Eutaw Street station, one operating the western division of the Red line on West Baltimore Street, one operating the northwestern end of the White line on Madison Avenue to Druid Hill Park, and a short rope on Baltimore Street east from Eutaw Street, through the crowded portion of the city, which is used by both the Red and White lines. The station is a handsome structure of red brick trimmed with Seneca sandstone, with a frontage of 110 ft. and a depth of 160 ft., and an L, 70 × 47 ft. The driving gear is from the Walker Manufacturing Company, and a rope drive is used to transmit the power from the main shaft to the drum shafts. The cable drums for the West Baltimore and Madison Avenue ropes are fourteen feet in diameter, these ropes running at a speed of eleven miles an hour. The Baltimore Street rope is driven from ten foot drums at a speed of six miles. The power is furnished by two Reynolds-Corliss compound, non-condensing engines, with cylinders 24 and 38 × 60 ins. Steam is supplied by Campbell & Zell water tube boilers which are fitted with Roney stokers. Upton tension carriages, similar to those used on the Washington & Georgetown road in Washington, D. C., are used here and in the other stations of this company. A winding drum for reeling old cables has just been set up in this station, and similar reels have been put in the other houses. It consists of a wooden spool driven by a small Lidgerwood hoisting engine, connected by gearing. The drum is placed in the tension run and is designed to take the old rope as it comes from the street.

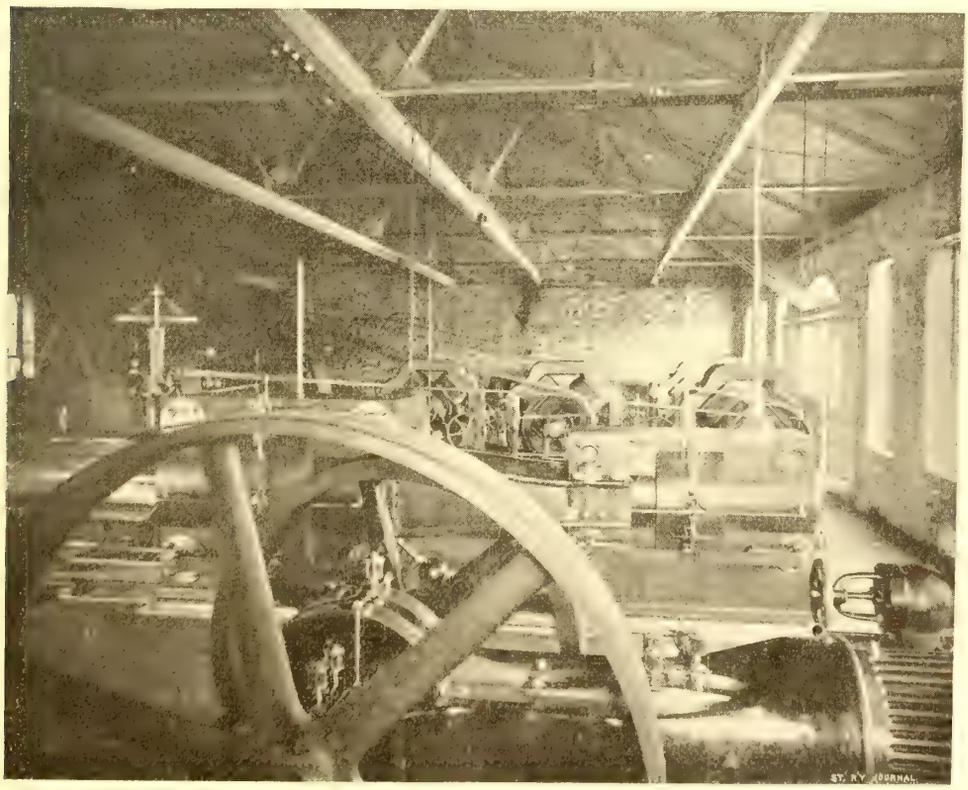


FIG 10.—INTERIOR OF STATION—LAKE ROLAND ELEVATED RAILWAY.

This station stands 500 ft. from the line of the tracks on Baltimore Street, and the three cables are carried to Baltimore Street in a concrete tunnel, 5 × 5 ft., under Eutaw Street. The Baltimore Street rope runs up Eutaw Street across Baltimore Street, and comes back on the curve leading into Baltimore Street, being used in carrying the cars around the curve. The Madison Avenue rope goes straight up Eutaw Street to Madison Avenue, and the West Baltimore Street rope goes to the western terminus of the line without a curve. The slow Baltimore Street rope turns up Gay Street at its eastern end, the fast rope on that line being taken after the turn into Gay Street. The Madison Avenue rope has 80 ft. of 100 ft. radius curve, 440 ft. of 250 ft. radius, and 23,869 ft. of tangent, making a total length of 24,389 ft. The West Baltimore Street rope is 23,285 ft. long, without a curve. The Baltimore Street rope has 153 ft. of 40 ft. radius curve, 84 ft. of 60 ft. radius, 4 ft. of 250 ft. radius, and 8,454 ft. of tangent, making the total length 8,695 ft.

The Baltimore Street station is of the same general style, and its equipment is identical with that of the Eutaw Street house, except in point of size, as only two ropes are

driven from the former. The engines are 22 and 36 × 60 ins., and the cable driving drums are 13 and 14 ft. in diameter. The 13 ft. drum drives the Gay Street cable at 9 miles an hour. This rope goes east on Baltimore Street to Gay, and thence up Gay. This rope has 1,000 ft. of curves of various radii—85 ft. of 60 ft., 195 ft. of 100 ft., 85 ft. of 175 ft., 635 ft. of 250 ft. radius, and 26,009 ft. of tangent, making a total of 27,009 ft. The East Baltimore Street rope, which runs east from this power house to Patterson Park, in East Baltimore, has a speed of 11 miles. Its curves are as follows: 203 ft. of 60 ft. radius, 105 ft. of 75 ft., 80 ft. of 100 ft., 45 ft. of 175 ft., 35 ft. of 200 ft., 230 ft. of 259 ft., and 13,234 ft. of tangent, making a total length of 13,932 ft.

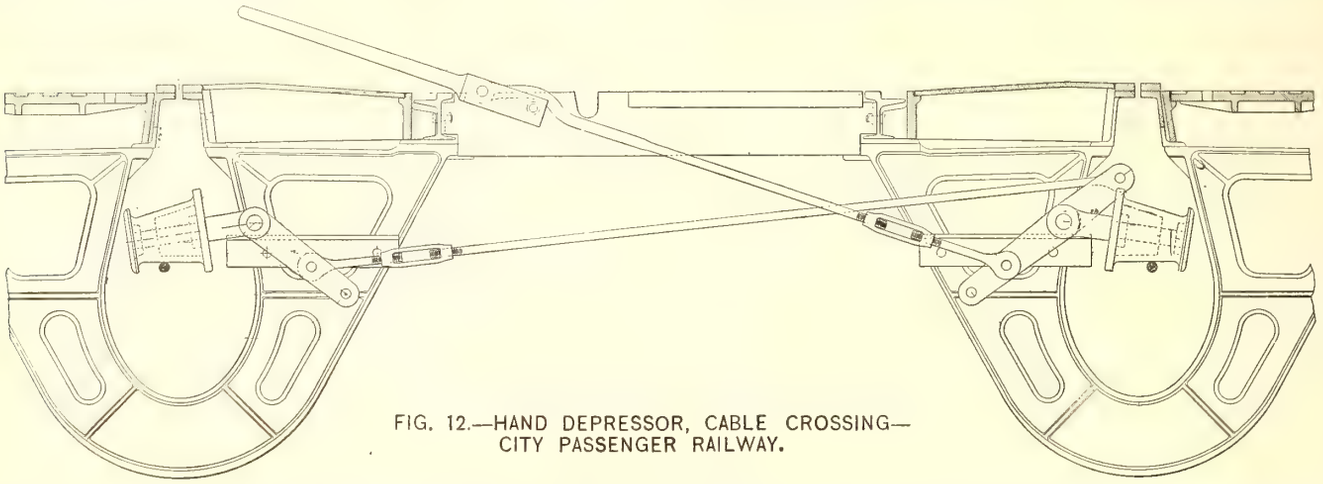
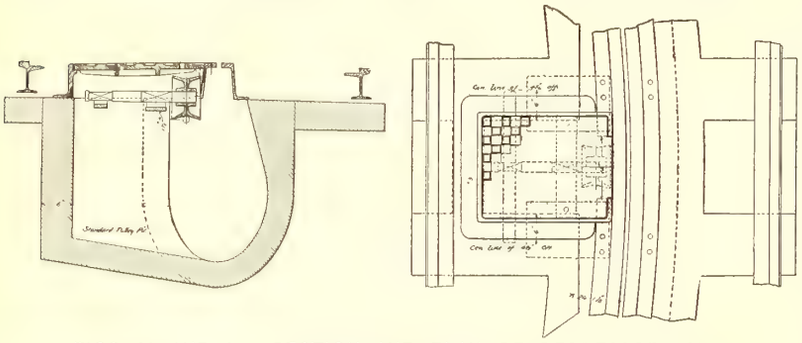


FIG. 12.—HAND DEPRESSOR, CABLE CROSSING—CITY PASSENGER RAILWAY.

The North Charles Street station is similar in construction to the other two. The driving gear in this station was supplied by the Robert Poole & Son Company, Walker differential drums being used. The engines have cylinders 20 and 30 × 60 ins. The steam plant and other fixtures are the same as used in the other stations already mentioned. Only one rope is driven from this house. It is driven from drums 8 ft. 6 ins. diameter, the speed being 9½ miles. This station has a car house attached, 180 × 56 ft., with four plain tracks and two open for inspection. This division of the road has the largest amount of curves, the length of each radius being as follows: 442 ft. of 43 ft. radius, 151 ft. of 60 ft., 44 ft. of 100 ft., 70 ft. of 150 ft., 32 ft. of 175 ft., 250 ft. of 200 ft., 125 ft. of 250 ft., and 22,294 ft. of tangent, a total length of 23,408 ft.



FIGS. 13 AND 14.—SECTION AND PLAN OF DEPRESSOR—CITY PASSENGER RAILWAY.

The track on the lines of this company is laid with seventy-five pound girder rails from the Pennsylvania Steel Company, a twenty-four inch splice with six bolts being used. Cast iron yokes are used, and the conduit is made of Portland cement concrete with a foundation of American cement for the pavement. The Red and White lines were built by E. D. Smith & Son, of Philadelphia, and the Blue line by E. Saxton, of Kansas City. Thirty-six inch pulleys are used on the curves, with spiral grooved pulleys wherever the rope has a tendency to ride high. On the fast ropes fourteen inch carrier sheaves are used and ten inch on the slow ropes.

One of the troublesome incidents of construction for the engineers of this road was the crossing of the cable lines of the Traction Company. There are five such crossings, the Traction Company having the upper rope at all but one. The North Charles Street line crosses the line of the Traction Company at Fayette Street. The cars of the Baltimore City Passenger Railway approach on the north side of this crossing with a rising grade of 2 per cent. and a curve of 250 ft. radius, the approach from the south side being on an up grade of 1¼ per cent. The worst crossing, however, is at the intersection of the Traction Company's tracks on Fayette Street and those of the White line on Eutaw Street. At this point there is a depression in the tracks of the Traction Company, which brings the cable of that line close to the top of the slot rail, and as the White line has the lower rope, the crossing presents two problems: First, to keep the Traction Company's rope permanently down from the slot, and, second, to depress it at the passage of the White line cars. The second problem is the usual one, and is met in the usual way by the use of a hand depressor of ordinary type. The high position of the upper rope brought it above the convenient point for contact with the pulley of the hand depressor, and necessitated the use of a special device designed by Chief Engineer Connett, of the Baltimore City Passenger Railway. The accompanying engravings show the construction of the hand depressor and the fixed depressing wheel, and with the following explanatory notes the working of the device will be apparent: East of the crossing there is an offset of four and three-quarters inches in the slots of the Traction Company's line, and a small depressor wheel is placed in the normal line of the Traction Company's cable at this point, which is fourteen feet from the center of the crossing. During the passage of a car the offset carries the grip clear of this depressing wheel, and after passing the cable returns to its place in the depressing sheave. The depressing wheel is 8½ ins. in diameter, with a 5½ in. face and 1⅝ in. depth of groove. It is mounted on the end of a $1\frac{15}{16}$ in. steel spindle, $21\frac{17}{32}$ ins. long, running in boxes set on the top line of the yokes. This gives the cable a fixed position 11 ins. below the top of the slot and brings it within reach of the hand depressor. This device has worked without defect, and thus far the cable has never slipped the depressing wheel. The construction of the hand depressor is shown by the engraving.

The new rolling stock for the cable lines of this company consists of sixty-two open grip cars and the same number of sixteen foot closed trailers. Trains of two cars are run on all the lines, the termini having no loop, but straight tracks with two crossover switches. These cars were built by the J. G. Brill Company, and are of the pattern used in Washington, Cleveland, Chicago and other cities. The running gear was furnished by the Baltimore Car Wheel Company, and Whitney wheels are used. The cars are handsomely finished in mahogany, and are of tasteful design. Ten additional grip cars have recently been received from the John Stephenson Company, which are of similar pattern, and a number of the old horse cars

formerly used by the company have been rebuilt for use as trailers. A double side-jaw grip, designed by the engineers of the railway company, is used. Reversible soft steel dies are used, the life being about twenty days. Roebling ropes are used on all the lines. The first set were Lang lay, but some ordinary lay were bought for the second set. Lang lay will be used throughout hereafter.

The electric lines of the Baltimore City Passenger Railway Company, now in course of construction, will form an important system of about twenty-one miles of track. The Green line, which traverses the city diagonally from Druid Hill Park to Canton, has been relaid with ninety pound Johnson girder rails on ties, by E. D. Smith & Son, and the Yellow line, which extends from the southern limits to the center, and thence to the northeast of the city, has been relaid with seventy-two pound Johnson girder rails on three inch chairs, by E. Saxton. The Hall Springs line embraces most of the Yellow line and a northern extension which will be rebuilt this spring.

The power house for the electric lines is being erected at Light and Heath Streets in the southern part of the city. The engine room proper will be 72 ft. wide, 116 ft. long on one side and 134 ft. on the other. There will be a boiler room, 45 × 112 ft., a coal room, 58 × 58 ft., a machine shop, 72 × 34 ft., and a car barn 227 ft., long by 64 and 50 ft. wide. It is also the intention of the company to erect extensive car shops at this point in the future, but plans for this have not yet assumed definite shape. The power plant will consist of three Reynolds-Corliss simple engines, 30 × 60 ins., belted to three 500 K. W. Westinghouse generators. There will be eight Campbell & Zell 250 H. P. boilers with Roney stokers. The engine room will have a ten ton overhead traveling crane built by the Maryland Steel Company. There have been ordered for the electric lines of the company fifty eighteen foot Brill cars, with No. 21 Brill trucks which will each carry two thirty horse power Westinghouse motors.

The extensive improvements which have been made by the Baltimore City Passenger Railway Company during the past two years are noteworthy for the high character of the work. There has been no stinting of money, and those portions of the system that have been completed stand as good examples of modern practice in street railway construction. A. N. Connett, the chief engineer of the company has much to be satisfied with in the troublesome problems he has solved during construction.

BELTS.

All the belts used in the station of the City & Suburban Railway are Charles A. Schieren & Company's perforated electric belts, and are twenty-five inch, double. All the belts employed in the plant of the Lake Roland Elevated Railway are of the same manufacture.

SUPERINTENDENT HANNAN, of the New York State Department of Public Works, gives considerable space in his annual report to a discussion on the electric propulsion of canal boats on the Erie Canal. He estimates that the boats can be operated for about ten cents per mile per boat, and at a speed of three and a half miles per hour.

THE Montreal Park & Island Railway, operating between Montreal and Sault au Recollets, was put into operation last month. This company proposes to establish a freight service between midnight and 5 A. M., so as not to interfere with the regular passenger traffic. The road will bring in buttermilk and farm products, as well as manufactured articles, and arrangements will be made, it is said, with the Montreal Street Railway Company to run into the center of the city.

An Electric Road in a New Field.

The Mousam River Railroad, which connects the town of Sanford, Me., with the nearest freight station on the Portland & Rochester Railroad, and extends to the town of Springdale on that same road, marks a new departure in electric railway economics in having a large freight, express, mail and baggage business, besides the regular passenger travel. A short description of this road was given in a recent issue, but through the kindness of Superintendent E. K. Day we are enabled to present the following additional particulars:

Sanford is a manufacturing town of about 5,000 inhabitants, and is situated on the Mousam River, at a distance of about three miles from the nearest passenger station on the steam road. The Sanford Plush Mills, the principal industry of the place, are about one and three-quarters miles from the freight station on the steam road.



ELECTRIC FREIGHT LOCOMOTIVE AT SANFORD, ME.

All of the baggage, express and mail business of the town is handled by this road, using for this purpose trail cars attached to the regular closed motor cars.

The freight and coal hauling is done by a special electric locomotive in ordinary freight cars, making a direct haul from the railroad junction to the point of delivery. All coal and merchandise is brought in and all shipping done in this manner. An idea of the amount of business done in this line may be gained from the fact that from February 28 last, when it commenced to haul freight, to December 15, 23,586,377 lbs. had been handled in 1,332 freight cars, an average of nearly six cars and fifty tons per working day. This is certainly a remarkable showing, and opens up a new field for electric transportation in many sections where towns doing large business are situated at a distance from the railroad. The passenger traffic for the eight months from May 30 was 111,725, with an average of eighty-five car miles per day.

This road and all of its equipment are built in the best possible manner. The power station is a wood and brick building, 117 × 54 ft. in size, and is situated on the line between Sanford and Springdale. The power plant consists of one seventy horse power Corliss engine, made by the Swampscott Machine Company, of South Newmarket, N. H., and one 150 H. P. Humphrey water wheel, which together drive two 100 H. P. Westinghouse multipolar generators.

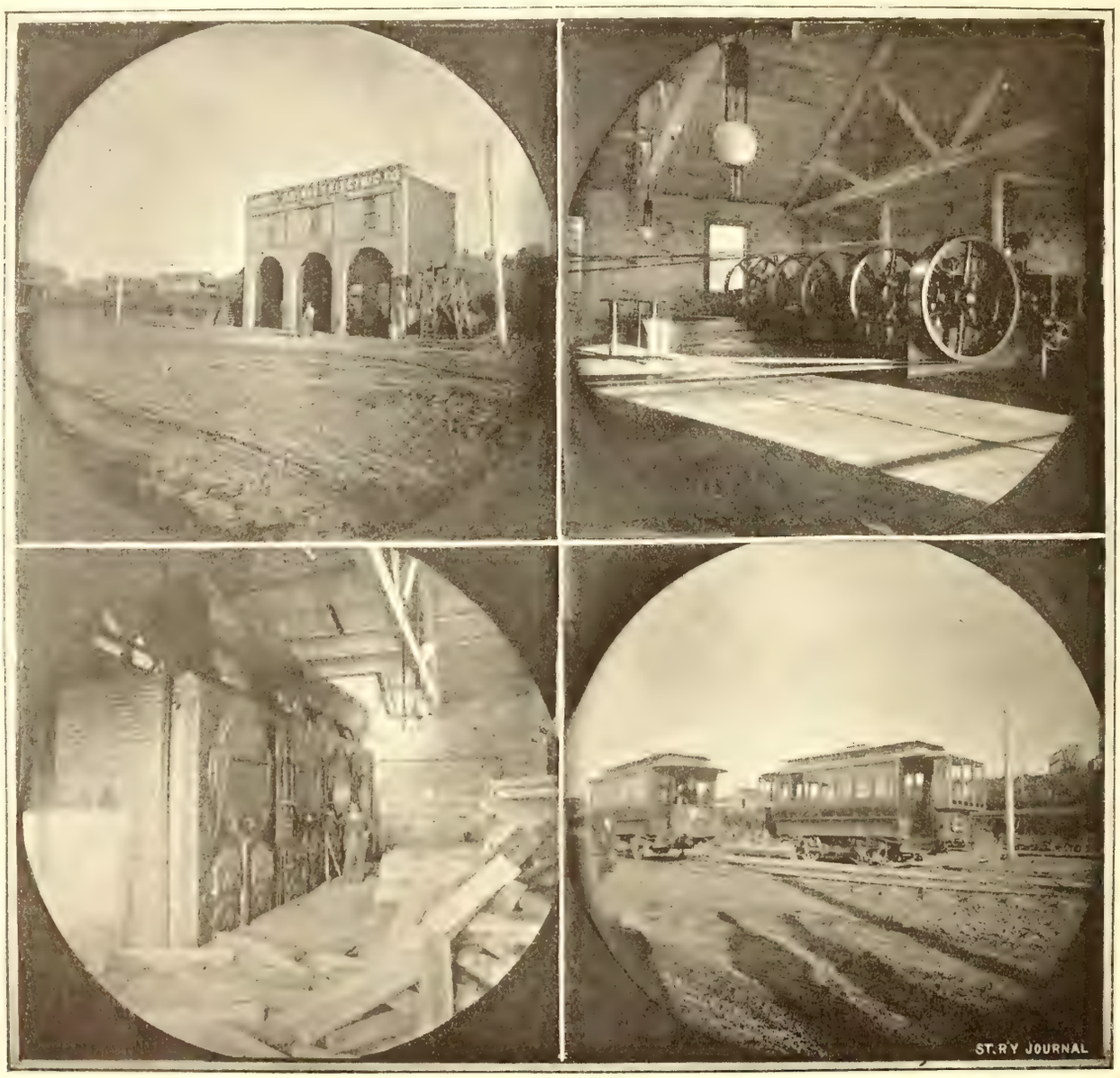
The trolley wire is No. 0 and the feed wire No. 0000, all from the John A. Roebling's Sons Company. The poles are of hard pine and chestnut with clamp brackets.

The roadbed is of the same construction as for a steam road, with sixty pound T rails laid on cedar ties spaced two feet to centers, and equipped with patent lock switches, The length of line is 2.47 miles single track, maximum grade 5½ per cent. for 700 ft., smallest curve 104 ft. radius. The bonding is with No. 0 soft copper, riveted and soldered on each end and also connected to six copper plates $\frac{5}{16}$ ins. × 6 ft. square, sunk three feet in the ground near the river. The car house is forty feet square, with three tracks, and having three pits lighted by electricity.

since February 28, 1893, and the total expense for maintenance, including turning one commutator, has been but $8.64.

The Everett (Wash.) Electric Railway.

The city of Everett, Wash., is situated on a peninsula about four miles long and one and a half wide, formed by the Snohomish River, which empties into Puget Sound at this point. The town is largely owned



VIEWS ON THE LINE OF THE EVERETT ELECTRIC RAILWAY—EVERETT, WASH.

The rolling stock consists of two twenty-seven foot, closed motor cars, built by the Briggs Carriage Company, of Amesbury, Mass., each with two twenty horse power, single reduction Westinghouse motors. There are also two open trailers and two box baggage and express trailers. All cars are lighted and heated by electricity, Ahearn heaters being used. Bemis trucks, with sand boxes, and Dorner & Dutton track scrapers, are used on all cars.

The electric locomotive used, of which we show an illustration, is furnished with two thirty horse power Westinghouse single reduction motors. The drivers are three feet in diameter with five and a quarter inch axles. It is twenty-seven feet long over all and weighs 20,100 lbs. The normal speed is fifteen miles per hour. The cab is heated and lighted by electricity. Sand boxes, bell, track scrapers and snow plow are parts of its equipment. The locomotive hauls, regularly, four cars loaded with thirteen tons of coal each up a 5½ per cent. grade, and has started 104 tons one time. It has been in use by the Everett Land Company, a syndicate of New York capitalists, whose intention is to build up a large industrial city at this point. This company has recognized the fact that a well developed electric railway system is a most important factor in the growth and development of a city, and has installed at Everett an electric railway system, which has materially advanced the growth of the city. For a considerable extent the line lies through uninhabited territory. One branch runs from the Wire Nail Works, located on the Sound, directly across the peninsula to the river. Two other lines branch off half way between these two points, one going in a southerly direction about two miles to a large paper mill belonging to the Puget Sound Pulp & Paper Company, the other extending north about the same distance to the Smelter & Reduction Works and the Pacific Steel Barge Works, the Pacific home of the famous steel ships, the "whalebacks."

The plant was constructed by J. L. Colby, of 36 Wall Street, New York. The constructing engineer was Prof.

Leo Daft, the well known inventor and pioneer in early electric railway work. Work was commenced about the middle of January, 1893, and the plant was turned over to the operating company July 3. Since that time it has been in continuous operation without a stop, day or night.

The power station, which is of brick with a truss roof, measures 97 × 56 ft. It is located on Federal Street, between Hewitt and California Street. The stack is five feet in diameter and measures ninety feet in height. The engine room contains three cross compound Ball engines, having cylinders of the following dimensions: One 12 and 20 × 12 ins., one 11 and 19 × 12 ins., and one 13 and 22 × 12 ins. The first engine drives three arc light machines of the Standard Electric Company's make, each having a rated capacity of fifty 2,000 C. P. lamps. The second engine is belted to a Westinghouse 225 ampere, multipolar railway generator. The third engine is belted to two 1,000 light Westinghouse alternators for incandescent lighting. All three of the engines are speeded to run at 300 revolutions per minute. Hoyt's belts are used. The engines are rated at 125, 150 and 200 H. P. each.

The exhaust is carried under the floor to the condenser pit, located between the engine and generator foundations, where it enters two surface condensers manufactured by the Barr Pump Company. The salt water, which is used for condensing purposes, is taken from a crib built out in Puget Sound, 1,000 ft. from the power house. In the condenser pit are also located the grease extractors, oil and water filterers and the hot well pump.

The switchboard is a handsome piece of California redwood, highly polished, on which are located Westinghouse instruments of latest design, all of which are mounted on marble bases. It stands ten feet from the wall, allowing easy access to all connections.

The boiler room, which measures 32 × 56 ft., contains a battery of four hand made return tubular boilers, seventy-two inch shell, sixteen feet in length and containing eighty-two four-inch flues. These were supplied by the Washington Iron Works, of Seattle. Fir and pine wood is exclusively used for fuel. The boiler feedwater is obtained from several springs back of the boiler room, but connection has been made with the city mains for use in cases of emergency. Two Barr pumps are used for the boiler feed. Tests have shown that 60 per cent. of the feedwater for the boilers is obtained from the condensed steam from the condensers.

Directly off from the engine room is a small store room and engineer's office, measuring 10 × 10 ft., and a work room measuring 10 × 40 ft. Here all the testing of the arc lamps, transformers, etc., is carried on, and every facility provided for repairs, rewinding armatures, etc.

The car house is located two blocks south of the power house, and measures 57 × 100 ft. It is of brick and wood, two stories in height, and contains two tracks, each having a capacity of three cars, with repair pits under each track. On the first floor is also located the manager's, superintendent's and bookkeeper's office. The second story is used for a store room and rewinding room.

The rolling stock of the company consists of five cars, from the works of the American Car Company, of St. Louis. These have sixteen foot car bodies, and are all finished inside with cherry and oak veneer, with plush upholstered seats. The exterior coloring is yellow. Each car is mounted on a McGuire Columbian truck, with a six foot wheel base and thirty-three inch wheels, and is equipped with two twenty horse power, single reduction Westinghouse motors. The vestibules were made from designs furnished by the superintendent, making a very attractive looking car. Nuttall trolleys and Lewis & Fowler stationary registers are used. The sand boxes, which were designed by the president, H. C. Wybro, are of novel design, and have given excellent satisfaction. They are hopper shaped, with a gas pipe leading from the valve located at the bottom of the hopper, so that the sand strikes the track about four inches in front of the wheels. The valve is operated by a pin projecting about two inches above the platform floor, and is operated by the foot of the motorman.

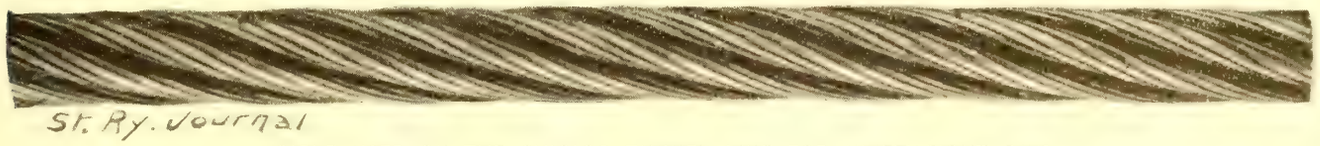
The line consists of seven and four-tenths miles of double track, with a maximum grade of 9 per cent., extending for a distance of 250 ft. It is laid with forty pound girder rail, connected with six bolt fishplates and laid on 5 × 7 in. Washington fir stringers, which are in turn supported on 5 × 7 in. × 7 ft. ties of the same width, spaced two feet between centers. The return circuit is made by bonding each joint with channel pins and connecting to a copper supplementary at every fifth joint. Wherever the double track is used the rails are double and cross bonded at regular intervals.

The overhead trolley wire used is a No. 0, and was purchased from J. A. Roebling's Sons Company. The line appliances were supplied by the Railway Equipment Company, of Chicago, and Washington fir poles are used.

As this city is the new Pacific Coast terminus of the Great Northern Railway, it is expected that the car line running to the Barge Works will eventually be extended across the river, where the Great Northern Railway owns considerable land, on which its shops and roundhouses will probably be constructed.

An Excellent Cable Record.

The Lang lay rope, manufactured by George Cradock & Company, which, as noted in the December issue, was then running on the tunnel division of the North Chicago Street Railway, was taken out on December 2,



CABLE USED ON THE CHICAGO TUNNEL LINE FOR NINETY-EIGHT DAYS.

having been ninety-eight days in service. This is regarded as an exceedingly good result considering the conditions and the heavy traffic incident to the World's Fair, it having lasted longer than any other rope previously employed on this division. Had it not been for a heavy snow storm, during which the management were afraid to risk the rope, it would have lasted for several days longer.

The service in the La Salle Street tunnel, as is well known, is most severe, as the cable not only operates all the cable cars for all the North side lines of Chicago, but passes about four sharp curves under great tension and under a depression pulley at the bottom of the tunnel. The rope was 9,760 ft. long, ran at the rate of seven miles per hour, and the first splice ran eighty-three days. It is one and three-eighths inches in diameter, of the Lang lay and is composed of six ten wire strands wound around a hemp center. The engraving on this page is from a photograph of a section of the cable sent us from Chicago, and as will be seen, none of the strands are broken, and the wear is very evenly distributed. Two of the Cradock ropes in the same place lasted, one, ninety-three days and the other seventy-three days, when it was still in good condition, but was ruined by the carelessness of a gripman. The North Chicago Street Railway Company has just placed an order for five new Cradock ropes for use on the tunnel loop, and also for a main line rope, 22,000 ft. in length.

In this connection it is interesting to note that a rope by the same makers, employed on the lines of the Tramway Funiculaire de Belleville, Paris, ran 365 days, having been put to work September 21, 1892, and taken up September, 21, 1893. The succeeding rope on this line, manufactured by another firm, broke in eighty-five days, and has been followed by a second rope of the Cradock manufacture.

An Investigation of an Egyptian Franchise.

By Arthur Hodges.

My attention was recently called to the fact that the Egyptian Government had granted a concession for the construction of a street railway in Cairo, and invited bids for the privilege of building and operating the same. Thinking that there might be a possibility of a remunerative venture in a city of 500,000 inhabitants, with a summer influx of 50,000 travelers, even though it was located in Egypt, I determined to investigate the subject, and having done so, it strikes me that there may be something of interest in it for the readers of the Journal, as indicating the difference in value between a street railway franchise in America and a "concession" in Africa.

The concession starts out by saying that the person to whom the concession is made "is authorized, at his own risk and peril, without any responsibility on the part of the government, and without the present authorization being considered as constituting any privilege or monopoly whatsoever, to construct" a street railway upon certain designated streets. It is stipulated that the "grantee of this permission shall not be allowed to claim any indemnity whatsoever * * * * by reason of the condition of the street, and the influence which it might exercise over the preservation and maintenance of the railways, nor by reason of the opening of new ways of communication or of the establishment of new services of transportation in concurrence with that of the grantee, nor by reason of the interruptions of service which might result, * * * * by the city authorities or by companies or individuals duly authorized; neither for *any cause whatsoever* resulting from the free use of the public highway." In case the track is disturbed by private companies or individuals "the reconstruction of the track is to be at the charge of the grantee," and in case the street is torn up by the city authorities or government, "the repairing and reconstruction of the street and the track is to be at the charge of the grantee." The government reserves the right to disturb the tracks, or to authorize others to do so, at any time, without constituting a claim for damages, and the "grantee must constantly maintain, at his own expense, in good running order, the lines of track and the paved belt, the construction of which is imposed upon him, in such manner as that the public travel is always easy on that part of the public highway occupied by the street car line." "At the time of construction, the grantee is bound to raise carefully the materials composing the pavement where the line is to be laid, to sort them, and transport them to the places which will be indicated by the city authorities." "Before signing the contract" the person to whom the authorization is to be made "shall deposit in the safe of the Ministry of Finances, as security, a sum of three thousand Egyptian pounds, either in gold not bearing interest, or in bonds of the Egyptian debt, valued at the current price of the day. He can detach the coupons when due." The work is to be commenced within nine months from the date of the authorization, and to be completed within two years, and "in case of his default in conforming to either one of the periods of time indicated, the benefit of the authorization shall be declared forfeited as to him." "In case of forfeiture, the security will be confiscated, and the works already completed will become in full right the property of the government, in which case it is clearly understood that there shall not be due any indemnity to the grantee or anyone for him." "Forfeiture will also be pronounced if *at any time whatsoever* the operation of the lines is interrupted *totally* or *partially* during an interval of six months." "In case of failure or insolvency of the grantee, the authorization shall of full right become null and void, without any indemnity as well." The grantee is not permitted to sell or dispose of his rights to any other parties without permission of the government, under penalty of forfeiture. "The government reserves the privilege, in case of necessity, of which it is and will remain supreme judge, to do away with any part or all of the roads conceded." In such case the indemnification is to be decided by "experts mutually chosen," and if necessary, "a third to be named by the President of the Mixed Tribunal of Cairo, to decide between the first two." "Forfeiture will be pronounced by decision of the Council of Ministers, and from that decision there shall be no appeal whatever." All decisions of every nature are to be made by the government or its agents, and from these decisions there is in no case any appeal.

In consideration of these *valuable* concessions and authorizations, the "grantee" agrees to pay to the government an "annual bonus" of a certain percentage of the gross receipts of the business (such percentage to be agreed upon before signing the authorization), a certain additional "annual bonus" also to be agreed upon, and one-half the profits above 7 per cent. It is also agreed that "at the expiration of the thirtieth year the government will enter into free possession and become owner in full right of the lines and roads, of the fixtures, of all constructions erected on the grounds of the state, and of the cars or other rolling stock, calculated at the rate of five cars to each three kilometers' length of the road, which the grantee shall be bound to turn over to it in a good state of preservation, all of which without the government having to pay any sum or idemnity whatsoever to the grantee of this concession. It will be the same in the cases of forfeiture or cancellation." There is to be a fine of two Egyptian pounds for each case of non-compliance with the clauses of the authorization or infraction of the regulations of the supervisors. The fines and other expenses of snpervisors, experts and so forth, are to be levied upon the security which must be made good within one month. The capital upon which the profits of the business are to be reckoned is the first cost of the road, to be determined by a tribunal appointed by the government, and which is to include a sum necessary for "the amortization in thirty years of the capital of the enterprise." There is also allowed a "floating capital necessary to carry on the business, but not to exceed 5,000 Egyptian pounds."

The total length of track I estimate to be about eleven miles. It is to be single track with necessary turnouts. The whole construction, including pavement, is to be approved by the authorities. The minimum radius of curves is to be twenty-five meters. The cars are to be of the best model, are to have a separate compartment for ladies who are alone, and are to be kept clean "outside and inside." The employes must be dressed in uniform and must be "polite and respectful to the public." The traction may be by animals or electricity. The speed shall "not exceed eight kilometers (a little less than five miles) an hour." "No departure of a car shall take place before sunrise nor after 1 o'clock in the morning." "The Ministry of Public Works will fix annually the minimum number of trips which must be made each day on each line; it will also fix the hours of departure." The joining of two or more cars in the same train is prohibited. The maximum fare, whatever the distance, is limited to "a piastre and a half" (about seven and a half cents), and "for distances up to two kilometers the fare shall not exceed a half piastre" (about two and a half cents). "Soldiers and policemen in uniform shall be carried at half rates." "Children, accompanied, under four years of age, shall be carried free, if they are held on the knees." "Postmen and telegraph messengers on duty and their packets, as well as agents charged with the supervision of the operation of the street railways, shall be carried free. For this purpose the grantee of this concession shall send to the Ministry of Public Works fifty passes, which will be distributed to the employes having to make vse of them."

One ludicrous feature is the requirement that "the conductor of each car must be furnished with a horn to signal the approach of the car, and assure the clearing of the way."

To those who may be anxious to embark in a scheme which promises so much, I am sorry to say that bids must be in before February 1, 1894.

I do not propose to say anything further about the concession, but to present it to the readers of the Journal, leaving them to make their own comments upon it.

THE INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS.*

BY EDWARD E. HIGGINS.

SECOND PAPER.

In examining the statistics of local street railway systems serving a population of from 25,000 to 50,000, it is found that in the smaller cities success is still more or less problematical, while in the larger it is much more certain though hardly yet universal. There is no sharp population line marking the change from frequently unprofitable to generally profitable street railway operation, but for present purposes it seems best to subdivide class III into two sections and first consider

Class III a. Surface Railways in American Cities of from 25,000 to 35,000 Inhabitants.

There are thirty-five cities in the United States having a population of from 25,000 to 35,000 by the census of 1890. Twenty-one are in the Eastern States, seven in the Southern, six in the Central and one in the Western. All are served by extensive and well developed street railway systems. The total track mileage now exceeds 2,000, of which 75 per cent. is operated by electricity, 10 per cent. by horses, and the balance by various systems of motive power.

Twenty-two of these cities are represented in the Table of Statistics, although but sixteen appear in the class now under consideration. The population of five cities, with their suburbs, exceeds 35,000, while another is connected with a metropolitan system, so that its statistics cannot be given separately. Of the street railway systems in the remaining thirteen cities not represented in the table, one has suffered a number of vicissitudes within the past three years, and did not operate in 1892, although now (1894) in operation by electricity, and the statistics of the remaining twelve cannot be obtained in a sufficiently complete form for present purposes. One city of less than 25,000, is also brought into this class by the added population of its suburbs.

At the end of the various fiscal years ending in 1890, fourteen of the seventeen systems represented in the table were in operation wholly by horses, one was operated chiefly by horses but owned a short steam line, one was operated wholly by electricity, and one was changing to electricity, its horse and electric mileage being about in equal proportions. By the end of the fiscal year of 1892 the conditions were completely reversed. Eleven systems were in substantially complete operation by electricity, only two by horses, three were in the process of change from horse to electricity, and one was operating by horses, steam and electricity. The astonishing rapidity of this change of motive power is also seen in the statement that while, in 1890, 161 miles of track were in operation by horses as against but 37 miles by electricity, in 1892, 248 miles were operated by motive powers other than horses as against but 50 miles by horses.

HORSE RAILWAYS OF 1890.

The horse railways of 1890 were capitalized with moderation. 35 per cent. of the total mileage had no funded debt whatever, the funded debt of 28 per cent. was less than $10,000 per mile, and that of the remaining 37 per cent. ranged from $10,000 to $20,000 per mile of track. There was little, if any overcapitalization of costs in these figures, and a study of the operating statistics will, therefore, indicate quite clearly the intrinsic value of the horse railways of this class.

Of the fifteen horse railway systems under consideration, five earned less than $1.00 per capita gross in 1890, eight between $1.00 and $2.00 per capita, and two over $3.50 per capita.

The five systems earning less than $1.00 per capita may be dismissed with a brief word of explanation. Their small earning power was due chiefly to the shortness of the riding distances (2 to 5 miles only in all but one case), and to the inferiority of the car service given. The latter exceeded 4 miles per capita in but one case of the five, against from two to four times that figure with the more prosperous railways of this class. The operating expenses of four of the five systems consumed from 75 to 80 per cent. of the passenger income, the fifth *apparently* operating with greater economy at 67 per cent. The net earnings, though comparatively small, ranging from $2,700 to $9,000, were sufficient for a return on the respective capital liabilities of from 3 to 11 per cent., averaging over 6 per cent. It should be noted here that, although these five systems made a somewhat insignificant showing in 1890, the introduction of electricity has benefited them all very materially. Their passenger income in 1892 ranged from $1.25 to $2.33 per capita, and their net income was greatly increased. The measure of this increase will be discussed immediately.

The eight systems which earned from $1.00 to $2.00 per capita, fairly represent the average horse railway development of this class. That they were capable of much greater usefulness under electricity will soon appear, but they were managed with great economy and probably attained the fullest measure of success possible to them with horse operation. Their gross passenger income ranged from $30,000 to $60,000, the average earning power of the entire group being nearly $1.50 per capita, $5,300 per mile of road, and $.16 per car mile, the latter varying within wide limits from $.09 to $.25. It is noteworthy that the three roads showing the smallest income per car mile, gave a service far superior to that of the others, and all three are situated in the Central States. We find here the first indication of the exceptionally good street railway service, which is being given by many of the Western roads, some of which have probably gone too far in their attempt to serve the public, and will find it wise and necessary to reduce the service. The operating expenses of this group are widely different, but the larger number apparently operated at from $.15 to $.20 per car mile, and at from 75 to 85 per cent. of the passenger income. The net income in three of the eight cases exceeded $10,000 and ceased to be wholly insignificant. The net income per car mile was fairly uniform, varying from $.029 to $.056, and the return on the capital liabilities was, in all but three cases, above 5 per cent. on a moderate capitalization.

The two systems reported which earned over $3.50 per capita are evidently exceptional. Case No. 51 is a Western city system which, even in 1890, had been developed to an unusual extent for a horse railway, operating over 15 miles of road, and giving a service of 34 car miles per capita. With such a stimulus to traffic and in an enterprising and commercially prosperous city, it is perhaps not impossible that the passenger income should rise to over $90,000, this sum being equivalent to but $.104 per car mile, a very low figure, and $6,000 per mile of street, a moderately high figure. The cost of this exceptional service is shown in operating expenses which consumed 96.1 per cent. of the passenger income, leaving a net income of but $4,021, equivalent to a return of less than 1 per cent. upon capital liabilities of $36,100 per mile of track. This result is not, of course, satisfactory, and it is evident that the large passenger income has been obtained at too great a cost. Unfortunately, the 1892 returns for this road, which has been completely equipped by electricity, are not obtainable, but there is no doubt that the net results are much better than in 1890.*

Case No. 58 is that of a city situated near a large

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*Since writing the above I have received information, which throws a decided suspicion on the credibility of the report to the census department of case No.51. It is believed that both the gross passenger income and the car mileage have been overstated.

TABLE II.—AMERICAN STREET RAILWAY SYSTEMS

PART I.—STATISTICS OF CAPITALIZATION.

See "Intrinsic Value of Street Railway Investments." Horse Railways are given in Roman figures.

Case Number	Miles of Track					Miles of Street	Capital Stock			Funded Debt			Capital Liabilities			Floating Debt		Case Number
	Horse	Electric	Cable	Miscel.	Total		Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Memo.	
A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T
48	10.1	.....	.....	.....	10.1	7.5	100,000	9,900	4.00	.....	.....	.....	100,000	9,900	4.00	39,411	Net.	48
	10.4	.....	.....	.....	10.4	7.7	100.000	9,600	4.00	.....	.....	.....	100,000	9,600	4.00	38,747	"	
49	7.5	.....	.....	.....	7.5	6.5	200,000	26,700	8.00	.....	.....	.....	200,000	26,700	8.00	21,250	B.A.P	49
	.5	10.3	.....	.....	10.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
50	5.3	.....	.....	.....	5.3	5.1	50,000	9,400	1.90	51,500	9,700	2.00	101,500	19200	3.90	s 1,887	Net.	50
	.....	6.7	.....	.....	6.7	6.4	50,000	7.500	1.90	200,000	29,900	7.70	250,000	37,300	9.60	17,498	"	
51	14.5	.....	.....	3.3	17.8	15.5	342,250	19.200	13.20	300,000	16,900	11.50	642,250	36,100	24.70	.....	.....	51
	1.0	17.2	.....	.....	18.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
52	5.5	.....	.....	.....	5.5	4.9	75.000	13,600	2.80	.....	.....	.....	75,000	13,600	2.80	27,992	Net.	52
	.....	6.5	.....	.....	6.5	4.9	250,000	38,500	9.30	113,000	17 400	4.20	363,000	55,800	13.40	s 3,523	"	
53	.....	12.1	.....	.....	12.1	10.0	200,000	16,500	7.10	185,000	15,300	6.60	385,000	31,800	13.80	114,000	B.A.P	53
	.....	13.9	.....	.....	13.9	13.5	200,000	14,400	7.10	185,000	13,300	6.60	385 000	27,700	13.80	250,000	?	
54	6.3	.....	.....	.....	6.3	5.8	50,000	7,900	1.70	50,000	7,900	1.70	100,000	15,900	3.40	10,453	B.A.P	54
	6.5	.....	.....	.....	6.5	.....	50,000	7,700	1.70	50,000	7.700	1.70	100.000	15,400	3.40	.....	.....	
55	6.7	.....	.....	.....	6.7	6.3	60,000	9,000	2.70	30,000	4,500	1.40	90,000	13,400	4.10	s 1,681	Net.	55
	5.4	6.0	.....	.....	11.4	10.8	135,000	11,800	4.70	30,000	2,600	1.00	165,000	14,500	5.70	7,239	"	
56	12.5	.....	.....	.....	12.5	10.5	208 000	16,600	6.90	100,000	8,000	3.30	308,000	24,600	10.30	.....	.....	56
	.....	16.0	.....	.....	16. 0	.....	200,000	12,500	6.70	125,000	7,800	4.20	325,000	20,300	10.80	.....	.....	
57	3.5	.....	.....	.....	3.5	3.3	74,261	21,200	2.50	.....	.....	.....	74,261	21 200	2.50	3,433	Net.	57
	.....	z 6.5	.....	.....	z 6.5	6.0	180,000	27,700	6.00	42.500	6,500	1.40	222,500	34.300	7.40	s 3'538	"	
58	29.6	.....	.....	.....	29.6	18.4	400,000	13,500	12.90	545,000	18,400	17.60	945,000	31,900	30.50	120,997	Net.	58
	23.6	7.0	.....	.....	30.6	19.2	400,000	13,100	12.90	750,000	24,500	24.20	1,150,000	37,600	37.10	69,291	"	
l 59	10.0	18.1	.....	3.8	37.9	31.3	747,500	19 700	2.40	845,000	22,300	2.70	1,592,000	42.000	5.10	.....	.....	l 59
	3.0	32.0	.....	10.5	45.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
60	z 11.1	.....	.....	.....	z 11.1	z 11.1	200,000	18,000	6.30	.....	.....	.....	200,000	18,000	6.30	.....	.....	60
	.....	25.0	.....	.....	25.0	20.0	1,000,000	40,000	31.30	500,000	20,000	15.60	1,500,000	60,000	46.90	.....	.....	
61	12.2	.....	.....	.....	12.2	11.3	110,100	9,000	3.30	.....	.....	.....	110,100	9,000	3.30	.....	.....	61
	.....	16.8	.....	.....	16.8	15.5	385,000	22,900	11.70	385,000	22,900	11.70	770 000	45,800	23.30	.....	.....	
62	11.1	.....	.....	.....	11.1	11.4	68,000	6,100	2.00	100,000	9,000	3.00	168,000	15,100	5.10	12,370	Net.	62
	.....	10.6	.....	.....	10.6	15.7	400,000	37,700	12.10	400,000	37,700	12.10	800,000	75,500	24.20	88,924	"	
63	2.5	.....	.....	.....	2.5	2.0	38,000	15,200	1.20	.....	.....	.....	38,000	15,200	1.20	.....	.....	63
	.....	9.0	.....	.....	9.0	.....	300,000	33,300	9.10	300,000	33,300	9.10	600,000	66,700	18.10	.....	.....	
64	7.0	.....	.....	.....	7.0	3.5	100,000	14,300	3.00	100,000	14,300	3.00	200,000	28,600	6.10	90,000	B.A.P	64
	.....	52.7	1.1	.....	53.8	.....	610,000	11,300	18.50	288,000	5,400	8.70	898,000	16,700	27.20	.....	.....	

s. Current assets exceed current liabilities. z. Approximate. l. This report does not include two small steam motor roads, one in hands of receiver, the other insignificant.

metropolis. The system has always obtained a heavy summer excursion traffic from the larger city, as well as much of the daily transportation business tributary to the metropolis. The reason for its large gross income is therefore explained, but here again we have even more unsatisfactory results than in the case just discussed with respect to net income. A service of 32 car miles per capita, costing $.15 per car mile, has consumed more than the entire gross income in 1890, leaving a deficiency of nearly $2,000, while in 1892 the net income is merely nominal. In this particular case, one cause of the heavy operating expenses has been the exceedingly wretched condition of the company's roadbed, situated in streets which were practically unpaved, and which were in winter frequently choked by snow and ice to an extent which made traffic impossible. The system is now being equipped electrically, and in an exceptionally complete and thorough manner, and it is believed with reason that its net earnings under the new conditions will be sufficient to make a fair return on both the old and the new investments.

THE ELECTRIC RAILWAYS OF 1890.

These were but two in number. Case No. 53 operated about 10 miles of road; was capitalized at $31,800 per mile of track; gave a service of 22.6 car miles per capita; earned $3.39 per capita, $.15 per car mile, and $9,500 per mile of road; but the operating expenses in that year, which was a year of change to electricity, consumed a little more than the entire income, leaving a small deficiency. It is evident from the previous discussion that this electric road rose above the average of the horse railways of 1890, at least in passenger income.

Case No. 59 was, in 1890, a combination horse and electric road. It operated 31.3 miles of road, capitalized at $42,000 per mile of track; it served the public with nearly 45 car miles per capita; and by reason thereof earned $4.35 per capita, which is less than $.10 per car mile, and but $4,300 per mile of street; while its operating expenses consumed nearly 95 per cent. of the passenger income, and left but $8,232 of net income, equivalent to one-half of 1 per cent. on the capital liabilities. Unfortunately, again, the 1892 report of this road is not given.

SERVING FROM 25,000 TO 35,000 POPULATION.

PART II.—STATISTICS OF OPERATION.

Electric, Cable and Steam Railways are given in italics.

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Case Number	Population Served	Area	Population Per Mile Street	Population Per Square Mile	Year Ending	Car Mileage Total	Car Mileage Per Capita	Passenger Income Total	Passenger Income Per Mile Street	Passenger Income Per Car Mile	Passenger Income Per Capita	Operating Expenses Total.	Operating Expenses Per Car Mile	Operating Expenses % Passenger Income	Net Earnings Total	Net Earnings Per Car Mile	Net Earnings % Passenger Income	Net Earnings % Cap. Liab.	Case Number
a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u
48	25,000	....	3,300	.....	9-30-1890	175,434	7.0	37,560	5,000	.215	1.50	31,305	.179	83.0	6,256	.036	16.7	6.3	48
	25,000	....	3,200	.....	9-30-1892	195,398	7.8	43,537	5,700	.223	1.74	37,020	.190	85.0	6,518	.033	15.0	6.5	
49	25,000	....	3,900	.....	6-30-1890	373,982	15.0	33,578	5,200	.090	1.34	23,096	.062	68.7	10,777	.029	32.1	5.4	49
	.....	....	.....	.....	*9- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
50	26,000	....	5,100	.....	9-30-1890	89,425	3.4	11,833	2,300	.132	.45	9,460	.106	80.2	2,735	.031	23.2	2.7	50
	26,000	....	*4,100*	.....	*9-30-1892*	.....	.....	*32,427*	*5,100*	....	*1.25*	*26,063*	....	*80.6*	*6,819*	....	*21.1*	*2.7*	
51	26,000	....	1,700	.....	6-30-1890	883,250	34.0	92,188	6,000	.104	3.55	88,556	.100	96.1	4,021	.005	4.4	.6	51
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
52	27,000	....	5,500	.....	6-30-1890	219,000	8.1	23,842	4,900	.109	.88	16,044	.073	67.2	7,972	.036	33.5	10.6	52
	27,000	....	*5,500*	.....	*6-30-1892*	.....	.....	*43,474*	*8,900*	....	*1.61*	*34,536*	....	*79.3*	*8,985*	....	*20.6*	*2.5*	
53	*28,000*	....	*2,800*	.....	*6-30-1890*	*634,000*	*22.6*	*95,000*	*9,500*	*.150*	*3.39*	*95,700*	*.151*	*100.7*	d *400*	....	....	....	53
	28,000	....	*2,100*	.....	*12-31-1892*	.....	.....	*110,000*	*8,100*	....	*3.93*	.....	....	....	.....	.....	.....	.....	
54	29,000	....	5,000	.....	6-30-1890	229,656	7.9	45,118	7,800	.197	1.56	36,804	.160	81.6	8,814	.038	19.5	8.8	54
	29,000	....	.....	.....	6- 1892	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
55	29,000	....	3,500	.....	9-30-1890	126,338	5.7	30,962	4,900	.246	1.41	25,596	.203	82.6	5,807	.046	18.7	6.5	55
	29,000	....	*2,700*	.....	*9-30-1892*	*200,380*	*6.9*	*58,059*	*5,400*	*.290*	*2.00*	*40,426*	*.202*	*69.5*	*18,170*	*.091*	*31.3*	*11.0*	
56	30,000	....	2,900	.....	6-30-1890	409,098	13.6	50,139	4,800	.122	1.67	39,430	.096	78.6	13,358	.033	26.7	4.3	56
	30,000	....	.....	.....	*6- 1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
57	30,000	....	*9,100*	.....	6-30-1890	107,200	3.6	20,544	6,200	.192	.68	16,697	.156	81.5	4,555	.043	22.2	6.1	57
	30,000	....	*5,000*	.....	*6-30-1892*	.....	.....	*57,051*	*9,500*	....	*1.90*	*35,960*	....	*63.1*	o *21,091*	....	*36.9*	*9.5*	
58	31,000	....	1,700	.....	6-30-1890	996,000	32.1	151,351	8,200	.152	4.87	151,844	.152	101.0	l 1,780	....	....	....	58
	31,000	....	1,600	.....	6-30-1892	.....	.....	178,500	9,300	....	5.77	176,033	....	98.3	2,395	....	1.3	.1	
59	*31,000*	....	*1,000*	.....	*6-30-1890*	*1,393,470*	*44.8*	*134,782*	*4,300*	*.097*	*4.35*	*127,749*	*.092*	*94.8*	*8,232*	*.006*	*6.1*	*.5*	l 59
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
60	32,000	....	2,900	.....	6-30-1890	.....	.....	46,302	4,200	....	1.45	44,326	.. .	95.7	2,760	....	5.9	1.4	60
	32,000	....	*1,600*	.....	*8-23-1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
61	33,000	....	2,900	.....	6-30-1890	127,319	3.9	28,211	2,500	.222	.85	22,114	.174	78.4	6,097	.048	21.6	5.5	61
	33,000	....	*2,100*	.....	*6-30-1892*	.....	.....	*76,974*	*5,000*	....	*2.33*	*49,510*	....	*64.3*	*27,464*	....	*35.7*	*3.6*	
62	33,000	....	2,900	.....	6-30-1890	150,440	4.5	33,144	2,900	.221	1.00	28,828	.192	87.0	5,088	.034	15.4	3.0	62
	33,000	....	*2,100*	.....	*6-30-1892*	.....	.....	*70,160*	*4,500*	....	*2.13*	*57,616*	....	*82.1*	*14,850*	....	*21.2*	*1.9*	
63	33,000	....	17 000	.....	6-30-1890	94,900	2.9	12,124	6,100	.128	.37	9,153	.096	75.6	2,971	.031	24.5	8.0	63
	33,000	....	.....	.....	*6- 1892*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
64	33,000	....	9,400	.....	6-30-1890	374,400	11.3	59,757	17,100	.160	1 81	39,081	.104	65.4	20,835	.056	34.8	10.4	64
	33,000	....	.....	.....	*11- 1892*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	

l. This report does not include two small steam motor roads, one in hands of receiver, the other insignificant. d. Deficiency. o. From operation.

THE ELECTRIC RAILWAYS OF 1892.

The fully reported electric railways of 1892 are but six in number, and as all are the successors of fully reported horse railways in 1890, the discussion of their characteristics can be best made by direct comparison of the two financial statements.

The combined capital liabilities of these six railways averaged, in 1890, $13,900 per mile of track. This sum probably represented quite closely the actual cash expenditures which the several companies had charged to "Cost of Road and Equipment" up to that date, although many items which should have properly been charged to operating expenses were very likely carried to the capital account during the early history of the various companies, as horse roads in cities of this size can ordinarily be built and equipped at from $10,000 to $12,000 per mile of track.

In facing the problem of adopting electricity as a motive power, the managers of horse railway properties, both in this and in other classes, soon learned that it was necessary to provide nearly enough money to entirely rebuild and re-equip their roads *de novo*. The actual selling value of their tangible assets shrank to insignificant proportions. Electric motors were too heavy for the old cars, and the latter had no selling value; the introduction of heavy electric cars made it necessary to reconstruct the roadbed and to sell the old rails at scrap prices; the old barns and car houses were usually sacrificed; and fortunate was the manager who could obtain for his horses even one-third of their original cost. Nevertheless, the old security holders had to be provided for, and, naturally enough, the new investment was added to the old and the capital liabilities were made to represent what was really the cost of building duplicate roads plus the cost of extensions. If this had been all, if new securities could have been sold at par, if the prices for apparatus and construction work had been on an entirely cash basis, and if the promoters had not generally required large profits, the percentage returns on the new capitalization, even with the duplication of investment account above described, would probably have been, in nearly every case, increased, particularly in the larger places. Unfortunately, however, there

were many cases where these exceptionally favorable conditions did not obtain. The most common form of financing these enterprises was to issue mortgage bonds having a par value somewhat greater than the valuation placed upon the old properties, plus the estimated requirements for making extensions and equipping by electricity. Stock was then issued, frequently for about the same par value as the bonds, although the proportions varied according to the fancy of the promoters. The theory of the latter was that the sale of the bonds at a moderate discount would provide all the necessary money for the entire work, and that the net income would largely exceed the fixed charges, so that substantial dividends could be earned on the stock. This theory was doubtless held with entire honesty by nearly all those who have so actively promoted street railway enterprises, and it should be said that the value of their estimates of the earning power of these reorganized properties has been established in many cases, particularly in the larger cities. Moreover, it by no means follows that the present mortgage indebtedness of electric street railways is not frequently considerably less than the total cash investment in the properties, even aside from those companies whose capital stock was always intended to represent actual money. The original estimates of cost have frequently been greatly exceeded in practice, so that assessments upon the stock subsequent to reorganizations, or the creation of a floating debt, have been absolutely necessary.

It is not surprising, therefore, that we find the funded debt of the six systems under consideration increased from an average of but $4,100 per mile of track in 1890 to an average of $19,900 in 1892, nor that the average capital liabilities were increased from $13,900 per mile of track in 1890 to $43,700 in 1892. It is evident, however, that under the new conditions the percentage of net earnings to the funded debt is a much fairer measure of the intrinsic value of the properties than is the percentage to capital liabilities. In this case it is probable that the average funded debt per mile of track ($19,900) represents approximately the present cost of duplicating the tangible assets of the six electric roads, and the capital stock may be said, therefore, to represent the franchises.

Now the earning power of these six properties has greatly increased since the change of motive power. The gross passenger income in 1890 was $148,536—an average of $24,756 for each road, $3,500 per mile of street, and $.83 per capita. The gross passenger income in 1892 was $338,145—an average of $56,358 for each road, $5,700 per mile of street, and $1.90 per capita. A portion of this increased income was due to an increase in the average length of the roads from 7.1 miles to 9.9 miles, but by far the larger part was undoubtedly caused by the improved service which is always given by the reorganized properties.

The ratio of the combined operating expenses to the combined passenger income, which was exactly 80 per cent in 1890, was reduced to 72.2 per cent in 1892. Three of the six systems operated at from 63.1 per cent. to 69.5 per cent. and the remaining three at about 80 per cent.

The combined net earnings of the six systems was $97,379 in 1892, as against but $32,254 in 1890, an average of $16,230 and $5,376 respectively. This is encouraging in the main, four of the six systems having reached a condition where their net earnings are not wholly subject to contingencies impossible to foresee and guard against. But, the net earnings in 1892 are equivalent to a return of only 3.8 per cent. on the combined capital liabilities, as against a return of 5.2 per cent. on those of 1890, and at first sight it would seem that the change of motive power has not been as yet an unmixed benefit to the security holders. Bearing in mind, however, the previous discussion and with the knowledge that many of the properties have been in operation for too short a time to have reached the full measure of their earning power, the results are not unsatisfactory. If we may consider the funded debt as the true gauge of the actual cash investment in these properties we have here, in the first year of electric operation, a return of 8.3 per cent. as against but 5.2 per cent. on the probable true investment account in 1890.

GENERAL CONCLUSIONS.

What then can be said of the intrinsic value of the properties of this class. It is obviously unfair to allow the results of but eight systems out of a possible twenty-eight to have too much influence on our judgments. Nevertheless, in the light of all the information at command, I believe the following conclusions will be found nearly correct:

1. Properly developed and well managed electric railway systems in manufacturing cities and towns of this class, operating under average conditions, and giving a service of from 10 to 12 car miles per capita should be able to earn about $2.50 gross per capita, and from $6,000 to $7,000 per mile of road. Under exceptionally favorable circumstances, or where a large summer traffic can be developed by special attractions the passenger income may exceed this figure.

2. Electric railway systems of this size cannot be permanently maintained and operated, except under rarely favorable conditions at less than 75 per cent. of the passenger income. This statement is perhaps surprising but will be fully justified, I believe, by longer experience and for reasons which will be more fully explained in another chapter.

3. Assuming, therefore, that the safe net income will be 25 per cent. of the gross, we obtain $.625 as the net income per capita reasonably to be expected. This is 5 per cent. on $12.50, which is the measure of the total investment per capita permissible to the street railways of this class, if overcapitalization of earning power is to be avoided. Now it is easily possible to build and equip electric railway systems in cities of this class (at the rate of, say, one mile of track for each 2,500 inhabitants served) for a cash expenditure at present prices of somewhat less than $12.50 per capita. For example, a twelve mile street railway system in a city of 30,000 inhabitants can be built in most cases for about $250,000 It should be able to earn $75,000 gross and $18,750 net. The return on the investment would be, therefore, about 7.5 per cent., and this is roughly the average intrinsic earning power of the properties of this class.

4. Finally, it may be said in general that investors should refuse to consider any small electric railway proposition which does not involve: (a.) The service of a present population of at least 25,000 inhabitants; (b.) a traffic necessity for at least 5 miles of track and 5 cars; (c.) the direct service of a population not less than 3,000 per mile of track; (d.) the free gift, without burdensome conditions, of a franchise running for thirty years or more; (e.) the privilege of using a roadbed construction costing, ready for service, not more than $7,500 per mile of track.

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 25,000 TO 35,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
MILES OF TRACK.				
No. of miles operated	161.4	37.3	50.4	247.8
FUNDED DEBT PER MILE OF TRACK.				
No. of miles not reporting	....	....	....	74 5
" " having no funded debt	52.4	....	10.4	.....
" " " an indebtedness less than $5.000	6.7	....	....	11.4
" " " " " from $ 5,000 to $10,000	35.2	....	6.5	76.3
" " " " " " 10,000 to 15,000	7.0	....	....	13.9
" " " " " " 15,000 to 20,000	47.4	12.1	....	31.5
" " " " " " 20,000 to 30,000	.....	37.9	30.6	23.5
" " " " " " 30,000 to 40,000	.....	....	....	19.6
CAPITAL LIABILITIES PER MILE OF TRACK.				
No. of miles not reporting	....	....	....	74.5
" " capitalized at less than $10,000	51.7	....	16.9	6.7
" " " at from $10,000 to $ 15,000	42.1	....	30.6	95.1
" " " " 15,000 " 20,000	43.9	50.0	....	.....
" " " " 20,000 " 30,000	11.0	....	....	23.3
" " " " 30,000 " 40,000	.....	....	....	51.1

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 25,000 TO 35,000 POPULATION.

	1890.		1892.	
	Horse.	E. C. M.	Horse.	E. C. M.
POPULATION SERVED PER MILE OF STREET.				
No. of roads not reporting	....	....	1	6
" " serving less than 1,000 inhabit. per mile of street	....	....	....	....
" " " from 1,000 to 2,000 " " "	2	1	1	1
" " " " 2,000 " 3,000 " " "	4	1	....	4
" " " " 3,000 " 4,000 " " "	3	....	1	....
" " " " 4,000 " 5,000 " " "	....	....	....	1
" " " " 5,000 " 6,000 " " "	3	....	....	2
" " " " 6,000 " 8,000 " " "	....	....	....	....
" " " " 8,000 " 10,000 " " "	2	....	....	....
" " " over 10,000 " " "	1	....	..	...
CAR MILEAGE PER CAPITA.				
No. of roads not reporting	1	....	2	13
" " giving a service of less than 5 car miles per capita	5	....	....	....
" " " of from 5 to 10 " " "	4	....	1	1
" " " " 10 " 15 " " "	2	....	....	....
" " " " 15 " 20 " " "	1	....	....	....
" " " " 20 " 25 " " "	....	1	....	....
" " " over 25 " " "	2	1	....	....
PASSENGER INCOME.				
No of roads not reporting	....	....	1	7
" " earning less than $15,000 gross per annum	2	....	....	....
" " " from $15,000 to $20,000 gross per annum	....	....	....	....
" " " " 20.000 " 30,000 " " "	3	....	....	....
" " " " 30,000 " 40,000 " " "	4	....	....	1
" " " " 40,000 " 50,000 " " "	2	....	1	1
" " " " 50,000 " 75,000 " " "	2	....	....	3
" " " " 75,000 " 100,000 " " "	1	1	....	1
" " " " 100,000 " 125.000 " " "	....	....	....	1
" " " " 125.000 " 150,000 " " "	....	1	....	....
" " " " 150,000 " 200,000 " " "	1	....	1	....
PASSENGER INCOME PER MILE OF STREET.				
No. of roads not reporting	....	....	1	7
" " earning less than $3,000 per mile of street	3	....	....	....
" " " from $3,000 to $ 4,000 per mile of street	....	....	....	....
" " " " 4,000 " 5,000 " " "	4	1	....	1
" " " " 5,000 " 6,000 " " "	2	....	1	3
" " " " 6,000 " 7,000 " " "	3	....	....	....
" " " " 7,000 " 8,000 " " "	1	....	....	....
" " " " 8,000 " 9,000 " " "	1	....	....	2
" " " " 9,000 " 10,000 " " "	....	1	1	1
" " " " 10.000 " 15,000 " " "	....	....	....	....
" " " over $15,000 " " "	1	....	....	...
PASSENGER INCOME PER CAR MILE.				
No. of roads not reporting	1	...	2	13
" " earning less than 10 cents per car mile	1	1	....	....
" " " from 10 to 15 " " "	5	....	....	....
" " " " 15 " 20 " " "	4	1	....	....
" " " " 20 " 25 " " "	4	....	1	....
" " " " 25 " 30 " " "	....	....	....	1
PASSENGER INCOME PER CAPITA.				
No. of roads not reporting	....	....	1	7
" " earning less than $1.00 per capita	5	....	....	....
" " " from $1.00 to $1.50 per capita	4	....	....	1
" " " " 1.50 " 2.00 "	4	....	1	2
" " " " 2.00 " 2.50 "	....	....	....	3
" " " " 2.50 " 3.00 "	....	....	....	....
" " " " 3.00 " 3.50 "	....	1	....	....
" " " " 3.50 " 4.00 "	1	....	....	1
" " " " 4.00 " 4.50 "	....	1	....	....
" " " " 4.50 " 5.00 "	1	....	....	....
" " " over $5.00 "	....	....	1	....
OPERATING EXPENSES PER CAR MILE.				
No. of roads not reporting	1	.	2	13
" " operating at less than 10 cents per car mile	4	1	.	....
" " " from 10 to 15 cents per car mile	3	....	....	....
" " " " 15 " 20 " "	6	1	1	....
" " " " 20 " 25 " "	1	.	....	1
PERCENTAGE OF OPERATING EXPENSES.				
No. of roads not reporting	....	...	1	8
" " operating at less than 60 % of pass. income	....	....	....	.
" " " from 60 to 65 % of pass. income	....	....	....	2
" " " " 65 " 70 % " "	3	....	....	1
" " " " 70 " 75 % " "	....	....	....	....
" " " " 75 " 80 % " "	3	....	....	1
" " " " 80 " 85 % " "	5	....	....	2
" " " " 85 " 90 % " "	1	....	1	....
" " " " 90 " 95 % " "	....	1	....	....
" " " " 95 " 100 % " "	2	....	1	....
" " " over 100 % " "	1	1	....	....
NET EARNINGS.				
No. of roads not reporting	....	....	1	8
" " showing a loss from operation	1	1	....	..
" " earning less than $5,000 net	6	....	1	....
" " " from $5,000 to $ 75,00 net	4	....	1	1
" " " " 7,500 " 10,000 "	2	1	....	1
" " " " 10.000 " 15,000 "	2	....	....	1
" " " " 15,000 " 20,000 "	....	....	....	1
" " " " 20,000 " 30,000 "	....	....	....	2
PERCENTAGE OF NET EARNINGS TO CAPITAL LIABILITIES.				
No. of roads not reporting	....	..	1	8
" " earning nothing on capital liabilities	1	1	....	....
" " " less than 2½ % on capital liabilities	2	1	1	1
" " " from 2½ to 5 % on capital liabilities	3	....	....	3
" " " " 5 " 7½ % " "	5	....	1	....
" " " " 7½ " 10 % " "	2	....	....	1
" " " " 10 " 12½ % " "	2		....	1

Statement From St. Louis.

We herewith present a table showing the number of passengers carried and trips made by tne street railways of St. Louis for 1893, also the total for 1892, showing the annual increase. Hard times have reduced travel to a great extent, the usual increase record of 10,000,000 passengers per year not being sustained in 1893.

	Trips.	Passengers.
Baden & St. Louis R. R.	21,462	465,554
Cass Ave. & Fair Grounds Ry.	590,652	7,585.2 0
Citizens' Ry.	740,426	8,746,551
Jefferson Ave. R. R.	185,082	1,857,912
Lindell Ry.	1,124,656	14,270,478
Missouri R. R.	1,123,612	14,927,465
People's Ry.	224,678	4,663,638
St. Louis R. R.	791,404	11,940,249
St. Louis & Suburban Ry.	255,996	8,030.182
Southern Ry.	3 4,785	5,427,259
Union Depot R. R.	795 845½	17.766,612
Total	6,168,598½	95,681,170
Total for 1892	5,382,698	91,683.7 5
Increase over 1892	785,900½	3,997,465

Street Railway Recommendations by New York Railroad Commissioners.

In the annual report of the Board of Railroad Commissioners of the State of New York, recently issued, considerable attention is paid to street railroads, and a number of recommendations were made concerning their government and regulation. These recommendations may be summed up as follows:

All electrically operated cars on double track lines should be equipped with gates so that entrance and egress can be had only on the off side of the rear platform, and also that no one but the motorman be allowed to ride on the front platform. Efficient guards, or safety fenders, should be attached to the tracks of all electric and cable cars as soon as possible. The speed of the cars shall not exceed four miles per hour in crossing streets.

When two or more lines cross or meet an agreement shall be made as to which line has the right of way, and the cars of all other lines shall come to a full stop before entering or crossing the other tracks. Inspectors shall be employed in sufficient numbers by all cable and electric companies, and all employes on cars shall wear a uniform, cap at least. Cars passing in opposite directions shall not meet on street crossings. At congested points a sufficient number of employes shall be placed to ensure public safety.

The speed of all cars shall be reduced to a minimum on all curves where the view is obstructed. The use of some form of air brake shall be considered by the managers of all cable and electric roads.

All applicants for positions as motormen shall be subjected to a thorough examination for fitness. The applicant shall then be placed in a shop or power house until familiar with the system, and then put on a car with an instructor who shall certify to his ability to serve on the lines of least travel at first. All cars on roads having grades of over 3 per cent. shall be equipped with sand boxes and sand. Stops shall be made only at crossings, or where blocks are long at designated points. The propriety of stopping with the front platform at the first crossing is considered, but no recommendation is made.

Drivers of vehicles in cities are recommended to use caution in driving from cross streets to streets on which there are cable or electric lines. Twelve miles per hour is fixed as the limit of speed in suburban districts. The local authorities should regulate the speed in cities. A mechanical speed governor is recommended. The use of gas or electricity is recommended on surface and elevated cars.

A Novel Use for Electric Cars.

In Bath, Me., the electric street cars are used, it is said, by the city authorities to inform parents on stormy days whether school will keep. They have had big signs painted, bearing on one side the legend, "No School," and on the other, "One Session." These, with the appropriate side displayed, are placed on the forward fenders of electric cars, so that the public along the line of the railway only have to watch to know whether to send their children out or not.

A COMPANY for building a street railway in Puerto Principe, Cuba, was incorporated, December 1, 1893, with the following officers: President, Elpidio Marin; secretary, E. J. Loinaz del Castillo; treasurer, Ramon Pareias; superintendent, Enrique Loinaz. The capital will be $35,000 and the length of the line four miles of track. The cars will be operated by horse power.

The Broadway Cable Road Completed.

The year of 1893 was one of marked importance in the transportation annals of New York City, and will always be remembered as the inauguration year for cable traction downtown in New York City. The decision to install a cable railway on Broadway was made several years ago, and at that time it was predicted by many that on account of the many obstacles the undertaking would never be attempted. Work was commenced, however, May 1, 1891, and the first cars put in operation during June last. The engineering difficulties in the way, instead of proving to be less, were actually greater than was anticipated, but were all successfully overcome, and the results attained prove the wisdom of the management of the road in making the installation.

During the last three or four years we have published various articles giving the plans and recording the progress of the work. The principal articles appeared on the following pages: Vol. IX., pp. 4, 203, 360, 469, 517; Vol. VIII., pp. 66, 278, 339, 428, 536, 688; Vol. VII., pp. 290, 424, 546; Vol. VI. 556. In this number of the Street Railway Journal is published a general resumé of the work performed, together with an outline of the plans of the Metropolitan Traction Company for cable lines on Columbus and Lexington Avenues, New York.

The route of the cable line of the Broadway & Seventh Avenue Railway Company is from South Ferry to 45th Street on Broadway, thence to 59th Street on Seventh Avenue.

The type of yoke used on the straight line weighs about 550 lbs. The distance from the top of the slot rail to the bottom of the opening is twenty-four and a quarter inches, to the base of the yoke thirty and a quarter inches. The width of the opening is fifteen and a half inches. The curve yokes weigh about 975 lbs. each.

On straight line work the yokes, which are spaced 4 ft. 6 ins. apart, are mounted on concrete piers 18 ins. in width by 3 ft. 9 ins. in length, and 6 ins. high. The manhole walls are 12 ins. thick, the foundations measuring 6 ft. × 5 ft. 7 ins. The conduit has a sheet-steel lining.

The old paving stones taken up during the progress of the work of laying the railway were broken on the ground by a stone breaker driven by a portable engine, and formed part of the stone used in the concrete. The materials forming the concrete were mixed in a machine made by the Cockburn Barrow & Machine Company of Jersey City.

The tram rails are of the grooved type, weigh ninety-one pounds per yard, and were rolled by the Johnson Co. They are laid with suspended joints, being connected by a joint clamp manufactured by the McConway & Torley Company, of Pittsburgh, Pa., and by four bolt splice bars. The slot rails are sixty-seven pounds in weight to the yard and are of the Johnson type. At 59th Street there is a crossover, and at Bowling Green a balloon loop made up of six curves with radii from 160 to sixty feet.

The curve yokes employed are supported upon brick foundations, each fifty-five and a half inches wide and twenty-six inches high, which in turn rest on a concrete floor six inches deep, extending under all the curve yokes. A passageway has been left on the inside of all the curves, by which access is easily had to the curve pulleys for the purpose of inspection, repairs, etc., as will be seen by reference to Fig. 1. The retaining walls are twelve inches thick.

The cable carrying sheaves on straight line are fourteen inches in diameter to the bottom, and are of cast iron with chilled rims.

The most difficult and expensive portion of the work connected with the roadway construction consisted in the removal of the many gas, water, steam and sewer mains, electric conduits and other sub-surface pipes necessary. The excavation of the street upon the line of route of the road, revealed a regular net work of pipes of all sizes and every variety, which had to be moved before the regular work of conduit construction could be commenced. This task was one of herculean magnitude, and its successful performance reflects great credit upon the engineering ability of all who participated in the work.

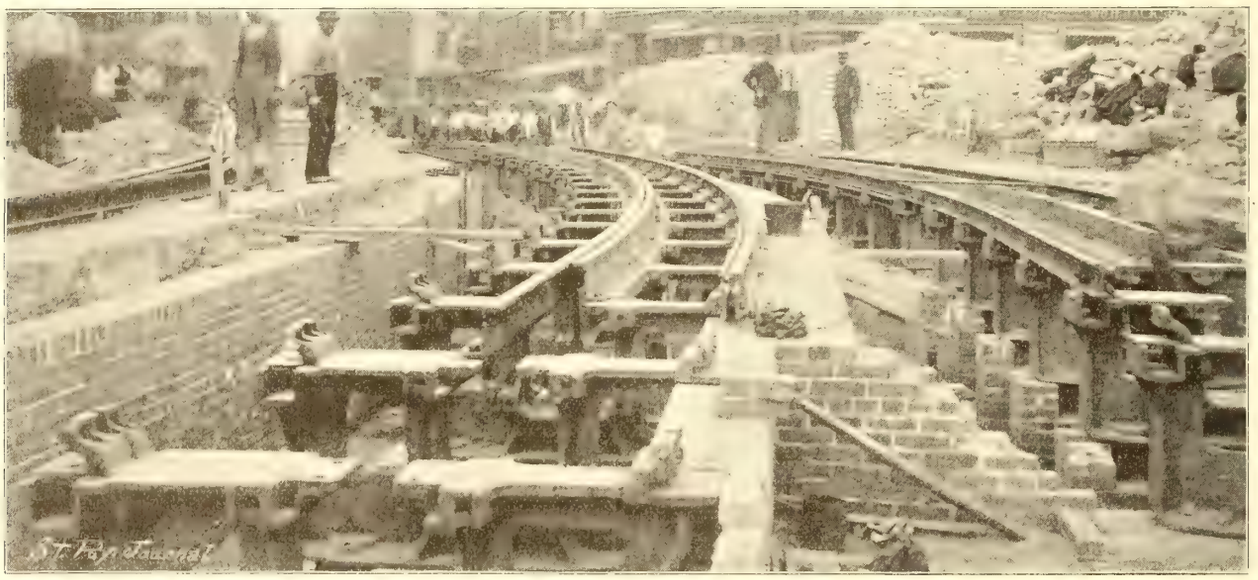


FIG. 1.—SCENE NEAR UNION SQUARE DURING CONSTRUCTION—BROADWAY CABLE RAILWAY, NEW YORK.

The cable system adopted is of the duplex type, two ropes being carried on separate sets of sheaves twenty-one feet six inches apart longitudinally, and three and a half inches laterally.

At the curves the carrying sheaves are mounted in horizontal planes, the sheaves for one rope being above those for the other rope, but with eccentric axes. A device known as a flipper, and consisting of a casting, forming a sort of elongated guide arm, is mounted on a shaft between two yokes at the entrance to the curve. This flipper is kept in position by two spiral springs, and its operating edge is shaped like a long cam to give easy motion when operated by the passing grip. The operation of the device is as follows: When the grip on the car entering the curve strikes the cam on the face of this flipper, it turns it out of the way, and in passing allows the flipper to spring back into place. If the outer cable is held in the grip at the time, it is guided by the flipper into the lower curve pulley; on the other hand, if the inner cable is held in the grip, it falls inside the flipper arm and is guided into the groove of the upper curve pulley.

The ropes used on the Broadway line are six in number, of which three are constantly in use, the others being held in reserve. The three sections are

from 59th to 36th Streets on Seventh Avenue, from 36th to Houston Streets on Broadway and from Houston Street to South Ferry. All ropes used were manufactured by the J. A. Roebling's Sons Company, and the Trenton Iron Works, and are one and a half inches in diameter. This is probably the largest diameter of cable ever used for street railway purposes. The lengths of the ropes on the several sections are 15,000 ft., 21,000 ft., and 22,000 ft.

The grip employed was devised by the engineers of the Broadway & Seventh Avenue Railway Company. The lower jaw is stationary and the upper jaw movable. Throw-offs are located on each side of the grip, and are operated by the gripman or automatically, in case the gripman should neglect this duty at a cable crossing or other point where the cable should be thrown off. Automatic action is accomplished by wedges located in the conduit and adapted to slide under a cross piece of the grip, raising the upper jaw and operating the throwoffs.

It was the original plan to operate the section of track between Bowling Green, the present southern terminus of the cable railway, and South Ferry by an independent cable operated from a power station to be located on Front Street. The plan has been altered, however, so that this section of road will be operated from the main power station by carrying the main ropes to South Ferry as above described.



FIG. 2.—NETWORK OF PIPES NEAR UNION SQUARE—BROADWAY CABLE RAILWAY, NEW YORK.

The cars run on a twenty-eight second headway during the busy portion of the day. The cable service is maintained from 5 A. M. to 3 A. M. An average of 100,000 passengers is carried during each day during these hours. Horse cars are run every twenty minutes from 3 A. M. to 5 A. M. About 145 cars are required for the daily traffic on Broadway, and each car makes six trips. The cars were supplied by the John Stephenson Company, of New York, and the Laclede Car Company, of St. Louis, and are mounted on Stephenson, Peckham and Bemis trucks. The cars measure thirty feet six inches over all, and have a width of car body of seven feet. The height of the car from the track to the top of the roof is ten feet four and a half inches. A characteristic feature is the extra large platforms, these being four feet one inch in the center, and protected on the left-hand side by a wire gate. The doors are double and work simultaneously. The windows on each side are eight in number. The interior of the car is finished in maple, with paneled ceilings and trimmings of solid bronze, the seats and backs are covered with Wilton carpet. The bonnets are supported by the pillars from the dashboards.

The wheels are thirty inches in diameter. A very popular feature of the car is the illumination, which is by Pintsch gas. Each car has three chandeliers, with four burners each. Sterling registers and Sterling and De-Witt sand boxes are used. One of the cars, using Peckham trucks, is shown in the accompanying engraving. These trucks have an eight foot wheel base instead of a nine foot; the wheel of those first adopted by the company and the spring support is fifteen feet nine inches instead of ten feet, that of the old trucks. The object of this change is to better support the bodies of the cars.

The Peckham Company is also putting on some trucks with even more of a spring support than that mentioned, the support being seventeen feet six inches, the wheel base remaining eight feet. The truck, without the car body, was illustrated in our November issue, and is similar to the standard Peckham 6 A truck, the changes mentioned above only having been made to better adapt it for use on Broadway. There are at present fifteen of this style of truck in use on the Broadway road, and they are giving great satisfaction. The officers of the road speak very highly of their easy riding qualities and the easy and efficient action of the brakes.

A very interesting result noticed in the traffic is that it does not vary 1 per cent. in amount from 8 A. M., to 6 P. M. This is true not only in the total traffic, but also in the traffic of the different sections.

There are two stations for operating the line. The uptown station is in a building owned by the company, bounded by Seventh Avenue, 50th Street, Sixth Avenue and 51st Street. The power plant occupies the eastern end of the building, the western portion being devoted to car storage, repair rooms, offices, etc. The cable is run from the eastern end through a blind conduit to the main line on Seventh Avenue. A full description of the power equipment of this station was given in our January, 1893, issue. As will be remembered, the plant is in duplicate in every particular, and half of the power equipment can be used to drive either cable of the duplicate cable system. The engines were supplied by the Dickson Manufacturing Company, of Scranton, Pa., and are two in number. The cylinder dimensions are 36 × 60 ins. The engines run non-condensing, at sixty revolutions per minute, and develop 1,000 H. P. each when running under 125 lbs. pressure. The flywheel of each engine measures twenty feet in diameter, and weighs fifty tons. Each engine drives one end of a long shaft extending entirely across the engine room and measuring

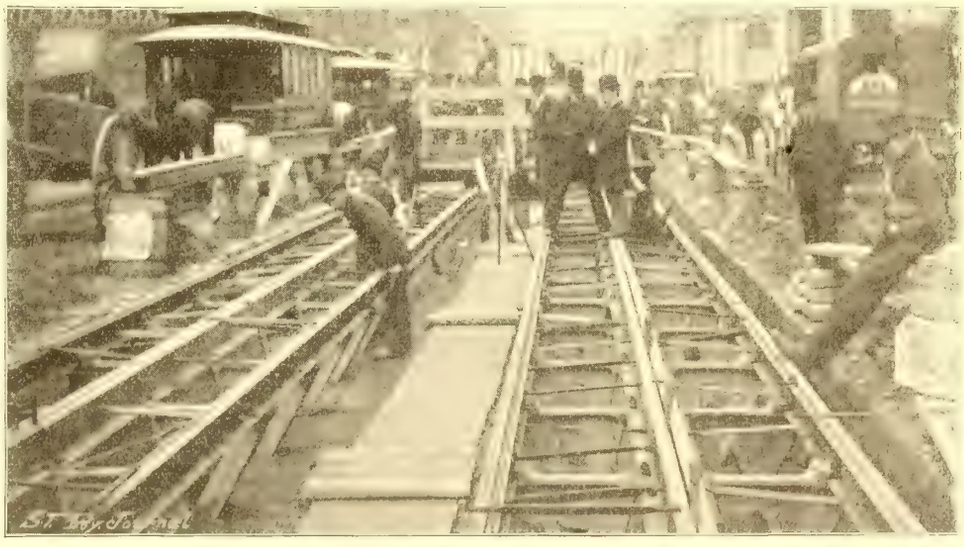


FIG. 3.—SCENE NEAR POST OFFICE DURING CONSTRUCTION—BROADWAY CABLE RAILWAY, NEW YORK.

eighteen inches in diameter in the journals and twenty inches in the swell.

This shaft is divided into six sections, connected by plate couplings, and carries four driving drums ten feet in diameter. These are not keyed to the shaft, but engage it by means of a friction clutch, operated by rack and pinion, with a hand wheel. The main driven drums



FIG 4.—CABLE CAR—BROADWAY CABLE RAILWAY, NEW YORK.

are thirty-two feet in diameter, and weigh sixty-five tons each. Each is driven from a driving drum on the main shaft by thirteen two-inch Lambeth cotton ropes. The main drums are keyed to the cable driver shafts, which are made of cast steel, and, like the engine shaft, are eighteen inches in diameter. The cable drivers are each twelve feet in diameter, and are keyed directly to the shafts. They are of the solid drum type, and are furnished with removable rims. By means of an auxiliary engine placed at the center of the engine shaft, while one cable and set of drums are in operation, the idle drums can be revolved and the idle cable drawn in for inspection and repairs without employing the idle engine.

The tension run for each cable is 100 ft. in length. On the frame of the tension carriage is fixed a reel, about which one end of the tail rope is wound. From the tension carriage the tail rope is carried to the tension tower, which is forty-five feet in height, and constructed of wrought iron. The weights are semi-circular in form, with a radius of fifteen inches, and weigh seventy-five pounds each.

The boiler room measures 45 × 100 ft., and contains six Heine boilers of 250 H. P. each. Here are also located a Goubert 1,000 H. P. feedwater heater and two Snow duplex pumps. The stack is of wrought iron and 150 ft. in height. The machinery at this and the downtown station was built and installed by the Pennsylvania Iron Works, of Philadelphia, under the direction of B. W. Grist and E. A. Moore.

The main power station is located at the corner of Houston Street and Broadway, in the magnificent office building erected by the Broadway & Seventh Avenue Company, and is all below the street level. The engine room measures 141 × 150 ft., and is thirty-six feet in height. The general arrangement of the machinery is similar in many respects to that of the machinery at the uptown power station, except that four cables instead of two are driven and a jackshaft is used. The engines, which are four in number, are of the single expansion Dickson-Corliss type, and may be run condensing. Their cylinder dimensions are 38 × 60 ins., and each has a rated capacity of 1,200 H. P. The flywheel of each engine is twenty feet in diameter and weighs 100,000 lbs. Further particulars in regard to these engines were published in our May, 1892, and March, 1893, issues.

Each condenser is operated by a pair of 12 × 12 in. upright engines, the piston rods of which extend through the floor and drive two 12 × 12 in. air pumps, to which is attached a 26 in. Knowles patent jet condenser.

The cable engines are arranged in pairs, each engine operating one end of a common shaft, eighteen inches in diameter in the journals and twenty-four inches in the swell, carrying a twenty-six foot rope drum. Each engine shaft is divided into three sections, so that either engine can supply power to the drum. These two rope drums drive drums of the same size on the jackshaft by means of twenty two-inch Lambeth cotton ropes. Also mounted loose on the jackshaft are four nine foot drums, with thirty-two grooves each. These drums are capable of being put into rigid connection with the shaft by means of friction coupling devices, similar to those in use in the uptown station. The jackshaft is divided into six sections, connected by plate couplings, so that power can be transmitted to either nine foot drum by either engine. Each of the nine foot drums is connected by thirty-four two-inch cotton ropes to the main driven drums, four in number, keyed to the cable driver shafts. These main driven drums are thirty-two feet in diameter, and made up in twelve sections. The rim segments are made the entire width of the wheel, which has two distinct sets of arms. The cable drivers are twelve and sixteen feet in diameter and are provided with solid rims containing each five grooves. Arrangements have been made for turning the idle drums by means of auxiliary engines, as in the uptown power station. The tension device is also similar to that in the uptown power station.

The boiler room contains twelve Heine boilers in two batteries of six boilers each. Each boiler is of 250 H. P.



FIG. 5.—GLIMPSE OF DRAUGHTING ROOM—BROADWAY CABLE RAILWAY, NEW YORK.

capacity. Goubert heaters, Snow pumps and Westinghouse separators are used.

The structure containing the cable driving machinery, at the corner of Houston Street and Broadway, is, without doubt, the handsomest power station building, of any kind, in the world. It is similar in general arrangement and appointments to the most modern office buildings of New York, and, in fact, every floor above the basement is devoted to business purposes. A large furnishing establishment occupies the ground floor, and the upper floors

are rented for offices. The executive and engineering headquarters of the Broadway & Seventh Avenue Company, the Metropolitan Traction Company and associated lines are now located here. The building is eight stories in height, and constructed in Renaissance style. The lower part is of granite, and in the upper part buff brick with terra cotta trimmings has been used. The architects were McKim, Mead & White.

A special method of construction was adopted to avoid the possibility of the vibrations of the cable machinery being transmitted to the building. The foundations of the building, for this reason, have been made entirely independent of those of the machinery. The floors of the building are supported on forty-five interior piers and twenty-eight piers built into the exterior walls. The exterior piers consist of steel columns fixed on a grillage of iron bars, all resting on the lower part of the exterior walls. The interior piers are constructed of large cylinders of wrought iron or steel sunk into the



H. H. VREELAND.

earth and filled with sand below and concrete above. On the top is a grillage of iron beams, and resting on each are massive iron bases, weighing in the neighborhood of 3,000 lbs; steel columns surmount these bases. The cylinders vary in interior diameter from eight feet six inches to twelve feet. By their use the sand foundation is prevented from spreading. Their use also divides the sand on which the building is to be supported from the sand foundation of the machinery floor. Bridges of iron beams, resting on brick walls, are constructed around the columns supporting the building, the purpose being to prevent any part of the machinery floor from touching the main columns. The building foundation is seven feet six inches thick at the base and three feet eight inches thick at the level of the sidewalk.

The work of constructing this power station involved a great many difficulties. The excavations had to be carried to a depth of forty feet, and considerable water filtered into the excavation, and had to be removed by the pumps. The amount of water thus raised averaged at one time 1,250,000 gals. in twenty-four hours. On the north side of the lot was a building, whose adjacent wall, 100 ft. high, and 200 ft. long, had to be shored up, under pinned, and its foundations carried down twenty-two feet below their former depth. This was a long and difficult undertaking, but was most successfully accomplished without any settlement of the building, so far as the most careful measurements could determine.

Another engineering feat of great difficulty which was successfully encountered, was the street excavation under Broadway for the deflection vaults. These excavations extended out a horizontal distance of forty-eight feet from the main wall of the building under the sidewalk and street pavement which for several feet beyond the east track of the cable line is supported on trusses and girders. Special provision had to be made for water, gas and pneumatic tubes, which were encountered, the largest of which was a thirty-six inch main, located almost directly under the east track of the road. This main was shored up while the brick foundation upon which it now rests, and which also forms the back wall of the wheel pit, was built under it. The other tubes and pipes were either carried above the pit or at one side on trusses or below the floor.

As the cable machinery was put in operation while the building was still far from completion, the engines had to be run and the complicated work of cable station operation carried on actually under canvas spread for protection against the falling bricks and mortar of the bricklayers at work. In spite of these adverse conditions, it is a fact which speaks well for the railway company's



J. D. CRIMMINS.

engineers, that not a moment's delay has occurred to the road since the machinery was started, from any fault of the station apparatus.

OFFICERS.

The officers of the Broadway & Seventh Avenue Railway Company are: President, H. H. Vreeland; vice-president, D. B. Hasbrouck; secretary, C. E. Warren; treasurer, H. S. Beattie; superintendent, Henry A. Newell. All construction work has been and is in charge of Major Geo. W. McNulty, chief engineer, ably assisted by H. W. Brinckerhoff, N. S. Latham, Albert Carr and C. I. Earll. The engineer of operation is F. L. Hart.

The Broadway & Seventh Avenue Railway is leased to the Metropolitan Street Railway Company, a corporation recently formed; being a consolidation of the Houston Street, West Street & Pavonia Ferry, the Broadway and the South Ferry Railroad Companies. The Metropolitan Street Railway Company has the same officers as the Broadway & Seventh Avenue Company.

The Metropolitan Traction Company is a Philadelphia corporation, controlling through ownership of stock the following street railway companies of New York: The Metropolitan Street Railway Company, with its leased lines; the Broadway & Seventh Avenue, the Sixth Avenue, the Ninth Avenue and 23d Street Railway Companies; the Metropolitan Crosstown Railway Company, with its leased lines, the 42d Street & Grand Street Ferry and the Central Park, North & East River Railroad Companies. The officers of the Metropolitan Traction Company are: President, C. R. Henderson; first vice-president, P. A. B. Widener; second vice-president, D. B. Hasbrouck; secretary and treasurer, C. E. Warren.

H. H. Vreeland, the executive head of the operating company, is thirty-six years of age, and is a thorough railroad man by training, having done actual service in all the various departments of railroad work. He began his career in 1874 in the service of the Long Island Railroad Company, remaining there until 1881, when he resigned

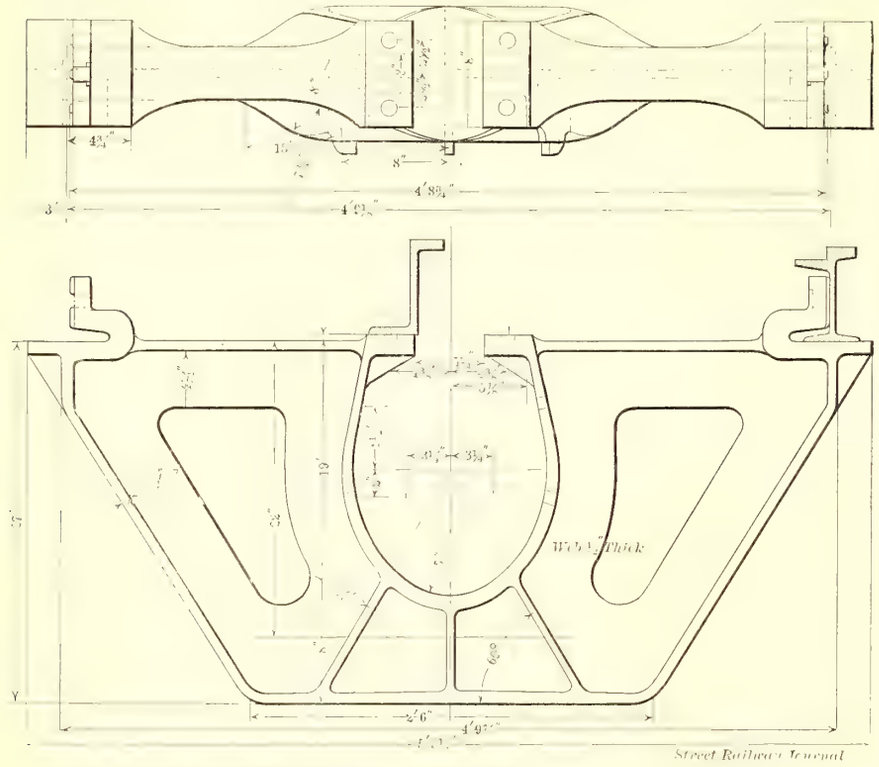


FIG. 6.—YOKE ADOPTED FOR COLUMBUS AND LEXINGTON AVENUES CABLE RAILWAYS, NEW YORK.

to enter commercial pursuits. He soon returned to railroading, however, in the service of the New York City & Northern Railway. Here he filled a number of positions, being constantly promoted until the last two years of his services with the company, when he was its general manager. He was elected to his present position in June, 1893.

J. D. Crimmins, who performed the street construction for the Broadway cable road, is a native of New York City, and has been prominently identified with many of the improvements of that city during the last twenty-five years as a large contractor for public works. In connection with installing the cable conduit, he also took the city's contract for repairing Broadway from 32d Street to Bowling Green. In 1892 he was elected president of the Metropolitan Traction Company, the Broadway & Seventh Avenue Railway Company and other roads comprised in that system, which positions he has since resigned to give more attention to a number of other street railway properties in New Jersey and elsewhere in which he is largely interested.

HISTORY.

Many attempts were made to secure a franchise for operating a street railway on Broadway from 14th Street to the Battery, but none were successful until one was secured by the Broadway Railway Company, incorporated May 8, 1884, with Jacob Sharp as president. This company secured the consent of the local authorities in December of the same year. There were charges that bribery had been used to secure this right, and Jacob Sharp, the promoter of the company, was tried on the charge and convicted, but obtained a stay, and died from pneumonia before the new trial came off.

The road was built, and on or about June 22, 1885, cars were run by the Broadway & Seventh Avenue Railway Company, in accordance with an agreement previously made with the Broadway surface railway. In 1889, the road was sold at public auction, and purchased by the present owners, and now forms part of the Broadway & Seventh Avenue system.

PROPOSED EXTENSIONS.

The management of the Broadway & Seventh Avenue Railway Company has drawn up plans for proposed cable railways on Columbus and Lexington Avenues, and the work of construction has already been actively begun. Fig. 6 gives section and plan of the yoke to be used.

The Ninth or Columbus Avenue line will extend from the corner of Seventh Avenue and 53d Street, on 53d Street to Ninth Avenue, whence it will extend on Columbus Avenue to 110th Street. A power station will be erected at the corner of Lenox Avenue and 116th Street which will operate the line from the lower terminus at 53d Street to the Harlem River. The section from the corner of 53d Street and Seventh Avenue to 110th Street and Ninth Avenue will be driven temporarilly from the present uptown power station of the company, described above.

The Lexington Avenue line will extend from the corner of 23d Street and Lexington Avenue north to the Harlem River, with a branch on 106th Street from Lexington Avenue to the East River. Two stations will be built, one at the corner of Lexington Avenue and 26th Street, the other uptown. The duplex system of cable operation will be used on both lines.

EMERGENCY WAGON.

The engraving Fig. (7) shows an improved form of wrecking wagon as built for use on the Broadway cable road, New York City, by the Gleason & Bailey Manufacturing Company, Seneca Falls, N. Y. The general design of these wagons is similar to the patented fire insurance patrol wagons built by this company. Unlike an ordinary wagon, the men enter from both rear and sides, instead



FIG. 7.—EMERGENCY WAGON—BROADWAY & SEVENTH AVENUE RAILWAY, NEW YORK.

of from the end of the body only. The seats run the entire length in the center of the wagon and form spacious tool boxes underneath the top covers, the men riding back to back. The top of this center tool box can be made more accessible by having the seat, which forms the cover, made sectional and hinged; under this long box or seat is a false bottom forming a long locker for carrying poles or any long tools. Back of the driver's seat are

wrought iron saddles with straps for holding horse blankets; a locomotive swinging alarm bell is hung under the toe board under control of the driver's foot. The foot piece of the brake extends across the footboard, so that the driver can operate the same from either side of the seat, or with both feet, at pleasure. The wheels are "Warner" patent of XXX quality, three feet two inches and four feet two inches in diameter, respectively, with 2½ × ¾ overlapping, round edge steel tires and brass open hub caps. The axles are two and a quarter inches, of imported refined iron, having bronze nuts secured by a linch pin. The springs are extra oil tempered, and so hung in connection with the Gleason & Bailey patent truss gearing, that the apparatus draws and rides like a light carriage. The body of the wagon is eleven feet six inches long, five feet four inches wide, and nineteen inches deep. There are brass railings around the driver's seat and surmounting the wagon body, supported by composition stanchions. The steps are all covered with corrugated rubber matting. Back of the rear wheels is placed a heavy metal mudsplash. Over all the wheels are sprung substantial metal mud fenders, supported by wrought iron brackets on the body of the wagon. Iron step pads and handles for mounting to the driver's seat and different openings in the wagon, are placed in accessible positions. A patent wind shield, bulls-eye and tubular lanterns are hung either side of the seat, so placed as to throw a powerful light forward; these lanterns are provided with non-heating handles, so that they can be taken off and used when occasion requires. Every feature and equipment of these wagons is novel, and the production of this company. The whip socket has a patent rein holder attached. Lockers for special tools, wire baskets, and iron framework for carrying hose bridges, etc., can be added to the wagon if required.

The Early Pioneers of the Electric Railway.

The names and achievements of the founders of electric railroading in this country, if not familiar to all electric railroad managers and engineers, are at least known to most of those engaged in the industry. But comparatively few, we imagine, among our readers are acquainted with the personality of the pioneers of the electric railway. All, with the exception of Mr. Van Depoele, whose death robbed the world of a most assiduous inventor and worker, are living and in the full vigor of their activity All are engaged in some branch of electrical research.

The public indebtedness to these early workers for their successful efforts to transform the street railway business, can hardly be over estimated.

THOMAS A. EDISON.

Thomas A. Edison, whose inventive genius has been fertile in so many branches of electrical science, early turned his attention to the electric railway. The development of the dynamo machine as an economical agent for the production of electricity, led the way to the adoption of electric power for transportation, and Edison was among the first to see the extensive use to which the new power could be put. In 1880 Mr. Edison built an electric locomotive and track, the latter being less than half a mile in length, at Menlo Park, N. J. The rails were insulated from each other, and each was connected with the poles of a dynamo, making one rail positive and the other negative. The voltage was 125, and the motor was an Edison dynamo of the Z or sixty light type. This locomotive was afterwards much improved.

In prosecuting his claim for patents, soon after the starting of this road, Mr. Edison found two other inventors, Messrs. Siemens and Field, with claims covering largely the features for which his application was filed. The claims of the first named were denied by the courts to which recourse was had, and, as outlined below, consolidation was later made between the Edison and Field interests, resulting in the formation of the Electric Railway Company of the United States.

Soon after this the "Judge" was built by the newly formed company, and, as mentioned below, was exhibited at Chicago in 1883, carrying large numbers of passengers. Mr. Edison, though since devoting most of his energy and time to other fields of electrical development, has kept up his interest in electric railways, and has taken out a number of patents for important improvements in this line.

STEPHEN D. FIELD.

Stephen D. Field was born January 31, 1846, at Stockbridge, Mass., where most of his life up to his seventeenth year was passed. In 1863, he went to California and entered the service of the California State Telegraph Company. He remained in California until 1879, being most of the time engaged in the promotion of various electrical enterprises. He is the inventor, among other successful mechanism, of the multiple call answering back signal box, the dynamo system of furnishing currents for the operation of telegraph lines, the dynamo quadruplex, which has been adopted as standard by the Western Union Telegraph Company, and many features of the electric railroad of the present day.

The first public record of the modern dynamo electric railway is claimed by Mr. Field to be his United States patent of July 13, 1880, wherein is shown the complete organization of a practical electric railway. The specification clearly shows how such an organization should be constructed while the drawings show a working conductor, stationary generator, electrically propelled car, trolley pole and trolley running on the under side of the working conductor. Directions are given for bonding the rails for a return circuit, and the working conductor is described as insulated mechanically as well as electrically.

This patent was thrown into "interference" with several rival inventors, the result being to so embarass and restrict Mr. Field in his operations that long before the issuance of his patent the business was so firmly established in the hands of powerful corporations as to place the unfortunate inventor so far in the back ground that nothing was left for him but recourse to the courts to establish his rights. A law suit, having this end in view is now in progress in the United States courts.

Mr. Field's first dates in the United States patent office are a caveat filed May 21, 1879, and patent application filed March 10, 1880, and issued after a prolonged interference in 1889. In May, 1880, Mr. Field commenced the construction at Stockbridge, Mass., of an experimental electric railway, but was delayed by various causes, so that the road was not put in operation until 1881, when it ran for some time very successfully. At the Chicago Railway Exposition, in 1883, the Electric Railway Company of the United States, which then represented both the Field and Edison interests, as mentioned above, exhibited an electric locomotive, the "Judge," weighing about three tons and operating by a third rail. This locomotive was put in operation June 9, 1883, drawing a trail car, and carried over 26,000 passengers during the two weeks in which it ran. The Field and Edison interests were afterwards separated, the patents of the former being retained by Mr. Field and those of the latter by the Edison Electric Light Company, now represented by the General Electric Company.

FRANK J. SPRAGUE.

Ensign Frank J. Sprague, a graduate of the Annapolis Naval Academy, class of '78, installed his first electric railway in the Durant sugar refinery on East 24th Street, New York, in May, 1886. Pivoted trucks underneath a platform car were used, and the method of gearing and motor support adopted was similar to that now in use, so that this equipment may be regarded as the prototype of the present direct geared type of motor car equipment. Previous to the date mentioned above, Mr. Sprague had become well known in the electric field through his investigations in electric railway and motor work, and in being the patentee of a large number of valuable inventions relating to the electric transmision of power, he being the first to bring out a constant speed motor for stationary work.

In the summer of 1886, Mr. Sprague commenced a long continued series of experiments on the 34th Street branch of the New York Elevated Railway, with a car equipped with a pair of pivoted trucks, and in the spring of the following year the Sprague Electric Railway & Motor Company took a contract for equipping the Passenger Railway, of St. Joseph, Mo., and the Union Passenger Railway, of Richmond, Va. The latter was for eighty motors, eleven miles of track, and 375 H. P. generating plant, and the road was to be completed in ninety days, at a cost of $110,000. These roads were started experimentally in the fall of 1887, but the Richmond road not regularly until the beginning of February, 1888. The electric railway at Richmond was by far the largest which had up to that time been equipped, and as the results attained were largely instrumental in giving electric railway construction the impetus which it has since had, and in convincing street railway managers of the successful commercial results obtainable with electric power, it seems fair to say that to Mr. Sprague, more than to any other one man, is due the credit of inaugurating the enor-



E. M. Bentley.
W. H. Knight.
J. C. Henry,

F. J. Sprague.
T. A. Edison.
C. J. Van Depoele.

Leo Daft.
S. D. Field.
S. H. Short.

mous development of the electric railway industry in this country which has excited the amazement and admiration of foreign engineers and workers in the "tramway" field.

The characteristics of the Sprague motor equipment, as used in elevated railway experiments in New York, and in the railway at Richmond, and which, it is claimed, were new in electric railway practice up to that time were: An independent truck with motors exteriorly centered upon the driven axles so as to maintain parallelism between the driving shaft and the driven axles; flexible support of part of the weight of the motors on the truck to allow perfect freedom in following the motions of the axles, suspension being below the car springs; the method of flexible suspension, avoiding all shock and jar and danger of stripping gearing, and the maintenance at all times of a spring touch to prevent back lash of the gears; direct single reduction of gearing; the use of fixed brushes for both forward and backward running. This equipment marked the abolition of ropes, belts, sprocket wheels and chains for the reduction between armature and axle. Besides the characteristics already mentioned, the Richmond road exhibited the following unique peculiarities: A feeder system with main and working conductor, the latter being of silicon bronze; main and working conductor system also applied to the rails; a universally movable trolley carried in the center of the car body; a series multiple and commutated field magnet method of control; single movement control for both speed and direction of movement.

Mr. Sprague's first proposal for a centrally located, upper pressure, contact trolley taking current from a conductor above the track, and following the line of all tracks and switches, was in connection with a suggested electrical equipment for the underground railroad in London in 1882 and 1883.

When the Sprague Electric Railway & Motor Company was absorbed by the Edison General Electric Company, Mr. Sprague was retained by the latter company as consulting electrical engineer, but wishing to be independent, he resigned the position at the end of a year, to devote himself to the solution of other problems, but remained in touch with consulting work as president of the corporation of Sprague, Duncan & Hutchinson, Limited.

In spite of extended work in other lines of electrical research, Mr. Sprague retains his fondness for the electric railway field, in which he has performed such valuable services, and it is rumored that he will re-enter the tramway field. He is an enthusiastic advocate of the use of electric power for heavier work, and in connection with Doctors Duncan and Hutchinson has nearly completed a 1,000 H. P. electric locomotive, for the North American Company for experimental work. On this subject, however, he avoids all visionary propositions, his belief being epitomized in a statement made in his inaugural address as president of the American Institute of Electrical Engineers, in Chicago, in 1892: "It narrows itself down to the one question of the number of train units operated between the terminal points." He has also devoted more thought than probably any other electrical engineer to the solution of the New York rapid transit problem, and his plans, if adopted by the Rapid Transit Commission, would undoubtedly result in the removal of this, at present, perplexing question from the minds of New Yorkers. He is the representative in this country of the Greathead system as exemplified in London.

Mr. Sprague's recent work, like that in the early electric railway field, displays great originality of thought, combined with a fertility of invention in the application of mechanical and electrical principles, and his ambition now is to make the hydraulic elevator an obsolete machine. Associating himself with Chas. R. Pratt, he attacked the hardest elevator duty, and the new Postal Telegraph building has challenged the hydraulic elevator on its own grounds in one of the largest plants in New York by machines illustrating one of the most interesting examples of the direct application of electric power to mechanical work, and of departure from established standards. The Sprague Electric Elevator Company is now building a substantial factory at Bloomfield, N J., where, it is rumored, some new inventions of Mr. Sprague's will be brought out, which will revolutionize the methods of this important industry.

Mr. Sprague's inventions have rewarded him from a financial standpoint, and he has amassed a considerable fortune which is unhesitatingly spent in developing new work. He is married, has one son, and lives in a very handsome residence, the former residence of a son of General Grant, on West End Avenue, in New York City.

LEO DAFT.

Leo Daft was born in Birmingham, Eng., in November, 1843. His father was Thomas B. Daft, a prominent civil engineer. Mr. Daft early showed a leaning toward mechanical and electrical pursuits, and in 1858 entered the University College, at London, where he had many opportunities for special instruction, and where he became acquainted with Sir William Siemens, who lent him considerable electrical apparatus for carrying on his experiments.

Mr. Daft came to America in 1866, and first engaged in railroad engineering, afterwards in various minor enterprises. He went to England in 1879, but upon his return to this country, about two months later, the developing activity in electrical matters attracted his attention, and recalled him to his old profession. His first connection was with the New York Electric Light Association, which was soon merged into the Daft Electric Light Company, with works first in New York, then in Greenville, N. J., and later in Marion, N. J. The company was almost immediately and exclusively devoted to the development of electric power, and established several electric power stations in Boston, New York, Worcester and elsewhere. In 1883, Mr. Daft built an electric locomotive called the "Ampere," for use on the Saratoga & McGregor Electric Railroad, and in the following year installed a short line at Coney Island. In the early part of the spring of 1885, Mr. Daft was requested to furnish an electric equipment for the Baltimore Union Passenger Railway Company, and on August 8, 1885, this road was put into operation. The first motor cars used were the "Morse" and the "Faraday," and a third rail was used to conduct the current to the car. The Daft system was adopted on a number of roads, and the Daft locomotive, "Ben. Franklin," was operated for some time on the Ninth Avenue elevated road, in New York City.

Mr. Daft is now engaged as a consulting electrical engineer on the Pacific Coast, with headquarters at Seattle, Wash., and has turned his attention chiefly to long distance power transmission and large railway and light installations. One of these latter has recently been completed at Everett, Wash., under his supervision, and is in very successful operation.

WALTER H. KNIGHT AND EDWARD M. BENTLEY.

The names of Walter H. Knight and Edward M. Bentley are closely associated in the early history of electric railroading, in which they took a prominent part. In 1883 Mr. Knight resigned from the electrical department of the Patent Office to take charge of some electrical engineering work, and, forming with Mr. Bentley the Bentley-Knight Railway Company, was soon engaged in electric railroad experimenting.

The first electric road of the company was built in the fall of 1883, in the yard of the Brush Electric Works at Cleveland, where Messrs. Bentley and Knight equipped a street car with a Brush motor, and built a short section of conduit. The first public line equipped by the Bentley-Knight Railway Company was the Quincy Street extension of the Garden Street line of the East Cleveland Company's system.

Work on this road was begun in the early summer of 1885, and on August 1, of the same year, a street car was put in operation. This car was immediately used in the business of the company, and, so far as was possible, was kept in continuous operation. The road was, of course, largely an experiment, and many changes were made to ascertain the best form of gearing, motor control and line construction, but it was operated regularly as part of the service of the railway company, and was the first commercial electric railway in this country. It was about two miles long, with a branch track, and the current was taken by a collecting device passing through a slot in the conduit, making contact with the conductors there.

Messrs. Bentley and Knight were next engaged in the construction of a trolley road at Woonsocket, R. I., and then in the construction of a combined trolley and conduit road at Allegheny, Pa. The latter was on the Federal Street line, and operated successfully for several years. A combined trolley and conduit road at Boston, and an overhead trolley road at Lowell were afterwards installed by the Bentley-Knight Company. Soon afterwards this company was absorbed by the Thomson-Houston Electric Company.

Mr. Knight was a resident in Boston at the time that the West End Railroad Company of that city was proposing the equipment of its line with the cable system, but President Whitney's attention having been directed to the advances being made in electric traction, a trip was made to the Bentley-Knight road at Allegheny, Pa., and the Sprague road at Richmond, Va. Before his return Mr. Whitney had concluded to change over to the electric system, and Mr. Knight was delegated to select a site for the power station and draw up general plans. Soon after the absorption of the Bentley-Knight Company by the Thomson-Houston Company, mentioned above, Mr. Knight became chief engineer of the railway department of that company, a position which he still holds in its successor, the General Electric Company.

Mr. Bentley, after the absorption of the Bentley-Knight Railway Company, engaged in the practice of law, and is now a member of the firm of Bentley & Blodgett, attorneys, Boston.

JOHN C. HENRY.

John C. Henry was born in Woodstock, Ont., in 1848. He learned telegraphy at an early age, and was connected with several railroads as train dispatcher. In 1869 he entered the service of the Union Pacific Railway Company, of the Eastern Division, as electrician. During his connection with this road, which lasted about ten years, he brought out a number of valuable inventions, including the Henry Velocimeter. This device has been slightly modified by Mr. Boyer, who was in Mr. Henry's employ, and is well known as the Boyer Speed Recorder. During his service as railway electrician, Mr. Henry devoted a great deal of study to the subject of the application of electric power to the operation of cars.

In 1884-5, Mr. Henry, who was then a resident of Kansas City, constructed there an electric railway, using overhead wires. This road is claimed to be the first of the kind ever constructed. In the fall of 1885, he made some experiments in heavy electric railroading on a branch of the Fort Scott Steam Railroad, where heavy freight cars were operated. Mr. Henry later, in 1886, equipped the Kansas City Fifth Street Railroad with his street railway system. Here he employed, it is claimed, for the first time the following features which are still in common use: The trolley wires were of No. 1 hard drawn copper and were supported centrally over the street from insulators and span wires to poles placed along the curb lines; the trolley engaged the sides and bottom of the wires and was so held by spring pressure; the current was supplied by compound wound, constant potential dynamos; the motors were series wound and were journaled on the car axles at one end, the other end being spring supported; the gearing was encased and ran in oil; the practice of using two pairs of tapering brushes was discarded and a single pair which abutted the commutator was substituted. An independent switch was added to reverse the motor instead of shifting the brushes.

In 1887, Mr. Henry removed to San Diego, Cal., and constructed a number of electric roads, one of which contained 9 per cent. grades which were surmounted by his motors and trail cars with success. The system of underground feeders was first introduced on one of those roads. In 1889, Mr. Henry removed to New York, where he has since been engaged, not only in electric railroad investigations and improvements, but as an expert to some of the largest electric corporations. Mr. Henry took out a number of fundamental patents during his early electric railway work and his claims as the inventor of the main features of the trolley system of to-day, are now before the United States Court, in a suit which is being defended by the Westinghouse Electric & Manufacturing Company. He is most assiduous in his profession, and has taken out many patents for improvements in electric railway work during the last few years. He is a resident of Westfield, N. J.

CHARLES J. VAN DEPOELE.

Charles J. Van Depoele, whose death occurred March 18, 1892, in the vigor of his activity as an electrical engineer, was born in Litchervelde, Belgium, in 1846. His father was a railway engineer. Mr. Van Depoele came to this country in 1871 and settled at Detroit.

Becoming interested in the electric light, he constructed a dynamo in 1880, and soon after moved to Chicago and aided in the organization of the Van Depoele Electric Light Company. The first railway operated under the Van Depoele system was an experimental road installed in Chicago in the winter of 1882–3. In the fall of 1884, Mr. Van Depoele installed a conduit railway at the Toronto Exposition, and in the following year converted the same to an overhead trolley road, the wires being supported from brackets. The current was collected by an under-running trolley. Three cars and a motor car were run, and the road carried over 10,000 passengers per day. A speed of about thirty miles per hour was attained. In the fall of 1885, Mr. Van Depoele experimented on the streets of South Bend, Ind., with a number of motor cars. Later roads were installed in Montgomery, Ala.; Windsor, Ont.; Detroit, Mich.; Appleton, Wis., and Scranton, Pa. Mr. Van Depoele's first road used the over-running trolley; later the under-running trolley was employed.

In 1888, the Thomson-Houston Electric Company purchased all of Mr. Van Depoele's electric railway patents, and from that time until his death Mr. Van Depoele was connected with that company as electrician and inventor. Mr. Van Depoele was a prolific inventor and a tireless worker. He probably did more to boom the business in its infancy than any other man.

SIDNEY H. SHORT.

Sidney H. Short was born in Columbus, O., October 8, 1857. He received his entire education in that city, being one of the early graduates from the Ohio State University. While still young, he displayed inventive genius by developing one of the first telephones. His patents are now the property of the American Bell Telephone Company, of Boston, Mass. For two years prior to his graduation he was employed at the Ohio State University as instructor in the Physical Laboratory. Immediately after being graduated, Mr. Short accepted the vice-presidency of the Denver University, filling the chairs of physics and chemistry until the work became too much for one man, when he resigned the chemical work and gave all his attention to the department of physics. He remained with the University for five years. In the spring of 1885, he constructed a short electric railway here. The track was made of T rails laid on cross ties, the two conductors being supported on insulators between the rails.

The car had four wheels and a rigid truck; the motor was geared with one pinion and one gear to the axle. The car body was eight feet long, and fitted with a rheostat lever and reversing lever. The success of the road was so great that a party of capitalists induced Mr. Short to give up his professorship and develop a street railway system. The conduit system was adopted and five miles of track were laid on 15th Street, in Denver, and operated with considerable success. The difficulties with insulation in the conduit in wet weather, and the imperfections of the early types of motors and generators led to electricity being finally abandoned and the cable substituted. This was in turn given up, and the road is again equipped with electricity, the overhead trolley system being used.

In 1889 Mr. Short returned to Columbus, where, under the firm name of S. H. Short & Company, a short line about two and a half miles in length, using the overhead system and series motors, was built. In 1888 Mr. Short constructed another line on the overhead series system in St. Louis. In June, 1889, he made Cleveland his home, and organized the Short Electric Railway Company, with a capital of $5,000,000. The manufacturing was done by the Brush Electric Company. Railways were built in Muskegon, Mich., Indianapolis, Jamestown, Rochester, N. Y., and many other cities, the Rochester railway calling for the installation of 200 motors, an order then unprecedented. The motors were of the double reduction type, and the cars were run on the multiple arc system. In 1891 Mr. Short put upon the market a single reduction motor, and at the Pittsburgh Convention in the same year, his first gearless machine was shown. As the original inventor of this, the gearless, type of machine, it will, doubtless, always bear his name.

In the summer of 1892 Mr. Short sold his entire interest in the Short Electric Railway Company to the Thomson-Houston Electric Company, of Boston, Mass., and thereby severed his connection with the company. He has since been engaged in developing, for the Brush Electric Company, the largest arc light dynamo ever built. This machine has a capacity of 125 lights of 2,000 C. P. each, but it has been operated successfully carrying a load of 150 lamps, all burning at their full candle power.

Since completing this machine, Mr. Short is turning his attention to new and very important developments in the electrical field, which he hopes to soon bring before the public.

A New Rapid Transit Plan for New York City.

The latest plan presented to the New York Rapid Transit Commissioners comes from a syndicate represented by R. T. Wilson. This syndicate proposes to deposit $1,000,000 to be forfeited if it fails to sign the contract for the construction of the road when the execution thereof shall be authorized by the vote of the people of the city.

The syndicate proposes to commence the construction immediately upon the execution of the contract, and to build that portion between the City Hall and 14th Street within two years, between 14th and 59th Streets, and south of the City Hall, within three years and the uptown section within four years from the time of signing the contract. As soon as the routes mentioned pay 4 per cent. on the cost an additional mile on either side of the city will be built, and as soon as that extra distance pays 4 per cent. on its cost an additional mile be built, and so on until the northern termini are reached. The city is requested to loan the syndicate two-thirds of the cost of each mile of track when approved, in 3 per cent., fifty year, gold bonds, with the provision that the loan from the city shall not be over $2,500,000 per mile on any part below 42d Street, and $2,000,000 per mile on any part above. It is also provided that the loan from the city shall not exceed $30,000,000, the syndicate agreeing to pay the interest on the bonds and redeem them at maturity.

The plan proposes an underground road having a double deck, two-track tunnel, sufficiently below the street to clear all pipes, etc., the method of propulsion to be electricity or some other power not requiring combustion, and the motors to be capable of a uniform speed of forty miles per hour, exclusive of stops, for long distances.

Care of Street Car Motors.

At a recent meeting of the Massachusetts Street Railway Association some very interesting discussion was had on the care of street railway motors on the different lines represented.

Robert C. Brown, of the West End Street Railway Company, stated that the equipment of that line consists entirely of W. P. 50 motors, and that the practice is to inspect to a certain degree—especially as regards brushes, leads and other parts which are likely to get out of adjustment easily—every day. Every third day the car is "over the pit" and is thoroughly inspected from trolley wheel to rail. Every other third day the brush holders are removed, at the same time this inspection goes on, and cleaned. Also the journal caps, and so far as possible, the motor, in general, receives a thorough wiping. Once every thirty days the motors are taken apart, the lower half of the shell being dropped into the pit. When this is done, all the parts of the motor are inspected and thoroughly cleaned. The brasses are removed, the oil wells cleaned out, the commutator and armature thoroughly cleaned, and the whole motor put in as cleanly a condition as possible. This is followed finally by a coat of asphaltum paint. This paint is used at all cleanings, a little each time, as it gives a good surface to the iron, and leaves it in a condition that allows of its being more easily cleaned. At the same time the axle gears and pinions, both of which are of steel, are closely examined for loose bolts, loose keys, wear and other depreciations. Two men can do this work in two and a half hours. The foreman gives the whole car a thorough inspection at the same time.

As a protection against water, the openings at each side of the motor are covered with snug fitting canvas shields. A canvas curtain is also hung from the car body at the commutator end. These guards work well in practice and keep the water out. In the snow plows the motors are on the floors of the body, and need very little attention in service.

E. C. Foster, general manager of the Lynn & Boston Street Railway, stated that that company had some fifty cars equipped with F 30 motors, and seventeen with No. 6 Sprague, all of which have been in service from three to five years, and the remainder, with W. P. 30, W. P. 50 and G. E. 800 motors.

The F 30's require a great deal of care and attention; as the capacity of the armatures is somewhat limited, they become heated, and as a result, will short circuit and burn out. The intermediate shaft and gear are also a source of expense, and the pans are a source of annoyance; in fact, they seem to be made up of delicate parts which seem to create trouble and annoyance to those having them in charge. Certainly, for the winter season, they are not adapted and cannot be operated with any profit in a northern climate. In the summer season it might be profitable to have a limited number of open cars equipped with them, to be run on special occasions, but for regular service they are not as satisfactory as those of modern types. The cost of keeping them in repair is about three times as great as it is with the W. P's.

The W. P. 30 motors have given very good service, yet, are not considered of sufficient capacity to do the work required of them, in operating over grades of 5 per cent. with trailers; the last season, during the summer months, the company operated ten seat cars with trailers, and with the type K controller, and they did the work very nicely, but they were not of sufficient capacity to do it continuously without impairing the usefulness of the motors.

The W. P. 50's are very profitable motors, and, the cost of maintenance is less than with the other types and they are given very hard service.

The G. E. 800 seems to be the ideal motor, as it is very efficient, having a greater capacity than the W. P. 50, is a more "speedy" motor, and has about 1,000 lbs. less weight, which is something to be considered. Great difficulty is experienced in maintaining perfect joints. When it is necessary to have the weight in order to obtain traction, that weight is created by the burden of passengers in the car. When the passengers are not there, the weight of the car is burden enough to give proper traction. An average schedule of eight miles per hour is maintained, although in remote localities a speed of twelve miles is sometimes attained.

P. F. Sullivan, general manager of the Lowell & Suburban Street Railway Company, stated that the repairs and maintenance of their road was cared for on the following system: In the car house skilled mechanics are in charge who are responsible for results. The object is that when a car leaves the shop newly equipped, such equipment shall be thoroughly done, through the best material and workmanship, and after that a thorough inspection. Motors, trucks and cars are numbered and an official record is then begun, and date and description of any repairs made are kept, comparisons formed, and causes sought.

The work is only half done when a car leaves the shop and is passed into the hands of relatively unskilled help. It is assumed that a man before taking charge of a car is absolutely ignorant, has no interest in the apparatus, and the aim is to teach him so that he will look out for his motors and create a rivalry so that a man will boast of his record.

A green man is placed on the car in charge of a competent motorman, taught the names and methods incidental to car control, and is recommended as being competent to take charge of the car. He is then placed in the repair shop under the direction of the foreman, and shown all the parts, their relation to each other, and in order that he may realize more fully what certain carelessness would amount to, he is given the list price of the various parts. When in the shops such men take the place of helpers in all branches, and are paid accordingly.

To help to create an interest there are prizes for the motormen whose cars have had the best records in point of expense, delays, etc. All loss of mileage or taking off of cars is reported directly to the manager's desk, who exacts an accounting for the cause from the superintendent.

By following the above methods it has been possible to adopt a standard of car mile expenses, and the different foremen are given to understand that if the expenses are kept below such a figure they may expect a present at the end of the fiscal year. The equipment consists chiefly of W. P. 30 motors, Bemis standard trucks, thirty-three inch wheels. Nearly all cars are equipped with type K controllers, and all have gear cases. The cars were previously equipped with the former style of Bemis truck, thirty-inch wheels, but it was found in the line of economy to change.

N. E. Weston, superintendent Lawrence division of the Lowell, Lawrence & Haverhill Street Railway, mentioned considerable trouble from water getting on the commutator and brush holder during sleet storms in winter and also from the salt put on the tracks destroying the insulation of the wires underneath the cars, and stated that a strip of No. 1 duck, painted with fireproof paint, hung between the motor and the wheels on either side, formed a sufficient protection. This road uses S. R. G. 15 and W. P. 25 motors, two to each car.

The S. R. G. requires a seventy ampere fuse, and the W. P. a 100 ampere fuse. Great care has to be exercised that the men do not use the larger fuse on the smaller motors, as they are liable to do if not watched closely. If this is done, and the small motors become overloaded, they are apt to burn out. There are at the barn three night men. One of them looks after the cleaning of the cars, sweeping the floors, washing the windows and taking care of the stoves; the other two go through all the cars, lift all traps, and make a thorough examination of every part—lead wire, brushes, brush holders, etc.—and find all troubles that they possibly can. If they find a car that cannot be easily repaired, they put a sign on it, "leave this car in," and the repairs are made during the day by the electricians. These men oil all bearings every night, using in all oil cups a motor compound from the Vacuum Oil Company, that costs eight cents per pound; for the other bearings a cheap dark machine oil is used. All trucks, brakes and brakeshoes are also examined every night.

The car barn is so arranged that there is pit room enough to hold twelve cars. These pits are all heated by steam, and the men can walk under the cars easily, using a drop light, and making careful inspection of everything.

When an armature is burned out, the car is placed over the pit, and the armature is lowered down with chain falls and taken from under the car, through the pit, then to the armature room, and a new one put in its place.

James F. Shaw, treasurer of the Wakefield & Stoneham Street Railway, made some interesting statements with regard to the use of electric heaters on the Haverhill & Amesbury road, which line has used these heaters for the past two winters on a run of eighteen miles, having no difficulty in keeping the cars warm on the coldest days. The heaters used are the Burton, Cochrane and New England. The Burton heater to heat moderately takes four amperes, and on extremely cold days ten, more or less. The New England heater takes three amperes for each side of the car, which may be run in series or multiple. Several other lines are using electric heaters and although they cost slightly more than stoves, they are more satisfactory.

Chicago's Street Railway Traffic in 1893.

In this issue are published the reports of the three principal Chicago street railway lines The following comparison of the traffic returns will be found of interest:

	Passengers carried.	Increase.
Chicago City Railway	120,596,270	32,577,409
West Chicago Street Railroad	107,053,461	12,534,987
North Chicago Street Railroad	60,311,673	9,892,216
Total	287,961,404	55,004,612
	Gross earnings.	**Increase.**
Chicago City Railway	$ 6,059,989	$1,659,046
West Chicago Street Railroad	5,235,633	615,408
North Chicago Street Railroad	3,014,889	493,277
Total	$14,310,511	$2,767,731
	Car miles.	**Increase.**
Chicago City Railway	26,304,090	5,483,380
West Chicago Street Railroad	16,813,134	1,230,993
North Chicago Street Railroad	9,224,173	676,382
Total	52,341,397	7,390,755
	Operating expenses.	**Increase.**
Chicago City Railway	$3,422,040	$612,609
West Chicago Street Railroad	2,829,982	205,671
North Chicago Street Railroad	1,412,755	78,703
Total	$7,664,777	$896,983

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

We Heartily Appreciate the almost unanimous endorsement by street railway managers of our forthcoming financial supplement, "American Street Railway Investments" It has been made evident to us, in the large number of letters which we have received in answer to our circular letters of inquiry, that our belief in the necessity of such a publication is well founded, and that our purposes and methods have been understood and approved. It is already certain that this supplement will be the most complete and valuable compilation of financial information concerning street railways ever produced.

Through the Death of William Richardson, recorded in our January issue, the street railway industry parts with a member which it could ill afford to lose, and one whose place can not be refilled. Mr. Richardson was one of the few remaining members of that older generation in the street railway field who, engaged in the business some thirty years or so ago, when its importance and future were not appreciated and by keen foresight, combined with careful management made it one of the leading factors of municipal advancement and prosperity. Mr. Richardson lived to see the opening of a new era in street railway development, by the adoption of a motive power not dreamed of when he began his work as a street railway manager, and a progress made during the last six years equal in magnitude to all those in the preceding twenty-five. Mr. Richardson did not try to confine the benefit of his thought and experience to his own road. He was a most enthusiastic member of the National and State Street Railway Associations, of whose meetings he was a regular attendant, and in whose proceedings and councils he took an active part. He was a firm believer in that far-seeing policy of giving others the results of one's experience, and was not above benefiting by the advice of others in return. An example of his foresight and discernment is shown in his early advocacy of electric power for car propulsion and its adoption on the road of which he was president as soon as municipal permission was obtained, though used for so many years to animal power. Mr. Richardson deserves the thanks of the members of the street railway fraternity for the many benefits which he has conferred on them, and his memory will be cherished as of one who was a friend of all.

The Electric Railway Field has now reached such gigantic proportions, and the science of electric railway construction and operation has advanced so rapidly, that it is hardly possible to realize the fact that the industry is still very young. Less than ten years ago the inventors, to whom we are indebted for our apparatus of to-day, were engaged in working out the fundamental principles of electric railway design and operation and there was not a single electric road in regular operation. The honor roll of workers in this field is a long one, and one of which every American and every street railway man may well be proud. To no one man and to no one set of men can be attributed the credit of creating the electric railway of to-day. Like all great undertakings, it is the product of many minds. To many of those engaged in the operation of extensive systems this early work remains obscure and half or entirely forgotten. To recall to the minds of such the early struggles and problems in the electric railway field, we publish in this issue the portraits and short biographical sketches of nine of the pioneers in this country, and to whom the greater portion of the early development of the electric railway is due. This, like other branches of electrical development, seems destined to be a battle ground for patent litigation, and while the questions of law involved in these suits remain unsettled, there is certain to remain a degree of indefiniteness as to the ownership of the legal rights in certain inventions. Credit for actual work performed and progress made in the art, however, should be given, independent of the fact as to whether an invention, if made, was of such a character as to secure a patent for its exclusive use to the inventor. We should, therefore, give the due meed of praise to all those by whose efforts the great industry represented by our electric railways was established.

The Attention of Street Railway Managers in Southern cities should be turned to the various methods of increasing the patronage of their lines, which have proved so efficacious in other sections of the country, particularly in the West. It is not unusual to find Western city systems earning from $5 to $10 per capita, owing to excellence of management, frequency of service, high schedule speed, and sometimes the establishment or development of public pleasure grounds, beer gardens or picnicking resorts by the street railway companies themselves. The negro population in the South is not infrequently an element of strength rather than weakness, because of the well known fact that a "darkey"—the most improvident of mortals—will spend his last "picayune" for the pleasure of coursing over the country on the delightfully mysterious electric car. The constantly increasing number of Northerners who pass their winters in the South will patronize the local railways as a daily diversion if they are provided with clean and easily riding cars. When all is said and done, much depends on the ingenuity of the street railway manager in educating his permanent public to ride more and more frequentiy. In too many cases the cars are running on too long headway, and

while it may seem an expensive experiment to reduce the schedule intervals from fifteen minutes to ten, seven and a half, or five minutes, especially on systems which are barely paying expenses, the change will frequently be found unexpectedly profitable. Where the headway is too long, people will walk rather than wait, but especially within the city limits they can frequently be educated to ride freely, if given proper facilities. It is not to be expected however, that the street railway industry in the South will develop more rapidly than the other industries which have had a much shorter lease of life, but nothing should be left undone which will assist in the building up of "the New South" which has progressed so rapidly during the past few years.

The Preliminaries for the Thirteenth Annual Convention, of the American Street Railway Association are now nearly all arranged, following the meeting of the Executive Committee at Atlanta on the 24th of last month, and the indications are that the next will be largely attended and an interesting and successful convention. The only discouraging feature in connection with the arrangements is the distance (three miles) from the principal hotels to the Exposition buildings, in which the meetings are to be held. But as the street railway companies will present the delegates with complimentary tickets to and from the Exposition grounds, this factor will not militate against the success of the meeting. Judging from the enthusiasm of the local committee, and the assurance that everything possible will be done to make the coming of the delegates to this beautiful Southern city a delight, it is safe to predict that nothing will be wanted at that end of the line to give character to the meeting and render the exhibit of supplies remunerative to the manufacturers and dealers. One important matter that will add to the social features of the convention, will be the presence of street railway men from numerous Southern cities who have not heretofore been identified with the interests of the Association. Atlanta being centrally located in reference to Southern cities, together with the special efforts which the local committee will make to bring the claims and benefits of the Association to the attention of Southern roads, will, doubtless, bring them together, as noted above. Efforts will be made to engage some of the most prominent Southern orators to respond to the toasts at the banquet, so that a good opportunity will be given to listen to some of the fluent speakers for which this region is so justly noted. The subjects selected on which special committees are to report, cover a wider range than those presented at the last convention, and only practical street railway men will be appointed on the committees, the papers will be of a practical character and within the comprehension of all, so that a full discussion may be expected on all the subjects. The committee, however, has wisely selected one subject for discussion which will be open to all without the formality of a paper, so that no one may want for the opportunity to take part in the proceedings. There is also to be an executive session, which will remove the restraint under which the delegates usually labor, and this will, doubtless, bring out reports of operation and experiments more fully than has ever been done before. It is to be regretted that circumstances have compelled the executive committee to drop the subject of an Industrial Institute for the present. It is only laid on the table, however, and can be called up and progressed when the financial conditions of the country shall have become more favorable to such an enterprise. It is not too soon to begin preparations for the Atlanta Convention, and managers and superintendents should see to it that appropriations are made early and arrangements perfected for as many as possible to attend. The Southern railroads will, doubtless, grant more liberal concessions in the way of passenger and freight rates than ever before, so that nothing need stand in the way of a very large attendance, and a very full exhibit of street railway appliances and supplies.

The Responsibility of Resisting Unjust Taxation of street railway franchises is on each and every company manager, and cannot be evaded in any individual case without establishing a precedent which will probably be used to the serious injury of companies in other cities. That the financial necessities of municipal governments are often so pressing as to make it highly desirable, from their point of view, to obtain a larger revenue from quasi-public corporations, is no reason why the burdens sought to be imposed should be abnormal or crushing. In our January issue we pointed out the serious evils resulting from a policy of excessive taxation of franchises. In no better way can we illustrate these evils than by a diagnosis of the diseased street railway industry in England. There, the policy of municipal ownership or control of corporations serving the public—particularly tramway companies—has been carried to its highest development. All, or nearly all of the tramway companies were organized under the Parliamentary Act of 1870, which limits their franchises to twenty-one years and empowers municipalities to purchase their properties at the end of that time or at the end of each subsequent seven year period at the then valuation, exclusive of any allowance for past or future profits of the undertakings or any compensation for compulsory sale or other consideration whatsoever. The tramway companies have been compelled to adopt, in small cities as well as large, a type of roadbed construction costing not less than $25,000 per mile of track, low fares have been insisted upon, and finally, special taxes have been imposed by many of the municipalities, still further fettering the companies. Now, the effect of these onerous conditions has been disastrous in the extreme to both tramway companies and the people, the latter suffering more, if anything, than the former. Except in the larger cities, a return of 5 per cent. on the actual cash investment in the tramway properties is unusual, the net profits being, in many cases, insignificant, if not indeed negative. Capital is not attracted to this field because of the uncertainty as to the action which may be taken by the municipalities at the expiration of the franchise periods. For the same reason the tramway companies will not extend or perfect their systems, are giving inadequate service to the people, and are allowing their road and equipment to deteriorate. They will not extend their lines into the suburbs, and the population density of the English cities is, therefore, far greater than with us, so that the life of the people is restrained and fettered to an extent which cannot be appreciated except in comparison with the enormous development of our own municipalities brought about by street railway methods which are twenty years ahead of those in England. An example will illustrate how great are these differences,

The city of Birmingham has been held up to the world as a model city, well governed according to English ideas. The city of Boston, Mass.,occupies a somewhat similar position with us. The population of the two cities, with their suburbs, is not greatly different, Birmingham being the larger by about 75,000. The five tramways of Birmingham operate a total of about fifty-five miles of road, or one mile for each 12,500 inhabitants; the one system of Boston operates 137 miles of road, or one mile for each 4,500 inhabitants. The combined Birmingham tramways are serving the public with about five car miles per capita population as against twenty-eight car miles per capita in Boston; and as a result of this service Birmingham tramways are carrying about 37,000,000 passengers per annum, equivalent to fifty-three rides per capita population, while Boston street railways are carrying 120,000,000 passengers, equivalent to 192 rides per capita population. Do not these figures mean that, other conditions being equal, the people of Boston are far happier, more fortunate and more prosperous than those of Birmingham? What would we think in this country if Brooklyn was served with but thirty miles of street railway, as is Glasgow; if San Francisco had but ten miles, like Sheffield; if Detroit had but eleven miles, like Bristol; if Rochester had but nine miles, like Leicester; all these being cities of corresponding size? Nor are such examples of English city tramway cities isolated or unfairly quoted. They are types, more or less perfect, of all, and in considering the results of the English policy of high taxation of franchises, the most unreasonable city governments here cannot but turn back in dismay before imposing fresh burdens on a street railway industry which has done so much to make life worth living in America.

Legal Pointers.

By Wm. M. McKinney.

Excessive Speed of Electric Cars.—The fact that cars propelled by electricity are capable of being run at greater speed than other vehicles in the highway, and that the public convenience demands for passengers carried in such cars, what is called "rapid transit," has, it seems, led many electric railway companies into the erroneous notion that their cars may be run at such speed as will satisfy this public demand, and that other persons lawfully using the highway in the customary modes, must govern themselves and use the highway accordingly. While there are *dicta* in some judicial opinions which seem to support these extraordinary propositions, yet, there can be no doubt they are not sound law. Courts and juries and the public generally are beginning to demand that excessive speed of electric street cars, which becomes dangerous to life, shall be stopped. Justice Magie, of the New Jersey Court of Errors, makes the following eminently sound observations upon this question, in deciding the recent case in *Newark Passenger Ry. Co.* v. *Block*: "I am unable to subscribe to the motion which, carried to its logical conclusion, would permit this company, and other companies running cars in public highways propelled by electricity, cables, etc., to run at any rate of speed which they may deem a demand, undefined and unrecognized by law, to require. The right to use the highways by such cars is not paramount to the rights of others in the customary use thereof. It must be used in a manner consistent with such rights of others. Such a paramount right as is contended for could not, in any judgment, be granted without compensation, and it surely cannot be acquired from a vague notion of a public demand for rapid transit. There is no just analogy between the right of a street railway running such cars longitudinally along the highway and the right of a railroad company running its trains across a highway at grade. The latter company acquires by condemnation a right to run its tracks over the lands covered by the highway, and so burdens it with an additional easement. By legislative grant it uses the easement so acquired in the passage of trains run at great speed, and to a certain extent the public easement of passage is at such crossings modified. No grant for the acquisition and use of such additional easement has been made to the street railways, and in the absence of such grants no right to run cars at excessive rates of speed exists. Their only right in this respect is to run at such rate as will not interfere with the customary use of the highway by others of the public with safety."

Electric Railways—Rights of Property Owners. It may be settled beyond dispute that the construction and operation of a street railway by electricity and the erection of poles and wires along the sides of the streets when authorized by law, does not impose an additional servitude on the land, and affords abutting owners no legal ground of complaint nor right to compensation. (*Williams* v. *City Electric St. Ry. Co.*, 41 Fed. Rep. 556, 43 Am. & Eng. R. Cas. 215; *Taggart* v. *Newport St. Ry. Co.*, 16 R. I. 668, 43 Am. & Eng. R. Cas. 208; *Detroit City Ry. Co.* v. *Mills*, 85 Mich. 634, 46 Am. & Eng. R. Cas. 608; *Lockhart* v. *Craig St. Ry. Co.*, 139 Pa. St. 419, 47 Am. & Eng. R. Cas. 57.) The placing of poles in the middle of the street for the purpose of using electricity for street car propulsion does not impose a new servitude on the land in the street; the question whether an additional burden is imposed or not cannot be determined by the motive power employed. (*Halsey* v. *Rapid Transit St. Ry. Co.*, 47 N. J. Eq. 380, 46 Am. & Eng. R. Cas. 76.) Accordingly an injunction will not lie to restrain the construction and operation of such a railway on the ground that no provision has been made for securing such compensation. (*Lockhart* v. *Craig St. Ry. Co.*, 139 Pa. St. 419, 47 Am. & Eng. R. Cas. 57.) The poles necessary to support the wires used are not such an interference with the access to abutting property as constitutes an invasion of private rights, and it cannot be insisted that they are a detriment because in platting lots and selling them it may be necessary to take them into consideration. (*Detroit City Ry. Co.* v. *Mills*, 85 Mich. 634, 46 Am. & Eng. R. Cas. 608.) A temporary injunction to prevent the erection in the street in front of plaintiff's lot of a pole to sustain the wire of an electric motor system for street cars, is properly vacated where plaintiff has no further inducement to press his case, and the effect of the injunction is to obstruct or delay a public improvement or utility. (*Tracy* v. *Troy & L. Ry. Co.*, 54 Hun. 550.) In Michigan, it is said that a land owner has no right to enjoin the use of electricity as a motive power for a street railway unless he can show some present injury to his property therefrom. A mere apprehension that the injury may result in the future is not enough to warrant the issuance of a perpetual injunction. (*Potter* v. *Saginaw Union St. Ry. Co.*, 83 Mich 295.) And where a land owner permits a company operating a street railroad to expend large sums in putting in electrical appliances before he files a bill to prevent its using electricity as a motive power, an injunction will not be issued if the injury to his property, by means of the use of such motive power, will almost be insignificant in comparison with what the injunction will entail upon the company, and he has an adequate remedy at law. (*Potter* v. *Saginaw Union St. Ry. Co.*, 83 Mich. 295.)

An owner of a corner lot who owns to the center of the streets is entitled to no further relief against an electric street railway company, whose track is wholly on the opposite side of the center of the street, which has removed all its poles and wires from in front of such owner's lot, than an order perpetually enjoining the company from thereafter erecting in front of such premises any poles or wires without the consent of the owner. (*Barber* v. *Saginaw Union St. Ry. Co.*, 83 Mich. 299.)

C. E. Loss, of Chicago has bought the Freeport (Ill.) horse line, and intends to convert it into an electric road.

THE COMING CONVENTION.

RECENT MEETING OF THE EXECUTIVE COMMITTEE AT ATLANTA, GA.

The Executive Committee of the American Street Railway Association held a meeting at the Kimball House, Atlanta, January 24, for the purpose of making arrangements for the thirteenth annual convention of the Association, which is to convene in the city of Atlanta, October 17—19, 1894. The members present were: Henry C. Payne, president of the Association, Milwaukee, Wis.; Wm. Stephenson, vice-president, Washington, D. C.; Lewis Perine, Jr., Trenton, N. J.; Thomas H. McLean, Indianapolis, Ind; W. Y. Soper, Ottawa, Can.; Wm. J. Richardson, secretary, Brooklyn, N. Y.

Letters of regret were received from the other members of the Committee as follows: D. F. Longstreet, Denver, Colo.; James R. Chapman, Grand Rapids, Mich.; Edward Whitaker, St. Louis, Mo.

The committee spent the forenoon in visiting the different hotels and proposed places for holding the session of the convention and for locating the exhibits. The Aragon Hotel was selected as headquarters, and it was decided to hold the meetings and have the exhibition of supplies in Machinery Hall at the Exposition grounds, about three miles from the center of the city. The Exposition buildings are ample for all possible exhibits, and one L of Machinery Hall will be partitioned off as a place of meeting. The grounds are reached by two lines of street cars, and by the Richmond & Danville Railroad, whose tracks run directly into the grounds, so that exhibits can be delivered to the Exhibition Hall directly from the cars.

At the afternoon session the following subjects were selected, upon which special committees will be appointed to report:

"A Standard of Street Railway Accounts;" H. I. Bettis, Atlanta, chairman.

"The Best Method of Treating Accidents and Complaints."

"Street Car Wheels and Axles."

"The T Rail Construction of the Terre Haute Street Railway Company;" W. F. Burke, superintendent of the Terre Haute Street Railway Company," chairman.

"Can the T Rail Be Satisfactorily Used in Paved Streets?"

"Suburban Electric Railways."

"Mail and Express and Passenger Service on Street Railway Cars."

The following subject for general discussion was selected:

"Transfers and Commutation," and C. K. Durbin, of Denver, was selected to open the discussion. It was also decided to hold an executive session of the Association, on Thursday morning, the 18th, to which delegates are requested to come prepared to discuss fully, without reserve, any subject relating to the operation and conduct of the street railway business, and of their own roads in particular. It was also decided that not more than twenty minutes should be given to the reading of each paper. A special committee was also selected, consisting of the secretary of the Association, and Lewis Perine, Jr., to prepare a report upon "Street Railway Mutual Fire Insurance." It was resolved in view of the financial condition of the country, that the question of a street railway institute be laid on the table for the present.

T. E. Crossman was selected as official stenographer for the coming year.

It was also resolved, if satisfactory arrangements could be made, to make an excursion to Chattanooga on Friday, following the adjournment of the Association, where an opportunity could be given the delegates to visit Lookout Mountain, the neighboring battle fields, and other attractive features of the location, whence the delegates could return home by various routes.

In the evening the members of the Committee were entertained at a banquet at the Kimball House by the officers and directors of the Atlanta Consolidated Street Railway Company, at which Judge H. E. W. Palmer, presided. There were also present, by invitation, H. I. Bettis, W. A. Hemphill, of the *Atlanta Constitution*, H. H. Cabaniss, business manager of the *Atlanta Journal*, C. B. Fairchild of the STREET RAILWAY JOURNAL, Wm. M. Kingston, representative of the Johnson Company, of Atlanta, and W. Cameron, of Jamestown, N. Y.

A very excellent menu having been discussed, brief remarks were made by the host and some of the guests. The committee were assured of a very warm welcome to Atlanta, and were requested to report to the Association that the local representatives looked forward with a great deal of pleasure to the coming of the convention to Atlanta, and assured them that every possible attention would be shown and every facility provided to make the coming of the delegates to this beautiful city an enjoyable event. It was also mentioned that it was proposed to hold an exposition in Atlanta in September, October and November of 1895, in which every state in the Union would be invited to participate, and also some of the neighboring states of South America, the purpose being to make the exposition second only to the World's Fair.

As an evidence of the good feeling between the sections, it is also proposed to extend an invitation from the Confederate Veterans' Association and the city of Atlanta for the Grand Army of the Republic to hold their national encampment in Atlanta in 1895.

In another column will be found a description of Atlanta and her street railway system. In this connection it may be mentioned that there are many interesting historical points about the city that can be visited. These include the forts and embankments in a good state of preservation, that were occupied during the siege and defense of Atlanta in 1864. Grant Park, one of the public parks, embraces Fort Walker, which is in a commanding position, and in which may be seen several of the cannon employed in the siege, and which are still in position, although the carriages are fast going to decay.

HOTELS.

The Atlanta hotels are ample enough in capacity to accommodate all who may attend the convention, and only regular rates will be charged. The headquarters, as before noted, are to be at the Aragon, which is on Peachtree Street, at the corner of Ellis, adjoining the finer residence portion of the city, and about five blocks from the Union Depot. This hotel is comparatively new, thoroughly furnished, and at present has 100 rooms, but an addition is being erected which will be open in time for the convention, which will contain 100 additional rooms. The rates at this hotel are from $3 to $5 per day, American plan, and from $1.50 to $3.50 per day, European plan. There is an excellent café in connection with the hotel.

The Kimball House is the largest and most prominent hotel in the city, and is located on Pryor Street, opposite the Union Depot, and close to the business center of the depot. The balconies open on to an interior court, and the ledges are very wide, providing ample room for receptions and promenades.

The Kimball House has 450 rooms, with accommodations for 1,000 guests, and the rates are from $2.50 to $5.00 per day, American plan, according to the size and location of the rooms.

There are also several other hotels at which the delegates can secure accommodation. The principal ones are: The Markham House, the Arlington, the Leland, the Marion, the Albemarle and the Cooledge.

Application for space in Machinery Hall for exhibits should be made to Wm. J. Richardson, secretary of the American Street Railway Association, Brooklyn, N. Y. Those who desire to secure rooms in either of the hotels should address Joel Hurt, president of the Atlanta Consolidated Street Railway Company, Atlanta, Ga., or make application directly to the hotels.

Atlanta, Ga.

THE PRESENT HOME OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The fact that the American Street Railway Association is to hold its thirteenth annual convention at Atlanta in October next, makes this city of peculiar interest to street railway men and others engaged in allied industries. Atlanta, the capital of Georgia, is an ideal convention city, and as it is centrally located, with lines of railways radiating in every direction, it can be readily reached from all parts of the country. The distance from New York is 876 miles; from Chicago, 733; Cleveland, 720; Kansas City, 932; Galveston, Tex., 683, and San Francisco, Cal., 2,810. As this is the first time that the Association has convened at the South, managers of street railways in the Southern cities will doubtless attend in larger numbers than ever before. In fact, a number of representative street railway men in the South have already signified their intention to have their roads represented. The same is true of supply men in general. It is probable that the exhibit of street railway appliances will surpass that of any previous convention, while a rare opportunity is presented for Northern manufacturers to meet their Southern customers.

Atlanta is a very interesting city, and has had a phenomenal growth since the war, being not unlike many of the new cities of the Northwest. In public buildings, fine business blocks and beautiful homes, it has few equals, while its location gives it one of the most delightful climates to be found on the continent. It is known as the Gate City of the South, and is the commercial center of a vast region, embracing counties in Tennessee and Alabama, as well as the Northern half of Georgia. It is hard to tell why the city was located here, except that it was the terminal of one of the early steam roads built in the state, but there is no river or other natural feature that would suggest a site for a large city; hence, its growth is doubtless due to the enterprise and hustling qualities of its native and adopted citizens.

The United States Census of 1890 gave the city a population of 68,000, but a later canvass, for the purpose of compiling a city directory, gives the present number at 106,000. A safe estimate is probably in the neighborhood of 100,000, and of this number, about one-third are of the colored race. The latter, however, in proportion to their numbers, patronize the street cars about as much as the white people, and all ride together in the same car, with the rear seats reserved, usually, for the colored passengers.

As a street railway town, Atlanta leads all the Southern cities, with the exception of New Orleans, and it is this feature in which we are now especially interested. The aggregate trackage for the city and immediate suburbs is about 100 miles, and the lines are operated by three companies with electric power, with the exception of a short dummy line.

THE ATLANTA CONSOLIDATED STREET RAILWAY COMPANY

operates sixty-three miles. This company was formed by the consolidation of several other lines in 1891, and the management of the system is in the hands of Joel Hurt, president, with E. Woodruff, vice-president; T. K. Glenn, secretary; R. J. Lowry, treasurer, and H. N. Hurt, superintendent. Mr. Hurt, the president, is also interested in a number of other large industries in the city and state, and is regarded as one of Atlanta's most progressive citizens. To him Atlanta is greatly indebted for some of her fine blocks and public improvements.

The first electric car was run in Atlanta on August 24, 1889. Other construction followed rapidly after this, until all the lines in the city limits had been rebuilt. The Consolidated Company now operates forty cars over twelve divisions, all of which are run on a fifteen minute headway. The electric cars from the different lines meet at a common center at the corner of Broad and Marietta Streets, where the tracks are connected by a very complicated piece of special work, illustrated in Fig. 3, which was designed and built by the Johnson Company.

Various types of rails have been employed in the street construction on the different lines, including the T rails, the Providence girder and other types of girder rails, including section Y. The prevailing type, however, is a forty-five pound section D, of the Johnson girder type. The T rail in the paved streets rests on wooden



FIG. 1.—THE ARAGON—ATLANTA.

THE OFFICIAL HEADQUARTERS OF THE ASSOCIATION.

stringers, and in the suburbs is spiked directly to the ties. In the construction with granite block paving the upper edge of the stringer is chamfered off, and the lower inside corner of the block is removed, so that the pavement comes flush with the rail when laid, and the flange of the wheel makes its own groove by pressing down the blocks (Fig 4). The stringer construction is standing up exceedingly well, but the standard for future construction is the electric girder rail with the Johnson standard joint. Very good success has also been had with the Providence girder rail, with which a very long cast iron joint chair has been employed, which was designed by the engineer of the company. In all recent construction the ends of the rails have been butted together, leaving no space for expansion. Owing to the long headway, the rail joints on the various lines do not give as much trouble as is experienced in other cities where a two or three minute headway is the practice.

The rolling stock of the Consolidated lines consists of cars manufactured by a number of different makers, including those made by Stephenson, Brill, Pullman and Jones. There is also one car which was made by the Fiegal Car Company, which is kept as a special car and chartered to excursion parties. This car is finely finished, and was exhibited at the New Orleans Exposition some years since. The company has recently refitted some of

the ten foot horse cars which are equipped with a single motor without a motor truck. These cars are to be operated on one of the suburban lines, without conductors, fare conveyors and boxes being employed. One or two of the large cars are also equipped with conveyors, which save the expense of a conductor, and on some of the lines two conductors collect the fare for three cars, changing off at certain points. Most of the cars are mounted on Bemis trucks, and the company manufactures its own wheels.

The principal power station, from which most of the lines are operated, together with two of the car barns and repair shops, is located in an open field, three miles from the center of the city, near the Exposition buildings, being seven miles from some of the terminals to which the power is transmitted. The station is on the line of one of the steam roads, and from this coal is delivered directly into the boiler room. The power station and principal car barn are of brick, while other buildings are of wood. These are equipped with an automatic sprinkling device, as a protection against fire. There are a foundry and two small oil houses, which are built of brick, and which are detached from the other buildings.



FIG 2.—GRADY MONUMENT AND POST OFFICE—MARIETTA STREET, ATLANTA.

The present power equipment consists of two Cooper engines of 300 H. P. each, which are run at ninety revolutions, and from which the power is transmitted by means of leather belts to a forty foot countershaft, and from this, in both directions, to seven generators, which are of the D 62 Thomson-Houston type. Munson belting, and also belting manufactured by the Southern Belting Company, of Atlanta, is employed. One of the engines is provided with two eccentric levers, so that the intake and exhaust valves are operated separately, resulting, in the opinion of the station engineer, by whom the second rod was applied, in an improved service. There is no reserve power, both engines being constantly run. The boiler equipment consists of three return tubular boilers of 125 H. P. each, which were manufactured by the Bigelow Company of New Haven, Conn. The fuel consists of Jellico (Tenn.) and nut slack coal, which costs, delivered, $1.75 per ton.

It is the intention of the company to increase the capacity of the station in the spring, by the addition of a 500 H. P. engine, coupled direct to a 500 K. W. generator, and by replacing the present generators with two of 300 K. W. capacity, which are to be belted direct from the present engines.

The company is at present manufacturing nearly all its own supplies, including car wheels, gears and trolley wheels, and nearly all the appliances with which the work is done have been designed by the chief engineer of the company, Thomas Elliott. These include many ingenious devices not usually found in private foundries, together with a foundry practice that is exceedingly interesting, and which, if copied, will doubtless prove of great value to the street railway interests at large. The foundry is a plain building, 40 × 40 ft., and the cupola appliances are rather crude, but the flasks and moulding apparatus are of a high order. The car wheels are cast in iron flasks with home made chills, the material being scrap and enough pig iron to make a durable metal. The proportions employed are about 400 lbs. of scrap to 200 lbs. of pig iron. Two annealing pits and cranes for handling the wheels are provided, and the output is about twelve thirty inch wheels every two days. The wheels are provided with a thicker flange than is usually found on commercial wheels, and so far, the home made article is giving very excellent service, the life averaging from five to seven months. The motor wheels weigh about 300 lbs. and cost about $3.00 each. In the opinion of the engineer it does not pay to grind down the treads of old wheels. Very little trouble has been had so far with slid flat wheels, only one pair having been taken out for this cause. A hard brake shoe is employed, and the motormen are instructed never to skid the wheels. The axle gear wheels are cup shape, cast solid, with a five-eighths inch web, and after being bored out are pressed on to the axles. In the process of moulding, an iron pattern is employed, which is made about a quarter of an inch large to allow for shrinkage. The sand being packed about the pattern, a brass ring with corresponding gear teeth is placed on the surface, and the mould is removed by means of a tripod screw jack, the feet of which rest on the ring, while the lifting rod is inserted in a threaded opening cut in the center of the pattern. By this means the pattern is lifted from the mould without wrapping, which leaves the sand so smooth that the gear teeth do not require cutting. The solid gears of this pattern weigh about seventy pounds less than the commercial split gears, and so far are giving excellent service. It is found that the gears usually outlast three sets of wheels, but in case a gear is broken, the split gear is supplied until it becomes necessary to renew the wheels, when a new gear wheel is pressed on. Pinion blanks are bought, and the teeth are cut in at the company's machine shop, by means of a home made gear cutter, which is supplied with two circular cutters, which are worked in train, and finish the cut at one passage.

The mould for casting trolley wheels is of iron, and made in three parts, each of which is provided with handles. The metal having been poured in the mould the upper part of the mould is lifted off and the split ring which forms the groove is removed, when the casting rolls out and

the parts are adjusted for a second pouring. By this means the trolley wheels are cast about as fast as old time hunters moulded the bullets for their rifles. The casting is very smooth, and much more durable than when cast in sand, the theory being that the iron mould chills the metal somewhat. Other small castings besides trolley wheels are also made, including the armature and axle bearings.

The brasses for the armature bearings are cast with an eccentric shell which is about a quarter of an inch thick on top, and half an inch on the bottom side. This shape, it is claimed, gives about three times the wear of the usual bearing, or three-sixteenths of an inch in place of one, usually allowed. When first put in service, the armature is mounted close to the upper field, and as the box becomes worn the shaft comes to the center, and can be run until the armature approaches the lower field.

The frame bearing brasses also differ from those ordinarily employed. These are cast in the form of a sleeve which embraces the axle from the gear wheel to the opposite car wheel, the ordinary collar next the wheel being omitted, thus furnishing a stationary bearing for the gear cases, giving a dusttight fit and reducing wear. This sleeve is turned to fit the axle, and is provided with an oil cup on the upper side, which introduces the lubricant, and is so arranged that the waste oil is led directly into the gear case. The gear cases are cast of composite metal of old scrap which makes them light and durable.

In winding the armatures, the insulated wire is first thoroughly waxed, which, it is claimed, improves the insulating qualities and makes a more durable motor. Insullac is employed for covering the wires, and the armature is not baked.

The above are some of the shop kinks that are employed, with a view to economy in repairs, and strikingly illustrate how a little ingenuity, properly applied, renders a company comparatively independent.

The tool equipment of the repair shop consists of two lathes, one a thirty-four inch machine of Fay & Scott manufacture, and the other an eighteen inch, manufactured by Lodge & Davis; one 24 × 24 in. planer of the same make, and one twenty-four inch, back gear drill press. There is also a hand drill press and a Watson & Stillman wheel press. In the opinion of the engineer, a wheel press is an important adjunct to a repair equipment, and he thinks it would pay any road running six cars or more to employ a cheap wheel press. There is also a gear cutter, as described, and a number of small tools. For boring out the axle sleeves, a rod with right and left threads is employed, which runs out the shavings made by the cutting tool in both directions. The shop tools are operated by a ten horse power stationary motor. Axles of iron are considered preferable to those of steel, and so far the company has had only one broken axle. Tracks are provided for communication between the different buildings at the station, on which a small electric flat car is run for the purpose of transferring parts to and from the repair shop.

EMPLOYES.

White men only are employed for motormen and conductors, and their pay is twelve cents an hour, and they work fourteen hours per day. The track laborers are mostly colored men who receive $0.80 to $1 per day.



FIG. 3.—CORNER BROAD AND MARIETTA STREETS, ATLANTA, GA.

The fare is five cents, except on the dummy line, which runs to the neighboring town of Decatur, seven miles distant, upon which ten cents is charged, unless tickets are purchased, which, in lots of fifty, are sold at five cents. No transfers are given, except in connection with this dummy line.

The Atlanta Traction Company, which is under the general management of T. B. Felden, president, controls about nineteen miles of track, and operates ten or twelve motor cars which are equipped with the Detroit and Edison motors.

The Collins Park & Belt Railroad Company, under the management of J. W. Darr, receiver, operates fifteen miles of track with nine cars which are equipped with Short motors. Particulars of these systems will be given in our March issue.

PAVING.

About fifty miles of Atlanta streets are paved with granite blocks, the material for which has been furnished from neighboring quarries, making the cost exceedingly low, which at present is about $1.50 per square yard, or, at least, this is what the street railway company is required to pay the city for paving its portion of the street. The blocks are mostly laid on a sand foundation which does

not produce as even a surface as when laid upon a concrete foundation, as is now the practice in most of the Northern cities. There is also considerable asphalt paving, and on the street car lines this is laid, in some cases, with granite blocks next the rails which are toothed into the asphalt. In some of the recent construction the blocks

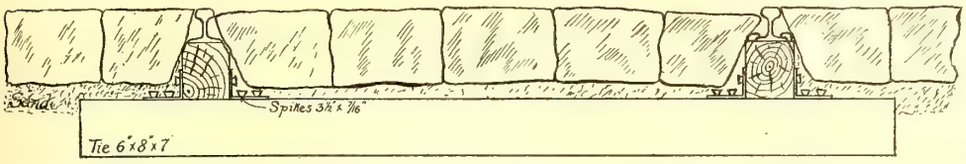


FIG. 4.—CROSS SECTION OF TRACK—ATLANTA CONSOLIDATED RAILWAY.

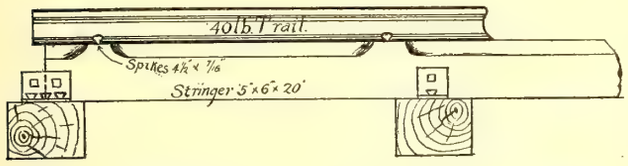


FIG. 5.—LONGITUDINAL SECTION OF TRACK—ATLANTA CONSOLIDATED RAILWAY.

are omitted, and the material is laid against the rails. The county authorities are paving some of the streets just outside the city limits with chert paving. This consists of a foundation of broken stone surfaced with chert, a silicious material quarried in the northwestern part of the state. This material has cementing qualities, and after being put in service becomes hard and smooth.

The granite quarries of Georgia, it is claimed, produce a material far superior for paving purposes, to the New England granite. From these quarries paving material is provided for most of the Southern cities, and to cities as far North as Cincinnati, Columbus, and Dayton, O. The principal quarries are located at Lithonia and Stone Mountain, about twenty miles east of Atlanta.

Stone Mountain, is conceded to be the largest deposit of merchantable granite to be found in the world. The mountain proper consists of a black, mottled, dome shaped rock, entirely denuded of vegetation, 1,400 ft. in height and seven miles in circumference at the base, and on the north the side is very steep. It is estimated to contain over 7,000,000,000 cu. ft. of exposed granite above the surface level of the surrounding plain. The rock is free from impurities, and lies in regular, heavy, vertical masses and sheets with a splenrift, and capable of being quarried in enormous dimensions. At Lithonia there are about 500 acres of exposed granite, and being in an exceptionably favored position, the stones are quarried for 20 per cent. less than can be done elsewhere. As now worked, the Stone Mountain quarries have an output of 25,000 paving blocks per day, and those at Lithonia a capacity of 30,000, both of which outputs can be increased to an almost unlimited extent. The rock, as here found, is of a light gray color of uniform grain, free from lamination, and is adapted to all kinds of structural and street work. The entire deposit is owned by the Venable Brothers, of Atlanta, who have provided every facility for prosecuting the work and transporting the product to the shipping stations. It is estimated that there are over 1,000,700,000 sq. yds. of granite paving laid in the different cities, material for which has been supplied from these quarries, and the supply is seemingly sufficient for any demands that may arise for centuries to come.



FIG. 6.—GRANITE QUARRIES NEAR ATLANTA.

New Cars for the Philadelphia Electric Lines.

The contracts for the cars for the People's Traction Company and the Electric Traction Company, of Philadelphia, were given out last month. The closed cars of the former will be 125 in number, and will be built by the St. Louis Car Company. All of the cars will be high and easy of ventilation. The doors will be double and four feet six inches high in the clear, giving sufficient space for tall men to enter without striking their hats. The cars will be finished in mahogany, and the seats of spring rattan, covered with red plush. The cars will be twenty feet long inside, seating, comfortably, twenty-eight passengers. Each car is to be lighted by ten electric lights, arranged in three clusters. There will also be a light on each platform.

The open, or summer cars, ordered number 165. The St. Louis Car Company will build 125, and the Lamokin Car Company forty. Their design will be alike. These

cars will be ready in the early summer. They will be twenty-eight feet long over all, with ten reversible cross seats.

Both closed and open cars will be mounted on four wheel trucks, supplied by the J. G. Brill Company, and the Peckham Motor Truck & Wheel Company. All of these cars will have double motor equipments. One-half of the winter cars will have double motor equipments furnished by the General Electric Company, and the other half double equipments furnished by the Sperry Electric Company.

The forty closed cars which the Electric Traction Company has ordered from the Pullman Company for the 10th and 11th Streets line, will be of the same general design and color as those now running on 13th and 15th Streets. Inside they will be eighteen feet long, and over all twenty-six feet.

The trucks will be of the McGuire Columbian pattern. Two General Electric motors, of twenty-five horse power each, will be used on thirty of the cars, and two Curtis motors, of thirty horse power each, on ten of the cars.

A New Anti-Oscillating Device.

End oscillation or rocking is one of the greatest difficulties that truck builders have to contend with in the present day of long car bodies, and an inspection of the leading patterns of trucks will show the various devices adopted to obviate this difficulty.

We illustrate herewith a device recently patented and put in operation on one of the cars of the North Side Railway Company, Fort Worth, Tex. This attachment is the invention of Geo. B. Hendrix, general superintendent of that road, and B. F. Chollor, of the same city, and as shown is exceedingly simple in construction. It consists essentially of a pair of double levers, one on each side of the car, which are hinged in the center and fulcrumed over the boxes. The outer ends of the levers are attached to the ends of the car body by means of spring brackets as shown. By this very simple device, it may be seen that one end of the car cannot move up or down without the other end moving in the same direction, thus effectually obviating all tendency to rock. The device has recently been applied to one of the worst "rockers" on the company's line, with the effect to entirely obviate that trouble. The patentees claim for this invention that it permits the use of very short trucks, simplifies the manufacture by doing away with extension tops, extra spring, etc., extends the life of the car body and absolutely prevents rocking.

A New Truck.

The Chicago Electric Truck Company has entered into the manufacture of high class electric motor trucks. Its line will embrace five styles, under patents of Geo. H. Graham. The illustrations show this company's No. A truck which is designed to meet the varied conditions and requirements of electric railways, especially as to simplicity, durability and economy of operation.

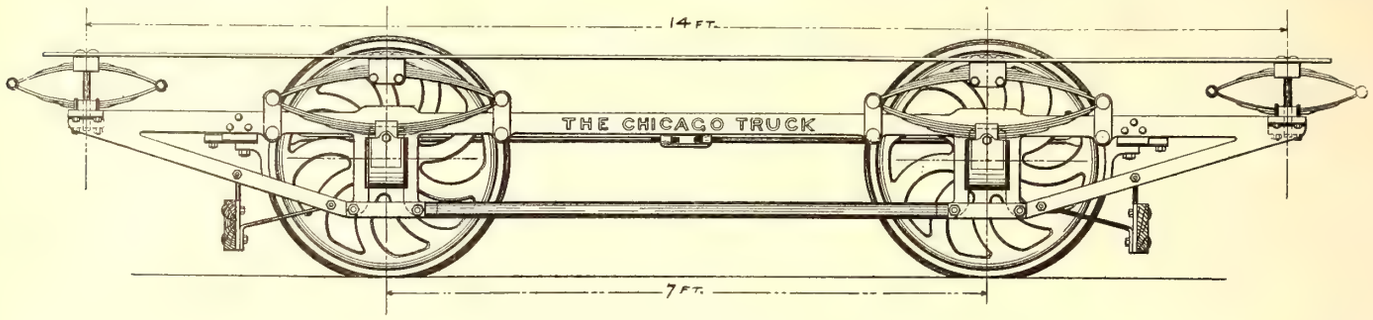


FIG. 1.—THE CHICAGO TRUCK—SIDE VIEW.

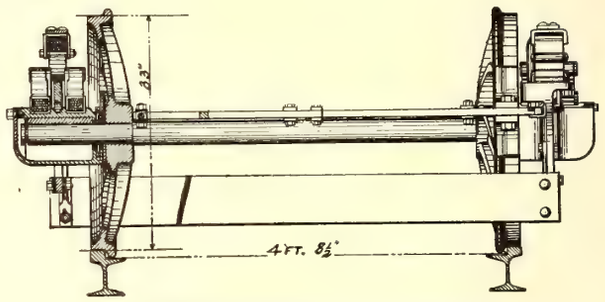
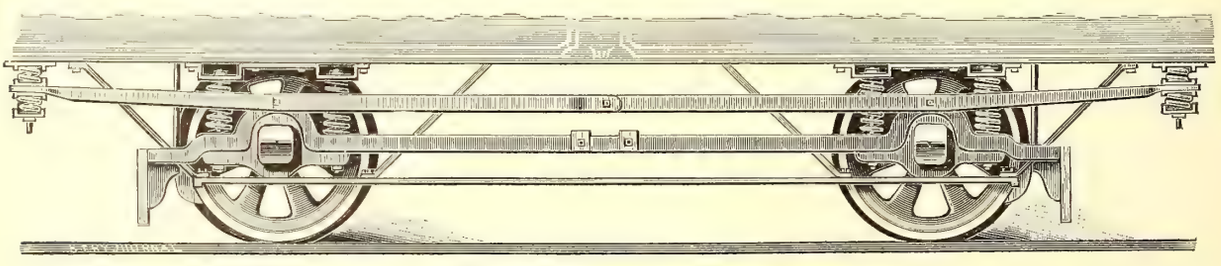


FIG. 2.—CROSS SECTION OF CHICAGO TRUCK.

The truck, it will be noticed, is extremely simple, having a solid forged steel frame, with long cantilever extensions, no castings and few bolts. This truck also permits of easy access to motors and the ready removal of wheels. The entire weight is cushioned on the axle boxes by the springs, thereby adding greatly to the life of both rolling stock and permanent way. The main springs are each composed of three half elliptics, two of which are placed a distance apart and rest on the axle box, with the frame passing over the box between them, while the third is inverted over the frame, and its ends are brought between the ends of the lower springs and held by the same pins or bolts. Two links or hangers, acting as washers to separate the adjacent ends of the three half elliptic springs forming the group, are suspended from the pins, and carry the upper bar of the main frame.

The makers claim that this truck will carry a longer car without oscillation, or the same car with less oscillation than any other on the market, because the frame, instead of being cushioned by spiral springs on the axle boxes, which would allow it to rock or oscillate on the axle box as a fulcrum, is suspended by half elliptic springs which gives it an extended support, so that a fifteen foot spring base can easily be used with a seven foot wheel base. The weight of the car body does not come on the main frame, except the portion borne by the end elliptic springs, but is transmitted directly to the axle boxes



NEW ANTI-OSCILLATING DEVICE.

through the combination springs, preventing strains and allowing the use of a lighter frame. Oscillation is destroyed where it begins by the arrangement of the springs. When the wheel passes over an obstruction or uneven rail joint, and is forced upward, the lower half elliptic springs, by which the frame is suspended, are compressed and therefore lengthened in relation to the frame, and the upper half elliptic springs, being on the same pins, are also lengthened, which would cause their centers, where the car body rests, to lower. This is compensated by the slight rise at the ends of the springs, due to the upward pressure of the lower springs, so that, in fact, the car body remains in the same relation vertically to the rail, and the tendency to oscillate is overcome. These springs are so constructed that this action does not interfere with the independent movement of the car body and truck frame unless the motion is imparted by the wheels, as above described.

The Works of the Barney & Smith Car Company.

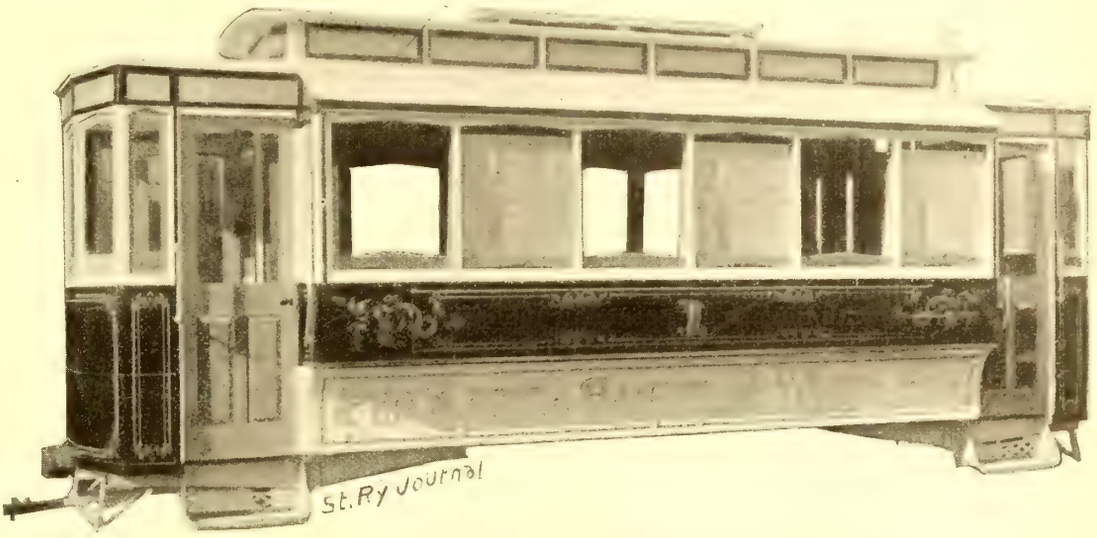
The work of the Barney & Smith Car Company is well known in many sections of the country through the handsome cars supplied from its factory to different roads. We illustrated in our last issue a car built by the company for the Dayton & Soldiers' Home line, in Dayton, as a sample of the high grade of work which this company is turning out regularly. The extent of the business of the Barney & Smith Car Company can be readily gained from an inspection of the accompanying engraving, which is a birdseye view of the works of the company at Dayton, O.

Characteristics of the Barney & Smith cars are their durability and high finish. The Barney and Smith truck was also illustrated in our January number.

THE Egyptian government will award a contract for a tramway from Mansourah to Menzaleh with local branches.

Car for Bangor, Pa.

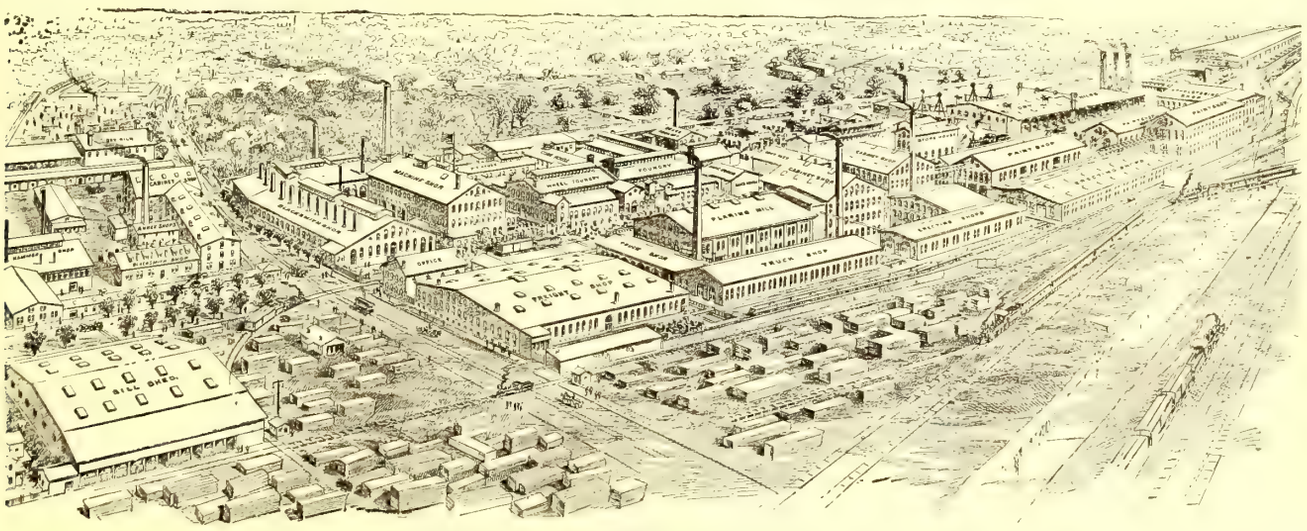
The accompanying engraving shows one of a number of cars now being built for the Bangor, Pen Argyl & Water Gap Electric Railway, of Bangor, Pa., by the J. W. Fowler Car Company, of Elizabethport, N. J. These cars are tastefully trimmed and decorated, and present a very handsome appearance. They are twenty-eight feet eight inches in length over all, with sixteen foot interiors and vestibules four feet two inches in length. The side sills are so arranged that the car bodies rest directly on the truck without blocking, and the vestibule platforms are constructed in such a manner that the steps are only thirteen inches above the track.



ELECTRIC CAR FOR BANGOR, PA.

The roofs are of the monitor type with rolled glass lights, and are provided with four steel carlines, $\frac{3}{8} \times 1$ in., extending across the car and bolted at each end to plate rails. The inside wood work is of ash and cherry finished in natural colors. The ceilings are of maple decorated with delicate scroll work of aluminum. Bronze trimmings are furnished throughout. The seats are upholstered in Wilton carpet, and the floors are provided with floor trap doors, affording easy access to the motors.

The vestibules have two stationary windows and three drop sashes, and are furnished with doors for winter and folding gates for summer. The inside wood work is of paneled ash and cherry, finished in natural colors. The main panel is painted with granite red with gold scroll work ornaments, and gold number shaded with carmine and two shades of green. The striping is of gold edged with black, with fine line of white. The cove panel is of white with ornamented aluminum letters edged with



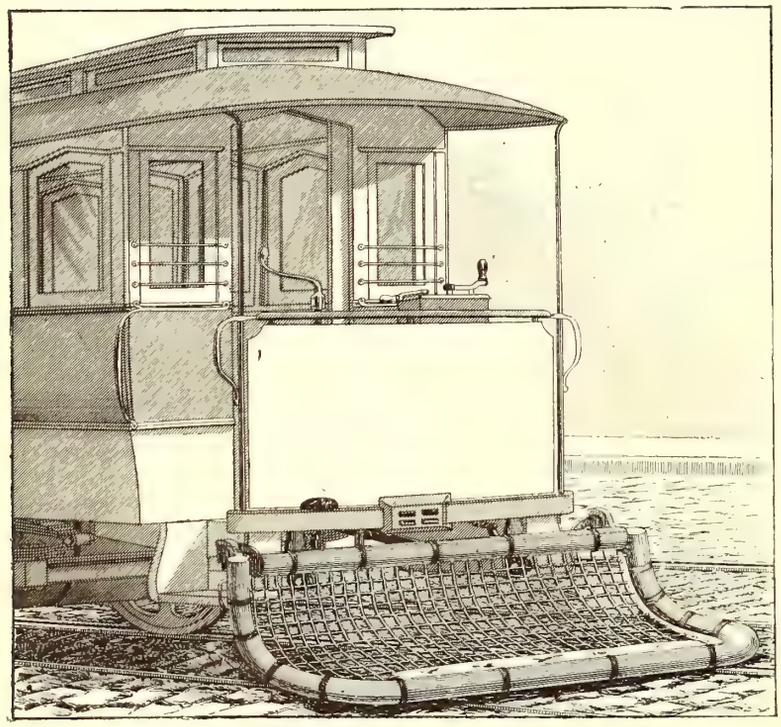
WORKS OF THE BARNEY & SMITH CAR CO.

black and shaded with two shades of green. The steps and sills are painted drab with Tuscan red striping, and the entire car is finished with three coats of varnish. Each car is provided with ratchet brakes, two De Witt sand boxes, radial drawbars, couplers and head-lights.

A New Type of Fender.

The accompanying engraving shows a new type of car fender, which has given excellent results in trials in Baltimore, and is manufactured by the Leonhardt Pneumatic Safety Car Fender Company of Baltimore, Md.

The fender is composed of a strong iron frame, cradle shaped, extending the full width of the car and hooked to the front platform, as shown. Its edges are bound, front, side and top, with three inch pneumatic tubing, or air cushions, with a pliable rope net stretched across the



NEW TYPE OF FENDER.

frame. All parts are interchangeable and adjustable, so as to be easily fitted to any car. If repairs should be come necessary, they can be made without any delay to the car, for the fender can be unhooked and replaced by another is less than two minutes. The great advantage this fender possesses over all others is the pneumatic tubing or air cushioning, which is generally admitted to be the best substance human ingenuity has been able to devise, to yield a soft cushioned blow.

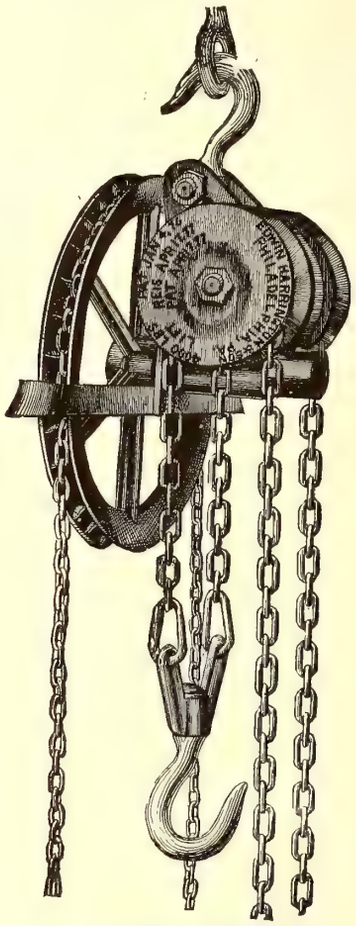
The height of the front edge of the fender, above the street level is adjustable and ordinarily measures two and a half to three inches. Owing to the up and down motion, the fender when struck by an object drops to the ground, and is held there by a self locking device until released by the motorman, thus compelling the object to drop or roll over into the netting and remain there until the car is stopped. In addition to this automatic device, the motorman can by placing his foot upon the treadle, press the fender down and lock it at the same time. When the fender is thus down, two rollers attached to the under side run along the track, preventing the fender from wedging itself under the car.

At public tests in Baltimore and Washington, a number of men and boys were run down in various positions and picked up by the fender without the least scratch or bruise, while the car was running at a speed of from eight to twelve miles an hour.

Double Chain Screw Hoists.

Our illustration shows the Harrington double chain, screw hoisting machine manufactured by Edwin Harrington, Son & Company, Incorporated, builders of iron working machinery, of Philadelphia, Pa. These hoists are made weighing from 35 to 925 lbs., to lift from 500 to 20,000 lbs. The hooks and worms are all of steel, as are all the smaller sizes of worm gears. All the worms and worm gears are cut and turned to templates. The chains are made with extra care. A double chain is always used as a protection against accidents.

The care in selection of material and excellence of the product have led to the adoption of these hoists by the United States Government as the best article of the kind on the market. A recent letter to this company from the Berlin Iron Bridge Company, signed by its president,



DOUBLE CHAIN SCREW HOIST.

states that a number of these hoists are in use in the shops of that company, and that this company has no hesitation in saying that they are the best in the world, the best it has ever used. That these machines have a world wide reputation is shown by the fact that among recent exportations several have been sent to the mining companies of South Africa.

Rumors of a Consolidation in Baltimore.

Rumors of a scheme to consolidate the Baltimore Traction Company, the City Passenger Railway, the City & Suburban Railroad Company and the Lake Roland and the Central Railway lines, in Baltimore, were current last month. The total capitalization of the consolidated companies would be about $12,000,000. The scheme proposes a single set of officers, with an executive board composed of representatives of each company in the combine.

The West End Street Railway Association has been organized, and will hold meetings the third Wednesday of each month. The officers are: President, J. M. Studley, Jr.; vice-president, Paul Winsor; treasurer, J. N. Neal; secretary, N. P. Quick.

An Independent Air Pump and Jet Condenser.

The apparatus shown consists of an independent air pump and jet condenser of large capacity. The exhaust steam from the main engines, pumps, etc., is admitted into the top of the condenser, and on its descent is met by a fine spray of cold water coming in the opposite direction through a copper spray pipe. The complete mechanical mixture of the steam and injection water is obtained. The water deprives the steam of nearly all its latent heat, condenses it, and a vacuum is formed. The air pump removes the condensed steam and injection water from the condenser, the action being continuous. The condenser is provided with the Davidson vacuum breaking device, consisting of a copper float and valve, opening to the atmosphere. Should the water in the condenser rise above a safe level, the ball float, acting on the valve, secures the immediate connection with the outside atmosphere, which destroys the vacuum in the condenser, and stops the flow of injection water. It is, consequently, impossible for the water to back up and prime the engine cylinders and cause the serious damage so common in some forms of condensers. With this machine a great saving in fuel or an increase of power can be had at a small cost where water is available.

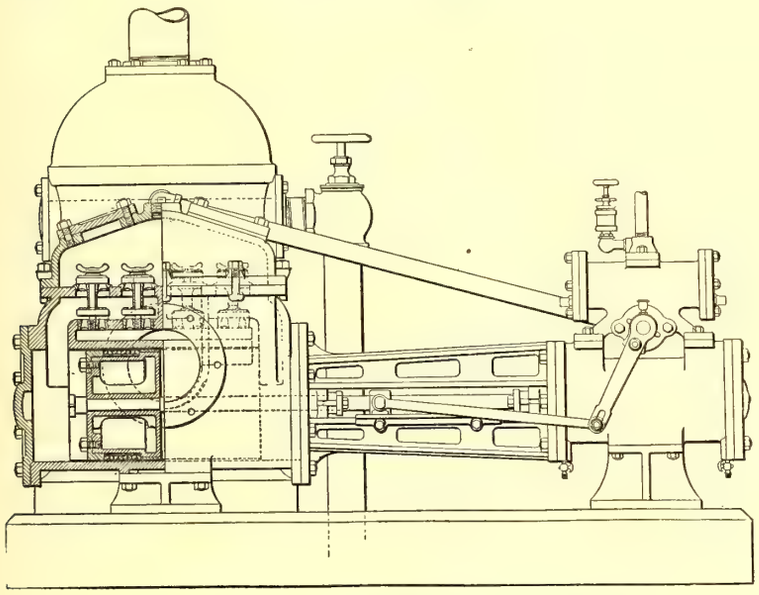


FIG. 1.—SIDE VIEW OF DAVIDSON AIR PUMP AND CONDENSER.

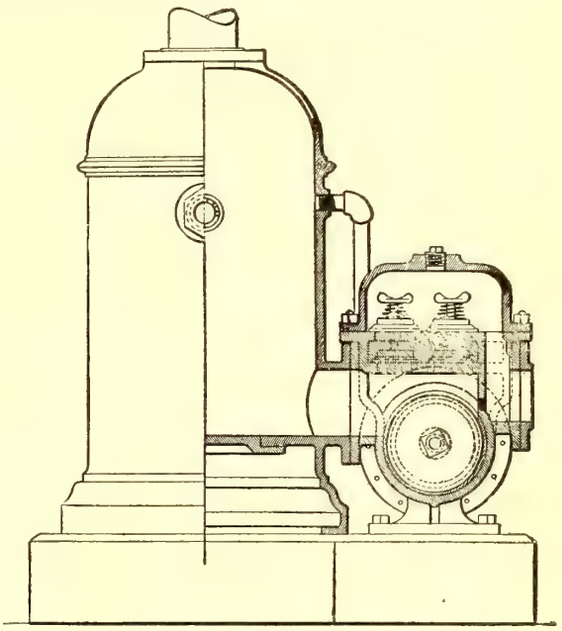


FIG. 2.—TRANSVERSE SECTION OF AIR PUMP AND CONDENSER.

When the steam in an ordinary non-condensing or high pressure engine has performed its work in the cylinder, it is ejected into the atmosphere against atmospheric pressure; it is usually reckoned at fifteen pounds per square inch. It is a well known fact that this resistance, together with the back pressure in exhaust passages and pipes, is just so much power taken from the steam on the engine piston. This condenser removes the back pressure and forms a constant vacuum, equal to thirteen or fourteen pounds per square inch, on the exhaust side of the piston, and the steam can, consequently, be expanded to nearly the absolute zero of pressure, thereby obtaining its full expansive power. By the application of this condenser an increase of from 25 to 30 per cent. in power is guaranteed. Where additional power is not required, a saving in fuel of 20 to 25 per cent., or a great reduction in boiler pressure, may be obtained. This, in many cases, is very desirable. The condenser has been tested under varying conditions, and its superior qualities fully demonstrated. The power required to operate this condenser and air pump is claimed to be not more than 2, or perhaps 2½ per cent. of the engines connected to the condenser, against 5 to 7 per cent. in the ordinary condensing engine with its air pump a component part, and this power is not taken from the engine, but direct from the boiler.

The quantity of injection water required depends upon its capacity for cooling, which is governed by its temperature. In this latitude the water required for this condenser will be about twenty to twenty-five times the amount required for the boiler, and the condensing water, after leaving the condenser for the hot well, should be about 100 degs. temperature, which can be used for boiler feeding.

When a close heater of any pattern is already located, it need not be laid aside, as it will act as a surface condenser between the engine and the independent condenser, and increase the temperature of the feedwater so it can be returned to the boiler at a temperature of about 150 degs.

A single condenser can be used for two or more engines, pumps, etc., one or all of which may be stopped without interfering in the least with the action of the condenser. Being wholly independent of the engine, it can be started to free the cylinder from water, and form a vacuum before starting the engine. In its operation it assists in regulating the running of the engine, particularly when the load is variable.

This condenser requires no steam pump (which is required in some forms of condensers) to lift its injection water. It will lift from any point that can be reached by pumps in general use. It requires no attention whatever beyond starting and stopping. Once started, and the steam and injection water adjusted, the apparatus is automatic. It can be set up by any mechanic, it being only necessary to select the most convenient place for water connections and lead the exhaust from the engine to it. In most cases it requires no masonry foundation. It occupies but little more floor space than a common steam pump. It is noiseless in its operation, and its location in the engine room is entirely unobjectionable. It can, by the use of two gate valves or a three-way cock, be shut off at will, leaving the engine simply non-condensing, and by the use of the Davidson automatic exhaust relief valve, this change can be made automatically.

The Davidson independent air pump and jet condenser is in use in many prominent electric street railway and power stations, notably the Ishpeming Street Railway Company, Ishpeming, Mich.; Wilmington Street Railway Company, Wilmington, N. C.; Utica Street Railway Company, Utica, N. Y.; Toronto Street Railway Company, Toronto, Can., and the Akron Electric Light Company, Akron, O.; Erie Electric Light Company, Erie, Pa.; Oskosh Electric Light Company, Oskosh, Mich.

This apparatus has given very satisfactory results in every case where it has been adopted, and the manufacturer, M. T. Davidson, Brooklyn, N. Y., finds business extremely good.

A New Roller Bearing.

The subject of roller bearings is an old and well worn one in the mechanical field, yet there is an immense range of adaptability and use open to a durable, cheap and practical bearing of this form, for aside from first cost and complication, the questions of friction, wear of parts and consumption of oil are decidedly in favor of the roller bearing.

We present herewith illustrations of a new bearing of this class, that seems to possess a number of features of merit. This bearing is known as the Hyatt roller bearing, and is manufactured by the Hyatt Roller Bearing Company, New York. This bearing is adaptable to all kinds of machinery, although its greatest ability is claimed for steam and street car and trolley bearings.

One great point claimed by the makers of this bearing in its application to steam and surface roads is the very small resistance to starting, thus saving the great wear on motors, cables, etc. The end thrust of the axle has been found by experience to be but slight and easily carried by the cap of the box, as shown in the cut.

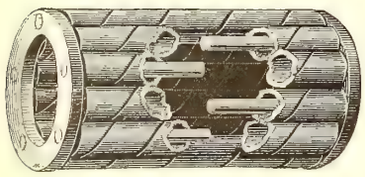


FIG. 1.—ROLLER BEARING FOR TROLLEYS.

When used for bearings where the pressure is light, the rollers are interposed between the cast iron inner surface of the box and the shaft. Where the pressure is heavier, as on car boxes, etc., spirally wound sleeves of the same material as the rollers are placed over the journals and as a lining for the boxes.

The spring rollers are made of a spirally wound ribbon of homogeneous steel and are not specially hardened, it being claimed by the makers that owing to the large surface in contact, due to the elasticity of the roller and the rolling friction, that this is not necessary. This greatly cheapens the manufacture and allows the shafting bearing to be placed on the market for the same, and the car box at a slightly higher price as the ordinary babbited form. The rollers have some longitudinal spring, giving perfect contact with the shaft and obviating the tendency to work out of parallelism, and thereby wear either at both ends of the box or the middle of the shaft, a fault so common in rigid roller bearings. The rollers are held in place by guides consisting of light rings at either end, with pins of smaller diameter than the inside of rollers projecting from them.

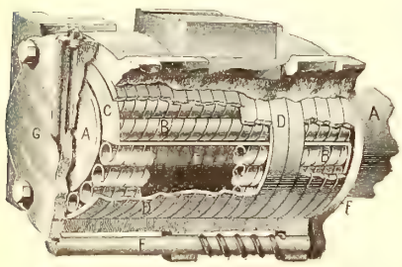


FIG. 2.—ROLLER BEARING FOR CAR BOXES.

The question of wear is very small, as a set of bearings run for 5,000 miles under a car of the Paterson Central Road, showed a wear of but two one-thousandths of an inch on the rollers. In case of wear either the lining or the roller may be easily removed and replaced with new ones at small cost. A trolley bearing of this pattern on the Brooklyn City road has outlasted two sets of ordinary bearings and is still good. This company has also had a set of its bearings running for five months on the jackshaft in the Edison lighting station, at Paterson, N. J., and giving great satisfaction. A set of these bearings applied to a transfer table at the 50th Street station, of the Broadway road in this city, enables one man to move it, where before four were required.

The boxes as shown in our illustration are made to fit the pedestals of all the well known forms of trucks.

The municipalities of Ekaterinoslaw and of Elisavetgrad, Russia, propose to grant franchises for the operation of tramways on their respective territories.

The New Castle Car Manufacturing Company.

The New Castle Car Manufacturing Company has had a remarkable success since it commenced operations two years ago. The company's works have turned out a large number of handsome, well built and durable cars which are now running on some forty different lines, some of them being the best known in the country. This company's trade has not been confined to any one section or state, but the lines on which its cars are running are widely scattered throughout the United States. The company was forced by the number of its orders to double its capacity in the spring of the year 1893. At this time the present painting department, with all the modern improvements and necessary conveniences for getting out things promptly and in first class style, was constructed. The company's rapid progress had been uninterrupted until the recent fire at its works, mentioned in our last issue, which completely destroyed the planing mill and machinery shop. The company is now building a much more extensive mill, and is equipping it with all the necessary machinery for a high grade of work. This mill, it is expected, will be in operation by February 1, at which



F. A. HOVER,
GENERAL MANAGER, NEW CASTLE CAR COMPANY.

time the company will be better equipped than ever for turning out first class work in the least possible time.

The company is composed of young men who are enterprising and anxious to establish a reputation surpassed by none. The general manager of the company, F. A. Hover, whose portrait we present herewith, was one of the organizers of the company, and to his enterprise and ability the success attained is in large part due. Mr. Hover was born in 1865, near Jamestown, Pa., and graduated with honors at Westminster College in the class of 1887. Mr. Hover then moved to New Castle, Pa., where he was engaged for some time in the study of law, but being attracted by the activity of business life, opened one of the largest carriage and wagon repositories in the city of New Castle. The year following, Mr. Hover, with a number of others, organized the New Castle Car Company. Mr. Hover is also prominent politically, and has been a member of the New Castle Common Council.

Two of the cars recently turned out by this company were illustrated in our last issue, one being for the Wheeling, Martin's Ferry, Bridgeport & Bellaire Street Railway Company, and the other for the Norristown & Bridgeport Railway Company. These cars are tasteful in finish and have attracted much favorable comment.

At a meeting of the New Castle Car Manufacturing Company, held last month, the following were elected officers of the company for the ensuing year: President, S. P. Emery; vice-president, G. W. Buffinger; secretary and treasurer, E. N. Baer; general manager, F. A. Hover.

A Swiss aluminum manufacturing company is reported to have reduced its price for aluminum to forty-five cents per pound.

A New Line of Overhead Appliances.

Fig 1 shows the type "W" trolley clamp recently put on the market by the Ohio Brass Company, of Mansfield, O. This clamp, which is especially designed for heavy traffic, consists of two jaws of bronze metal hinged on an interlocking pin which passes through the enlarged head of the stud bolt. The clamping effect is secured by

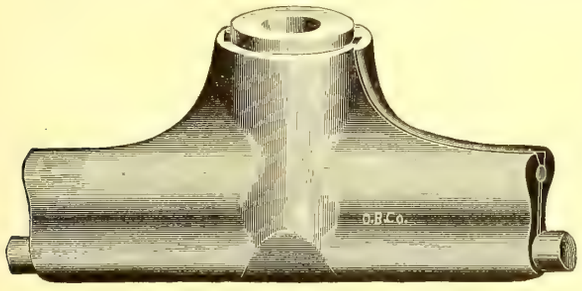


FIG. 1.—TROLLEY CLAMP COMPLETE.

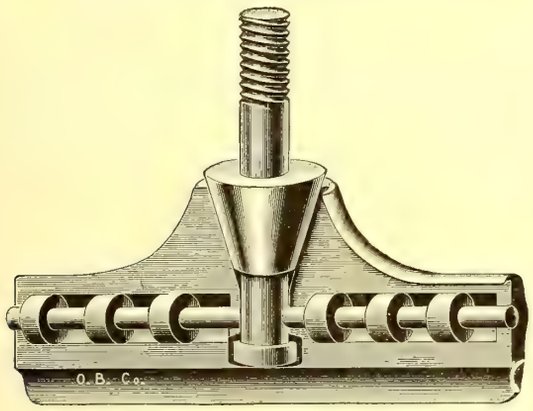


FIG. 2.—WITH SIDE DETACHED.

screwing the insulator on the stud, which forces the cone-shaped wedge down and spreads the upper part of the jaws apart, thus securely gripping the wire.

The great objection to mechanical clamps, that of causing the trolley wire to spark when passing over it, has been overcome without sacrificing the strength of the clamp. By partially unscrewing the cap of the insulator the clamp can be adjusted or entirely removed from the trolley wire. Its length is four and a half inches, its height two inches.

The electrical and mechanical construction of these hangers has been carefully worked out. The hanger

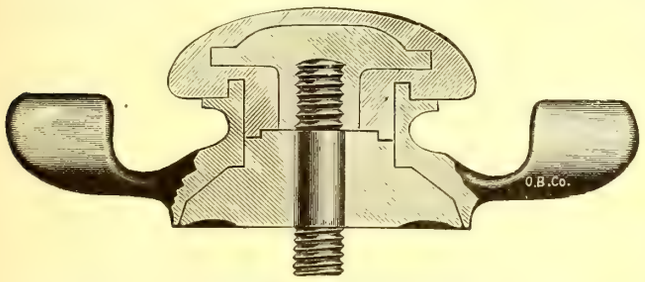


FIG. 3.—SECTION OF LINE INSULATOR.

bodies are made from the best malleable castings, giving strength with lightness. The insulating pieces are moulded from a specia compound selected after the most exhaustive tests. The top and bottom insulators are dovetailed together and also into the hanger body in a special manner, thus preventing any surface leakage. The iron casting, which is moulded into the insulating cap, is larger than the inside diameter of the collar. This does away with the possibility of the hanger stud pulling through and allowing the trolley wire to drop to the street. The insulator caps and washers for the type "W" hangers are all interchangeable.

The Ohio Brass Company, of which Frank C. Black is secretary and general manager, has in print a handsome catalogue describing its line of manufacturing specialties, which include all necessary appliances for overhead equipment. These are in use on some of the largest roads in the country and giving good satisfaction. Another important article this company will soon put upon the market is a new rail bond, which is very simple and easily handled, and makes, it is claimed, a perfect electrical joint. All overhead material is tested by a Riehle & Company's testing machine before leaving the shop.

The sales department will be under the management of Charles K. King, who has had a wide experience in the street railway field. He was at one time railway expert for the Northwest Thomson-Houston Company, with headquarters at St. Paul. Mr. King will also manage the electrical department of the concern.

The company will begin a vigorous campaign about February 15, when several representatives will be started on the road. The company will be also prepared to manufacture special pieces needed in street railway construction from specifications or models.

Graduated Car Springs.

The use of graduated springs on car trucks is by no means a new thing. On the old horse cars probably three-fourths of all the cars in use were so equipped, but with the advent of electricity and the use of much heavier cars and trucks, springs of less elasticity were employed.

With the requirements by the public for the maximum ease and smoothness in the riding of the cars, the graduated spring is again growing in favor.

We show illustrations of the Vose "graduated" spring manufactured by the Vose Spring Company, New York. These springs are in use on a number of the principal cable roads throughout the country and are giving

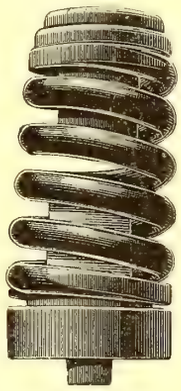


FIG. 1.

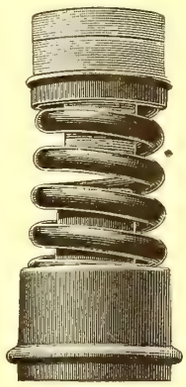


FIG. 2

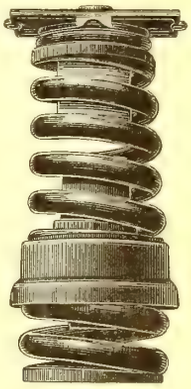


FIG. 3.

satisfaction by their easy riding qualities. The cuts show the pattern of spring used on the Stephenson and Bemis trucks on the Broadway cable road (Figs. 1 and 2), and also a form used on the Chicago City Railway in which the relief spring, usually of rubber, is replaced by a steel coil (Fig. 3). The main springs are of the patented "graduated" conical form, of which this company makes a specialty.

The Vose Company also makes a large number of different styles of springs suitable for different styles of trucks. For electric trucks a form consisting of an outer conical spring, with one iron and one rubber inner cone, instead of two rubber cones is recommended. This company also makes a specialty of elliptic springs for all kinds of trucks and drawbar, trolley and brush-holder springs, also machinery springs of every description, and rubber springs for horse and electric cars.

A REGULAR monthly meeting of the Massachusetts Street Railway Association was held at Young's Hotel, Boston, February 1. The special subject for discussion was, "Bonding Rails and Track Construction." Several members will read papers and gave short talks on the above subjects.

The California Wire Works.

The California Wire Works was incorporated in 1883 with a paid up capital of $500,000. It is the successor of the Dennis Wire Works, established in 1852, and of the California Wire Works and Eckfeldt & Graves, established in 1856, and manufacturers of wire work, wire cloth, etc., of A. S. Hallidie, manufacturer of wire ropes and cables, established in 1857, and of the Pacific Wire Mills and of Robinson & Hallidie, manufacturers of barb wire, established in 1881, all these different concerns being located in San Francisco, and were merged into the California Wire Works, in 1883.

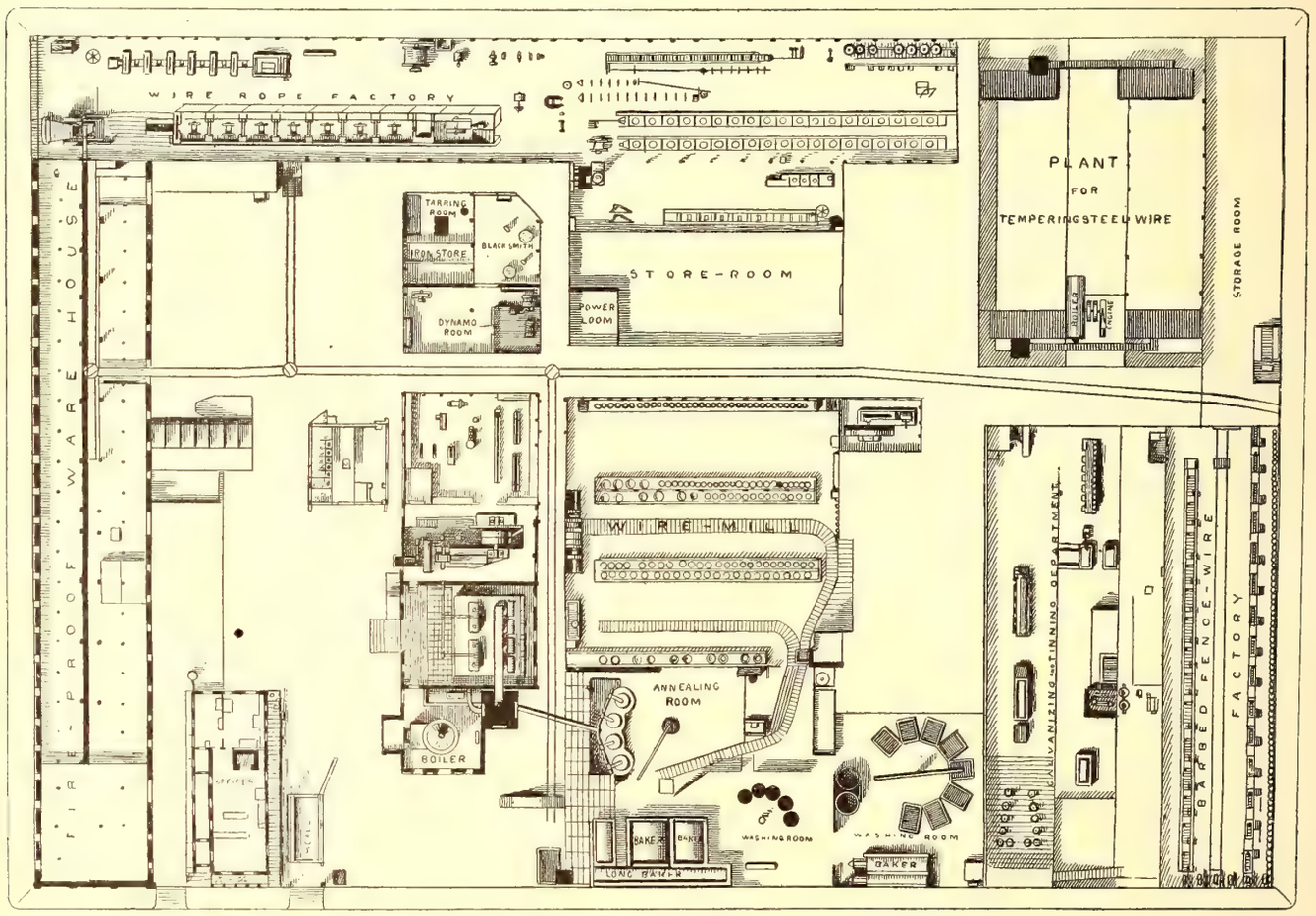
This company erected works in San Francisco occupying a block of land at the north end of the city and covering an area of two and a quarter acres.

The plant consists of a wire mill, barb wire and wire nail works, galvanizing works, wire cloth and netting factory, steel wire patenting or tempering plant and extensive wire rope and cable works. The machinery in the latter department has been specially designed and is patented by A. S. Hallidie, the inventor of the cable railway system, and most of the cables used on the Pacific coast are made on it.

This company has earned an excellent reputation for the excellency of its work, and in its cables especially it stands very high. It has for thirty-six years been manufacturing wire ropes and cables, and under the direct management of Mr. Hallidie has maintained a singularly good reputation. The steel wire patenting plant has been added within the past few years and enables the company to produce the best of steel wire, every piece of which is tested before going into a cable and is required to reach a certain standard. The works are driven by a 600 H. P. Corliss condensing engine and by other engines of 100, 50, 30, 12 and 5 H. P. respectively. In the wire mill are wire blocks for drawing wire and in the nail shop thirty-five nail machines, and in the barb fence department thirty-three barb wire machines.

The capacity of the wire rope department is much beyond the requirements of the Pacific Coast, and recently the company has been filling orders for cables for the cable railways east of the Rocky Mountains, among which are fourteen cables for the St. Louis Cable Railway.

The concern gives employment to 350 men, and is one of the important industries of San Francisco.



PLAN OF THE CALIFORNIA WIRE WORKS—SAN FRANCISCO.

Tramway Interests in Greece.

The only tramways now in Greece are those in Athens and Piraeus, and connecting these two cities. The organization of a new tramway company is being proposed, however, in Patras. The Athens Tramway Company, which owns the lines mentioned above, was organized in 1884 by M. Z. Demerp, with a capital of 3,000,000 francs. The number of miles covered by the cars of this line last year was 1,260,700; the number of passengers carried, 2,643,100; the average number of cars in daily operation, twenty-one.

The same company owns a steam tramway line between Athens, new Phaleron and old Phaleron.

The New Orleans & Carrollton Railroad, which was put into operation electrically last summer, is working very successfully. The company's receipts have increased over 100 per cent., and the system is so popular that a return to horse power would not be tolerated by the inhabitants of that city. It will be remembered that this railway company is one of the oldest in the country, having been organized in 1833 to build a steam railroad.

The Chicago General Street Railway Company started its 22d Street line June 24, 1893, with two old horse cars. The first trolley car was operated November 22, and a second trolley car was added November 30. During December the company started a regular trolley service with Pullman cars mounted on Peckham cantilever trucks and equipped with Sperry whaleback motors.

Uniform Supplies.

The supply of uniform buttons, badges, caps, ticket punches, transfer checks, etc., forms an important item for the consideration of street railway managers, and with the increasing number and classification of employes on the larger roads is no mean item of expense. One of the oldest houses in this line is S. A. French, of New York, having been established in this line since 1850. The long



BADGE AND BUTTONS FOR CONDUCTORS.

experience of this house enables it to furnish a variety of styles in every line of uniform supplies, second to none.

We illustrate herewith several styles of uniform buttons adopted by leading street railway lines. This concern also furnishes every conceivable style of metal and embroidered cap and coat badge, as well as a line of uniform caps. A combination reversible button is one of the specialties of this concern. This button has a plain rubber back with the regular stamped metal front, on a screw shank, and can easily be unscrewed and reversed when off duty. A line of metal fare and transfer checks is also manufactured, which have been used on a number of roads with great satisfaction.

Combined Brake and Fender.

A safety device which will cut off the source of power which propels the car, brake the car in the most effective manner, and so prevent any person from being crushed beneath the wheels in case of collision, is shown in the accompanying cut. The device, which is controlled by D. McFarlan Moore, of New York, is simple in construction and inexpensive.

It is operated automatically by pressure upon the hinged projecting fender, or by the motorman at will.

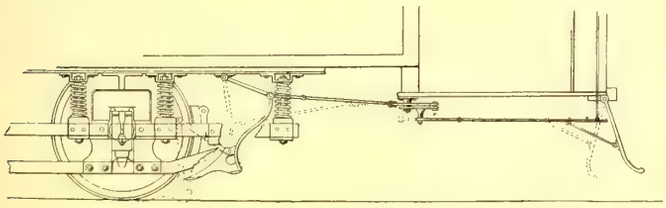


FIG. 1.—COMBINED AUTOMATIC BRAKE AND FENDER

Either method moves the rod under the car platform, cuts off the current or releases the cable and swings the shoes down upon the track under the wheels which run up slightly on the shoes, blocking the car. The heavier the load, the more effective the braking, particularly if the under surface of the shoe is slightly roughened. For this purpose the shoe may be constructed so that the roughened surface bears upon any desired part of the rail to prevent excessive wear.

The mechanism at the point directly under the body of the car, where the rod running from the hinged fender connects with the rod running to the shoes, is shown separately in Fig. 2. Here is a simple lever for the purpose of obtaining greater movement and of throwing the weight of the shoes upon a dead center, it being kept there by the slight spring shown in the cut. This arrangement keeps the shoes in their proper position when raised, offers a ready means of adjustment, both as to movement of of parts and delicacy of action, and prevents any opera-

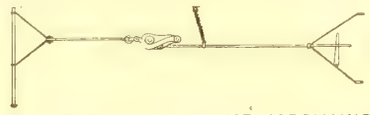


FIG. 2.—DETAIL OF BRAKE MECHANISM.

tion except in the manner appointed. The shoes, as already stated, may be lowered or raised by the motorman, by means of the lever upon the platform. The handle of this lever is hinged so as to drop into a slot to prevent it being turned accidentally, and this does not interfere with the operation by the hinged fender automatically.

IN the case of John N. Stewart versus the town of Ashtabula, *et al.*, which was decided in favor of the defendants in the Superior Court, and was carried to the Supreme Court, of Ohio, a decision is expected soon. It will be remembered that Mr. Stewart was owner of a street railway in the village of Ashtabula, and that owing to differences between the village authorities and the railway company in regard to the grade of the tracks the rails of the road were torn up (May 21, 1891) after the line had been in operation eight years. There are a number of interesting features in the case, and the decision of the Supreme Court will be watched with interest.

The National Statistical Association.

This is the title of a corporation organized at Washington, D. C., and of which Allen R. Foote is vice-president and manager. The work of the company will include the collection, recording and tabulation of such legislative, legal and statistical information as may be found to be of greatest service to its clients, and the furnishing of such information to them. During the compilation of his book on "The Law of Incorporated Companies Operating Under Municipal Franchises," Mr. Foote collected a great deal of matter which is of interest to street railway managers, and such changes as may occur in the laws of the different states on the subjects treated, will be issued in annual volumes, as a supplement to the present work. The Association will also supply special information on any special subject which may be desired in its line of work.

This is one feature of the work that may be undertaken by the National Statistical Association, which is of particular importance to the corporations of the state of New York, and can be utilized at a very opportune time; that is, in collecting information for proper arguments or measures to be presented to the Constitutional Convention of the State. It is our judgment that the experience Mr. Foote has had in compiling the laws and judicial decisions of all states in the Union, pertaining to public service corporations, in addition to the statistical work he has done, gives him exceptional qualifications for undertaking to look after corporate interests in all such matters brought before the Constitutional Convention, and it will undoubtedly be to the interest of every public service corporation in the state to immediately put itself in touch with the Statistical Association by becoming one of its clients, in order to put the Association and Mr. Foote in proper position to represent their interests in the matter above indicated. We are credibly informed that every corporation to which this subject has been presented to date, has become a client of the Association.

A New Fender.

A fender of new design was recently tested on the Wakefield (Mass.) & Stoneham Street Railway. The officers of this road express their satisfaction with the operation of this fender, and say it is the best and most satisfactory they have yet seen. It consists of two parts, the fender, which is hung from the truck instead of the car body, and the bunter, as it is called, a screen of wire supported by springs to break the force of the blow.

On striking any object the force of the blow is broken by the bunter, and the fender, which is dropped at the same instant, catches it and holds it free from the ground. At the back end of the fender is a wire screen to prevent the body from being thrown beneath the wheels, and a woolen apron running the entire length of the car keeps it free of the wheels in case it is thrown aside by the fender.

In a recent test made with dummies, about the size and shape of a man's body, the dummies, whether placed in a standing position or lying on the track, were in every case either picked up or thrown off the track by the fender, the car running at full speed at the time.

Annual Reports of the North and West Chicago Street Railroad Companies.

The annual meeting of the North Chicago Street Railway Company was held January 9. Pres. C. T. Yerkes presented his report as follows:

"Gentlemen:—In making my annual report to you it is with great satisfaction I am able to give you such a one as more than carries out my predictions of a year ago.

"At that time we were expecting the World's Fair, with all its bustle, and demands on us for facilities to carry the people to Chicago, as well as the large number of visitors who were expected, to different parts of our road would be very heavy. While our expectations were great, the realities were greater, and we closed the year with figures which must be most satisfactory to our stockholders. The receipts have increased to a very extensive degree, while the expenses have been kept down to such an amount as would hardly have been anticipated.

"A considerable increase in the number of cars was made, and as you will perceive by the statement which will be presented, the mileage has been much increased.

"To sum up this part of our business, which is, I suppose, the most important of any of the items which you will examine, I can say that the increase in receipts amounts to $493,277.85. while the increase in expenses or, in other words, the amount which it cost to produce that sum, was $78,703.36.

The receipts of the company for the year were	$3,014,789.50
While the total expense of operating the road was	1,412,755.80
Leaving for fixed charges, dividends and surplus to income account	$1,602,033.70
The total number of miles run in 1893 was	9,224,173
The total number of miles run in 1892 was	8,547,791
Which is an increase over last year of	676,382
The total number of passengers carried in 1893 was	60,311,673
The total number of passengers carried in 1892 was	50,419,457
Being an increase over last year of	9,892,216

It is very satisfactory to the management to know that this great increase of business was done even more economically than had been done in previous years. Where a corporation is making a large amount of money and its business is very profitable there is always danger of extravagance in some of its departments, but I am happy to say that the business of the road has been conducted in the past year at proportionately less cost than at any other time.

"While the present year is not as full of promise as the past, yet we cannot expect to have such a condition every year as we have had. Still we will not feel the difference as much as if the Exposition had been held on the North Side. I can congratulate our stockholders that it was not, and fully believe we have made more money than though it had been.

"In conclusion I might add that my opinion, given at our last meeting, in regard to the percentage at which we would be able to operate our road this year has been fully verified, as I find the percentage of expense to the gross receipts is 45.55 per cent."

According to the annual statement, the total receipts from all sources, including advertising, which aggregated $11,328.75, were $3,101,148.25. The cash balance was $1,000,000.

The biggest day's receipts of the year were on October 8, the day before Chicago Day at the fair, when $16,343 was taken in. The smallest day's receipts were on December 3, when the fares dropped to $4,382.50.

The cable lines carried 39,765,165 of the 60,311,673 passengers that were handled last year, and it cost the company just 1.788 cents to earn each nickel paid by the passengers. The expense of carrying passengers on horse car lines was given at 3.414 cents per passenger. A comparison of the cable and horse car lines is as follows:

CABLE.

Receipts	$1,980,751.80
Expense	711,217.14
Miles run	5,695,212
Trips	709,403
Passengers carried	39,765,165
Number of miles run per day	15,603
Trips	1 943
Passengers per trip	56
Passengers per mile	6,982
Receipts per day	$5,476.72
Receipts per trip	2.79
Receipts per mile: Cents	.3,478
Expense per day	$1,948.54
Expense per trip	1.00¼
Expense per mile	.12½

The principal items of expense in operating a cable line were given as follows:

Conductors and drivers	$277,050.60
Car repairs	36,500.93
Building repairs	7.044.08
Office salaries	13,534 03
General salaries	18,337.08
Rope expenditures	56,773.23

The report also showed that the company had expended $4,296.93 during the year in heating cable trains, or a little more than the profits for one day. The company paid $7,244.36 for car licenses during 1893.

The horse car statement was as follows:

Receipts	$1,032,037.70
Expenditures	701,538.66
Miles run	3,528,961
Trips	741,328
Passengers hauled	20,546,508
Miles run daily	9,668
Daily trips	2,031
Passengers per trip	27,716
Passengers per mile	5.82
Average daily receipts	$2,827.50
Average per trip	1.39
Average receipts per mile	.2,924
Daily average expenses	1,922.02
Per trip	.9,463
Per mile	.1 988
Per passenger	.03,414

Conductors and drivers received $270,652,46 in salaries; $23,005.16 was spent in repairing cars, The expense of heating the horse cars was $2,838.12.

ANNUAL REPORT OF THE WEST CHICAGO STREET RAILROAD COMPANY.

The annual meeting of the West Chicago Street Railroad Company was held January 9. In his annual report President Yerkes mentioned the fact that the year had been prosperous, and that company had profited by the World's Fair. -Evidence of this fact is presented in the following extract from this report:

"Gross earnings for the year	$5,235,633.53
Operating expenses	2,892,982.33
Net earnings	$2,342,651.20
Payments of fixed charges, interest, etc	941,749.39
Balance applicable to dividends	$1,400,901.81

"In making charges to expense account during the last year, owing to the fact that it was realized our profits would be large great liberality was shown in charging to that account many items that might have been properly placed in construction account. At the same time, we have added to our surplus $409,342, making it now a total of $1,862 851.

"During the last year the cable roads on Blue Island Avenue and on Halsted Street have been opened, but are running in an unsatisfactory condition, owing to the fact that it is necessary to convey the cars from a point east of Halsted Street with horses. This condition will continue until the Van Buren Street tunnel is finished, when these lines can then run in perfect order. I anticipate the time of the opening of the tunnel to be in the course of two months.

"The crosstown lines, which are comparatively new, have much to our surprise and satisfaction, shown themselves able not to only pay expenses, but to earn good profits. This condition will, no doubt, steadily increase. The opening of the Lake Street elevated road was expected to cause a heavy falling off in the receipts from the territory through which it runs. We find, however, that with the exception of a decrease in the receipts on Lake Street and Randolph Street this competition is not perceptible. The roads mentioned are horse car lines, which are very unimportant in our system, and the decrease can very easily be offset by taking measures to lessen expenses. I believe the result will be that we will confine the operation of these streets in a great measure to the east end of it, thereby leaving to the elevated railroad the long hauls. Since my last report there has been an increase in the capital stock of the company, which amount has in a great measure been used to pay off the floating debt; consequently, the amount of dividend necessary to be paid on this increase amounts to a little more than the amount of interest necessary to be paid in carrying the floating debt. I think I may safely say that there is no reason why there should not be a constant improvement in the affairs of the company. The cable road will be in full operation by spring; the new crosstown lines will be doing a very profitable business, and as there is every reason to suppose the general business of the company will improve as spring opens, it is not rash to predict a prosperous year. There is no doubt whatever in my mind that the present rate of dividend—namely, 9 per cent.—can be kept up and a still larger surplus passed to the income account. I would call your attention to the fact that this surplus now amounts to a very large sum, but just what will be done with it, the directors of the company have not yet determined, but that their actions in this regard will be most satisfactory to the stockholders I am well convinced."

The following figures are reproduced from the annual statement:

		Increase.
Gross earnings	$5,235,633.53	$615,408.23
Operating expenses (Operating expenses are 55.25 per cent of gross earnings.)	2,892,982.33	205,671.73
Net earnings	2,342,651.20	409,736.50

FIXED CHARGES.

Rent of leased lines	$490,500.00
Coupon interest	223,151.86
Interest and taxes	228,097.53
Total	$941,749.39
Balance applicable to dividends	1,400,901.81
Dividends paid	991,559.25
Balance carried to surplus	$509,342.56

EARNINGS AND EXPENSES.

		Increase.
Gross earnings from passengers	$5,196,171.95	$610,934.89
Manure	1,609.69	764.79
Advertising	20,032.62	3,730.55
Rents	17,819.27	22.00
Totals	$5,235,633.53	$615,408.23

OPERATING EXPENSES.

		Increase.
Conducting transportation	$1,377,849.01	$128,406.29
Maintenance of way	168,454.16	1,122.15
Motive power	906,159.90	64,380.72
Maintenance of cars	158,914.71	9,236.62
General expenses, including damages	281,604.55	2,525.95
Totals	$2,892,982.33	$205,671.73
		Increase.
Net earnings	$2,342,651.20	$409,736.50

From which deduct fixed charges as follows:

Rentals	$490,500.00		
Coupon interest	223,151.86	Decrease	$30,344.81
Interest and taxes	228,097.53	Increase	77,018.75
Total charges	$941,749.39	Increase	$46,673.94
Dividends	991,559.25	Increase	266,559.25
Balance to income account			409,342.56

TRAFFIC COMPARISON.

Trips	2,018,785	Increase	201,385
Miles	16,813,134	Increase	1,230,993
Passengers	107,053,461	Increase	12,534,987
Receipts, horse			$2,969,991.47
Receipts, cable			2,265,542.06
Total			$5,235,633.53
Expenses, horse			$1,903,963.62
Expenses, cable			989,018.71
Total			$2,892,982.33
Miles run, horse			9,602,245.04
Miles run, cable			7,210,889.56
Total			16,813,134.60
Receipts per mile, horse			$0.30.69
Receipts per mile, cable			.31.18
Expenses per mile, horse			.19.83
Expenses per mile, cable			.13.71
Passengers carried, horse			61,120,388
Passengers carried, cable			45,933,073
Total			107,053,461
Receipts per passenger			$0.04.85
Maintenance of cars, each car			$87.60
Average number of horses on hand			4,385
Average number horses on wagons, cars, etc			207
Average number horses on car service daily			4,178
Average number of miles per horse, per day			12.59
Cost of feed per horse per day			$0.17.69
Cost of shoeing per horse per day			.02.76
Other cost keeping horse, per day			.17.49
Cable rope run, miles			615,536
Cost of operating rope per mile run			$0.25.44
Cost of operating power station			100,264.20
Cost of operating power station per mile of rope run			16.28
Maintenance of track per mile, horse			6.78.34
Maintenance of track per mile, cable			7.07.64
Snow and ice per mile track, horse			$1.21.93
Snow and ice per mile of track, cable			.91.68
Sprinkling per mile, horse			.49.80
Sprinkling per mile cable			.49.05

A Novel Snow Plow.

The Ashtabula Rapid Transit Company has recently completed a novel snow plow from the design of T. Fricker, general superintendent of the company. The plow is built on a trailer truck, and resembles a strong flat car about ten feet long. The plows are on each end, and so arranged that the lower half of the rear one can be lifted up clear of the track. The wings are between three and four feet in height, and extend two feet beyond the track on either side. They are strongly built of two inch plank, and the lower edges shod with iron. These wings come within two inches of the track. The tracks themselves are cleared by iron scrapers placed just behind the plow. This plow has solid drawbars at either end, and is intended to be pushed ahead of one or more cars, as occasion requires.

This road has heretofore suffered frequent delays on account of the snow which, on parts of the line, often drifts to a depth of from four to six feet.

Annual Report of the Chicago City Railway Company.

The annual meeting of the Chicago City Railway Company was held on January 16. President Wheeler submitted figures showing that last year 120,596, 270 passengers had been carried. This number is 32,577,409 greater than in 1892. Of this increase 90.69 per cent. occurred during the World's Fair period. The revenue amounted to $6,029,813.51; the cost of operating, $3,422,040.62, or 56.75 per cent. of the receipts, and the net earnings were $2,438,711.77. The average receipts a day were $16,520.03, or an average increase of $4,494.60 compared with the daily average of 1892.

The cable furnished 65.27 per cent. of the receipts, the horse car lines 26,02 per cent. and the electric lines 8.71 per cent.. The report also showed improvements made during the year in the construction of an electric power house at Wabash Avenue and 52d Street, the equipment of crosstown lines with electric motors and the reconstruction of 13.13 miles of single track for use by electric cars. Some seventy miles of feed and trolley wires were put in operation, and altogether twenty-eight and a quarter miles of single track have been changed from horse car lines to electric lines, and the number of horses in use has been reduced during the year from 2,601 to 2,266.

The following figures are produced from the annual report of the secretary:

	1893.	1892.
Total earnings	$6,059,989	$4,400,943
Operating expenses	3,422,040	2,809,431
Interest	199,237	230,873
Depreciation	.....	29,500
Net earnings	2,438,711	1,331,137
Dividends	2,100,000	840,000
Balance	$ 338,771	$ 491,137
Per cent. of expenses to earnings	56.75	63.84
Per cent. of net to gross earnings	28.60	19.01
Per cent. earned on stock	27.00	19.00
Capital stock	$9,000,000	$7,000,000

The status of the income account is given below:

Income account January 1, 1893		$2,082,669.20
Surplus December 31, 1893		338,711.77
Total		$2,421,380.97
The following items are chargeable to income-account:		
Dividend of bonds and other securities	$2,250,000.00	
Loss by fire	32,460.00	
Harness account	11,108.37	
Auditorium stock	11,250.00	
World's Fair stock	100,000.00	
Board of Trade membership	1,150 00	
		$2,405,968.58
Balance		$15,412.39

The distance traveled by the cars is given below:

	Miles.
Cable lines	19,713,610
Horse lines	5,053,050
Electric lines	1,537,430
All lines	26,304,090
Increase over 1892 of	5,483,380

RECEIPTS PER MILE.

	Cents.
Cable	19.965
Horse	31.050
Electric	34.148

EXPENSES PER MILE.

	Cents.
Cable	9.921
Horse	24.863
Electric	13.600
Passengers carried 1893	120,596,270
Increase over 1892	32,577,409
Average receipts per day	$ 16,520.03
Increase over 1892 per day	4,494.60
	Per cent.
Increase during World's Fair period	90.69
Increase balance of the year	9.31

Resolutions were adopted authorizing the directors to donate the company's $100,000 stock in the World's Fair to the Field-Columbian Museum, and also authorizing them to give the museum not more than $50,000 in cash, provided they were assured the museum would remain in Jackson Park permanently.

The directors were empowered to issue stock to the amount of $1,000,000 during the year at their discretion, the stock to be offered to stockholders at par and pro rata with their holdings. In response to an inquiry, President Wheeler said the proceeds of the stock would be applied to the equipment of additional lines with electricity in case the City Council should pass the ordinances now before it.

Street Railway News.

Extensions and Improvements.

Alton, Ill.—The officers of the Alton Electric Street Railway Company are making an effort to raise money with which to begin the construction of the North Alton line early in the spring. General Manager J. F. Porter is confident of success.

Brooklyn, N. Y.—Application has been made to the Commissioners of Highways of the town of Flushing by the Brooklyn City Railroad Company for consent to construct and operate a double track line upon Strong's Causeway, and from the line dividing the towns of Newtown and Flushing, to Laurence Avenue and the southerly boundary line of Flushing.

Buffalo, N. Y.—The directors of the Buffalo & Williamsville Electric Railway have ordered two open cars equipped with high speed motors. The cars are to be delivered by April 1.

Camden, N. J.—The Camden Horse Railroad Company has commenced the work of locating the track for the new trolley road which will run along Broadway.

Charleston, S. C.—The City Railway Company has recently received permission to equip its line with electric power. The road, it is said, will be sold to a syndicate.

Clarksville, Tenn.—The Clarksville Street Car Company is extending its line to Porter's Bluff on Red River. A force of men has also been engaged at the work on Madison extension.

Fremont, O.—The Fremont Street Railway is being changed from horse to electricity.

Hamilton, Ont.—The Hamilton, Grimsby & Beamsville Electric Railway Company has let the contract for building eleven trolley cars to Ahearn & Soper, of Ottawa, and for fifty tons of copper wire to Eugene F. Phillips, Electric Works, Montreal.

Hot Springs, Ark.—The Hot Springs Electric Street Railway Company will extend its line to the race track.

Houston, Tex.—The City Street Railway Company will put a number of new lines into operation during the coming season.

Indianapolis, Ind.—The Citizens' Street Railroad Company has purchased twenty-five new, closed, motor cars. The contract has been awarded for the boiler house for the West Washington Street power house. The contractors agree to complete the building by April 1. The house when completed will front 320 ft. on Washington Street, and will have a depth of 330 ft.

Jersey City, N. J.—It is rumored that the Jersey City, Hoboken & Rutherford Electric Railroad Company will have an elevated track from the top of the Palisades to the space adjoining the Hamburg Steamship line, in Hoboken.

Kansas City, Mo.—The Westport Council has granted a franchise to the Kansas City Electric Company to construct and operate an electric railway in that city for a period of twenty years.

Lancaster, Pa.—The Pennsylvania Traction Company is considering the advisability of running a branch of the proposed electric railway to Oxford. The plan is to connect it with the main line of the electric railway at Parkesburg.

Long Island City, N. Y.—A new corporation, in which President Robert C. Pruyn, of the National Commercial Bank, of Albany, N. Y., is prominent, has purchased the system of street railroads in Long Island City owned and operated by the Steinway Railroad Company. Extensions will probably be made.

Marlboro, Mass.—The Marlboro Street Railway Company has appointed the following committee to go over both routes surveyed for extending the line to Hudson: L. S. Brigham, E. R. Alley, O. P. Walker, S. H. Howe and Thomas T. Robinson. The road will, no doubt, be built before the time limit of its charter expires, July 1, 1894.

Mount Vernon, N. Y.—The Common Council has granted the West Chester Electric Railway Company permission to run horse cars over its tracks on Fourth Avenue on certain conditions, one of which is guaranteeing to supplant horse power with electricity by the first day of June, 1894.

Newark, N. J.—The Consolidated Traction Company has been granted the right to make a number of extensions in Clinton and elsewhere.

Northampton, Mass.—The Northampton Electric Street Railway is to be extended four miles to Easthampton and seven miles to Williamsburg. Work is to be begun early in the spring.

Norwalk, O.—The projectors of the Norwalk & Southern Electric Railway Company are taking active steps toward the building and completion of that line. According to S. W. Owen, of Norwalk, the road will join that city with Olena, Greenwich, Fairfield, New London, Steuben, New Haven and Plymouth.

Philadelphia, Pa.—Work will soon be started upon the new car house at the northeast corner of Susquehanna Avenue and 12th Street, by Contractor Charles McCaul, for the Electric Traction Company. The structure will extend from 11th to 12th Street, along Susquehanna Avenue, and to a depth of about 100 ft. A repair shop will be fitted up in one end of the big building.

Racine, Wis.—The Street Railway Company proposes to extend its line to Mt. Pleasant and Caledonia.

Sandusky, O.—At a recent meeting of the Board of Directors of the Sandusky, Milan & Norwalk Electric Railroad Co., it was ordered that all the cars on hand, seven in number, be fitted with motors and all other necessary appliances. The line is to be extended out West Main Street early in the spring.

Springfield, Mass.—The Street Railway Company has contracted for a large part of the machinery for its new electric power station, which will be built this spring. The building will be of brick, and will have a capacity of 1,600 or 1,800 H. P.

West Chester, Pa.—L. M. Paterson, president of the Pennsylvania Traction Company, has officially announced that work on the new electric railway from Harrisburg to Philadelphia, through West Chester County, will be commenced next spring, and that all the rights of way for the branch road from Parkesburg to Oxford have been secured.

White Plains, N. Y.—The petition of the New York, Elmsford, White Plains & Mamaroneck Railroad Company for a franchise to construct a railroad to be operated by electricity through White Plains, has been granted.

New Roads.

Albion, N. Y.—An electric road is proposed from Batavia to Oak Orchard Harbor, in Albion.

Babylon, N. Y.—A company is being formed here for the construction of a trolley road connecting Babylon with Brentwood and intervening places. The new road will probably be completed in a year.

Baltimore, Md.—It is reported that the proposed electric road between this city and Washington will be built this summer. The company controls the Eckington and Belt street railway systems in Washington, and it is over these lines that an entrance will be made into that city. The length of the line between Baltimore and Washington will be a fraction over twenty-eight miles. The run will be made between the two cities in one hour. The charge for a round trip, it is said, will be $1. The plans for the cars are now in the hands of the J. G. Brill Company, of Philadelphia. Among those interested are: President Newbold, T. Edward Hambleton and Howard Munnikhuysen, of Baltimore and P. A. B. Widener, W. L. Elkins and Thomas Dolan, of Philadelphia.

Bel Air, Md.—The town commissioners recently signed an agreement granting to the United States Automatic Electrical Service Company, of Worcester, Mass., a right of way through the town for an electric railway to Van Bibber. It is to be completed by April 1.

Benton Harbor, Mich.—C. P. Wright, president and projector of the new Lake Shore Electric Railway, is securing right of way for this line from St. Joseph to Stevensville. He proposes to have the line in operation by June 15, to connect with the proposed road from South Bend.

Braddock, Pa.—The Braddock & Homestead Street Railway Company was incorporated on January 22, with a capital stock of $7,500. C. Jutte, of Pittsburgh, Pa., is the president of the company. Others interested are W. C. Jutte, E. K. Morse, C. M. Buchanan and George W. Theis, all of Pittsburgh.

Brentwood, L. I.—A scheme is on foot to construct a cross island electric railroad so as to connect Brentwood and nearby points, with the south side villages of Bay Shore, Islip and Babylon. A. J. Martin has the matter in hand.

Bristol, Pa.—An ordinance permitting the Delaware River Steamboat Company to lay trolley tracks and establish an electric road in Bristol, for which the company has been contending for a year, was finally passed at the Borough Council meeting January 8.

Charlottesville, Va.—The City Council has granted the franchise to the Piedmont Construction Company to establish an electric railway line in Charlottesville. The franchise is for fifty years. Work is to be commenced within ninety days.

Chattanooga, Tenn.—The contracts have been awarded for the machinery for a new cable incline up Lookout Mountain. The incline will connect with the Chattanooga electric street railway, at St. Elmo. M. M. Henderson is president of the company.

Cleveland, O.—An extensive project is now under contemplation for this vicinity. The scheme is to run an overhead electric system from Cleveland to Berea and to Medina.

Fall River, Mass.—The Fall River & Stone Bridge Electric Railway Company has been organized with the following officers: President, D. P. Church; clerk, M. G. B. Swift; treasurer, N. B. Church. The capital stock is $100,000. Work will begin in the spring. The tracks will connect with those of the Globe Street Railway at the Fall River end and cover eight miles of road.

Flatlands, L. I.—A franchise has been granted to the Thirty-ninth Street, Brooklyn Ferry & Suburban Railroad Company.

Frederick, Md.—An effort will soon be made to revive the interest of local capitalists in the Frederick & Middletown Electric Railway.

Gardner, Mass.—The incorporators of the Gardner Electric Street Railway Company have chosen L. A. Greenwood, James A. Styles, Charles Heywood, George R. Godfrey, of Gardner, M. A. Coolidge, F. S. Coolidge, of Fitchburg and E. F. Blodgett, of Leominster, as temporary directors. They have asked the selectmen for a franchise and propose a route about three and a half miles long, connecting the three villages with each other and with the stations of both railroads.

Hagerstown, Md.—The City Council of Hagerstown has granted to O. B. Ormsby, of Pittsburgh, and S. Ritter Ickes, of Altoona, Pa., president and vice president and general manager, respectively, of the Cumberland Valley Electric Passenger Railway Company, of Carlisle, Pa., a franchise to build and operate in Hagerstown a street railway. The term of the franchise is forty years. The company to which the franchise was granted contemplates constructing electric roads at Carlisle and in several Pennsylvania counties.

Harrison, N. J.—The Jersey City, Kearney & Harrison Electric Railway Company has been granted rights in Harrison under certain conditions.

Hartford, Conn.—The Hartford Suburban Railroad Company was lately organized here. The officers are: David Henney, president; W. R. Hurd, vice-president, Wilbur E. Goodwin, treasurer, and William H. Goodrich, secretary. This company will control a number of city and suburban electric roads connecting New Britain, Middletown, Windsor, Suffield and East Hartford with Hartford.

Hinesburgh, Vt.—The project of an electric railroad between Burlington and this place is being discussed.

Homestead, Pa.—The Homestead Street Railway Company, of which J. C. Whitla, of Beaver, is the president, proposed to build an electric railway from Homestead to the Southside, where the line will connect with the Pittsburgh & Birmingham electric line. It is expected to start building the line on April 15.

Jackson, O.—The City Council has granted a franchise to the recently organized Wellston Street & Belt Line Company. This company has a capital of $1,000,000 and will run between McArthur Junction and Jackson. The directors are Harvey Wells, J. C. Clutts and H. S. Willard, of Wellston, and C. L. Currier and Isaac E. Adams, of Chicago.

La Salle, Ill.—There has been incorporated the Inter-Urban Electric Railway Company, with a capital stock of $250,000. The incorporators are: C. W. Palmer, R. M. Gardner and M. C. Van Fleet.

Merriam, Kan.—The Merriam Park, Rosedale & Kansas City Electric Railway Company is the name of a new corporation recently formed. The company will build an electric railway from Merriam to Rosedale, to connect with the Metropolitan Street Railway Company's line and possibly to build to Kansas City. The capital stock is $50,000. Some of the directors are: A. A. Pearson, E. G. Bartberger, J. C. F. Maloney, B. F. Hollenback.

Morrisville, Pa.—The Morrisville & Trenton Street Railway Company was organized January 15, with a capital stock of $18,000, to construct and operate an electric railway in Bucks County, Pa. Wm. G. Howell, of Morrisville, was elected president. Other stockholders are George W. Robertson, of Morrisville and Lewis Perrine, Jr., of Trenton, N. J.

New York, N. Y.—Lawyer Edward Lauterbach, representing a powerful syndicate, composed of leading men in the Brooklyn Elevated Railroad Company and the East River Bridge Company and others, told the Rapid Transit Commissioners, on January 10, that these gentlemen were ready to pledge themselves to bid for the franchise of the new independent, elevated rapid transit routes proposed by Mr. Bushe, and to build the roads at once. In answer to a question asked by Mr. Inman, Mr. Lauterbach said the syndicate was willing to accept the plans as already laid out, with the privilege of extension on the East Side when the route has been fully decided upon.

Pottstown, Pa.—A contract has been signed for the construction of the projected Pottstown, Boyertown & Reading Passenger Railway Company's line between Pottstown and Boyertown. C. P. Eberle, of Philadelphia, was awarded the contract.

Richmond, Va.—A bill has been introduced into the legislature for the incorporation of the Henrico Railway Company, the corporators being G. C. Vincent, W. H. Brauer, A. Monteiro, L. H. Kemp, James Mantle, G. W. Randall and others.

St. Joseph, Mich.—The projectors of the St. Joseph & Lake Shore Railway Company, who will construct an electric railway in this city the coming spring, will, it is said, build an electric line from St. Joseph to South Bend in 1894. The line will go through Stevensville, Baroda, New Troy and Three Oaks.

Salt Lake City, Utah.—A franchise has been granted to H. M. McCartney for an electric or cable road, along certain streets of the city, and northward to Bountiful.

ARTICLES of incorporation of the Jordan River Electric Generating Company were filed last month. The company is incorporated for $500,000. The force utilized will be the water running over certain dams in the Utah & Salt Lake Canal and the Jordan Canal Company, where there will be furnished about 20,000 cu. ins. of water. The officers of the company are as follows: Charles S. Wilkes, president; Frank Harris, vice-president; Hoyt Sherman, Jr., secretary; and directors: T. C. Gentsch, John Olson, George W. Ballantine, James N. Smith, Frank Knox. All are from Salt Lake, with the exception of Mr. Ballantine, who is from Denver.

Shamokin, Pa.—The Morrison Cove Electric Railway Company was incorporated December 28, with a capital stock of $175,000, to construct and operate an electric railway in Blair and Bedford Counties. E. C. Hamilton, of Shamokin, is the president of the company. Others interested are: Charles M. Clement, of Sunbury, Pa., and G. M. Smith, of Philadelphia.

Slatington, Pa.—The Slatington Street Railway Company has been organized with a capital stock of $30,000, for building and operating an electric railway in Lehigh County. R. W. Mosteller, of Slatington, is president. Others interested are Henry Bittner, John Balliet and H. W. Hankee.

Tiffin, O.—The Tiffin & Inter-Urban Consolidated Railway Company, with headquarters at Tiffin, and a capital stock of $300,000, has been incorporated. The road is to run from Tiffin to Fostoria, Upper Sandusky, Fremont, Seneca and Huron to Norwalk. Some of the incorporators are: Thomas B. Williams, Charles F. Shaw, Frank W. Brightman and Tunison T. Rosendale.

Toledo, O.—Articles of incorporation have been filed for the Toledo & Maumee Valley Railway Company. The purpose is to operate railroads by electricity or other power, having Toledo and Perrysburg for their termini and passing through the counties of Lucas and Wood. This is part of the system which will ultimately embrace Tiffin and Fostoria. The entire system will be about 200 miles in extent. The company is capitalized at $300,000. The incorporators are Wm. B. Taylor, Josiah D. Cook, George G. Metzger, Parks Foster and Grant Williams.

Trenton, N. J.—A new electrical railway, to be known as the New Jersey Railway Company, has been projected to connect Trenton and Paterson. J. L. Stadelmann, of Philadelphia, is interested, as is also E. W. Hine and Charles E. W. Smith, of Morristown. We understand that work will probably be commenced in the spring. The proposed road, if built, will be longer than any electric road in the country.

Wakefield, Mass.—Chas. F. Woodward, president of the Wakefield & Stoneham Street Railway Company, is interested in the construction of a road from Lowell to Reading.

Waterloo, Ont.—Thos. M. Burt president of the Berlin & Waterloo Street Railway Company, is interested in building an electric line nineteen miles long, connecting several towns in Ontario.

Wilmington, Del.—Unless present indications fail, the New Castle & Wilmington Electric Railway will be built and in operation by June next. Preston Lea and Willard Saulsbury, of Wilmington, are stockholders in the New Castle & Wilmington Company.

Change of Officers in a New York Road.

At the election, held January 9, for directors of the Dry Dock, East Broadway & Battery Railroad Company, the following named gentlemen on the opposition ticket were elected: Richard Kelly, George H. Prentiss, A. S. Rosenbaum, Simon Danzig, Solomon Mehrbach, John H. Waydell, Henry Steers, E. W. Sumner, Marshall S. Driggs, N. Lansing Zabriskie, Henry A Morgan, M. Feuchtwanger and John Byrns. At the meeting of the new board on January 10, Richard Kelly was elected president. He had been secretary and treasurer of the company about twenty-five years up to last May, when he resigned. John Byrns was elected treasurer. He has been a director for the past ten years, and has been secretary and treasurer since Mr. Kelly's resignation. E. T. Landon was elected secretary. He has been connected with the company for over twenty-one years as its bookkeeper, and for the past ten years as auditor.

The Bordeaux-Bouscat-Vigean Electric Road.

The adoption of the electric railway as a means of rapid transit makes but slow progress in France, but signs are not wanting to show that the initial step having been made, the supersession of the horse car will shortly be undertaken on a more extensive scale. Three electric lines are already in operation, the last having been opened on December 17 last, to be operated between the town of Bordeaux and the suburban village of Vigean.

The history of this line resembles in many particulars that of the majority of the roads in this country. But contrary to the usual experience here, it was constructed with capital entirely contributed by the property owners and residents along the road which the line followed, and the inhabitants of the towns, or rather, villages, which would benefit by the improved means of transit, without the necessity of bonding or having recourse to some financial institution. In July, 1888, the first meeting to discuss the matter was held in the little town hall of Bouscat, which was attended by the mayors of the communes of Bouscat, Eysines, Bruges, Planquefort, and by a number of landowners whose property abutted on the Route du Medoc, to consider the advisability of starting a regular car service on the Medoc Highway which at that time was unsatisfactorily served by the Bordeaux Tramway & Omnibus Company. In fifteen days the amount subscribed to attain this end reached $20,000, and the communes interested in the scheme applied to the department authorities for the necessary rights and franchise. Negotiations were then begun with several financial societies to engineer the road, but after three years of fruitless talk they were abandoned, and the inhabitants determined to build the road themselves. They formed a company under the title of the Société de Tramway de Bordeaux-Bouscat au Vigean, and solicited subscriptions for stock. The plan adopted appealed to the popular interest, and the farmers and peasants plunged their hands into the woolen stockings, and drew on the savings banks in order to subscribe for the stock, and sufficient capital was soon obtained.

The question as to what system should be adopted was speedily settled. The company's engineers, after a careful study of the systems used in Paris, Clermont-Ferrand and Marseilles, reported in favor of electricity as more economical, more rapid and more easily exploited. Three manufacturing firms were then requested to bid on the installation—the Cie. Francaise pour l'Exploitation des Procédés Thomson-Houston; the Société Alsacienne des Constructions Mécaniques of Belfort, and the Sautter, Harle & Cie. and Ateliers d'Oerlikon. The contract was awarded the first named, the American apparatus of Gen-

eral Electric Company's manufacture being considered far superior to any other.

Work was at once begun, and the station and line pushed forward to completion without delay. The station is situated at about an equal distance between the extremities of the line, at 304 Route du Medoc. The boiler equipment consists of two Babcock & Wilcox boilers, furnishing steam to two McIntosh & Seymour compound, non-condensing engines, each of 150 H. P., at 275 revolutions. These are directly belted to two four-pole, compound General Electric railway generators, each of 100 K. W., running at 600 revolutions. The switchboard is built up of standard General Electric panels, one for each dynamo.

The line starts from the corner of the Rues David Johnston and Croix-de-Seguey, in Bordeaux, and runs as far as Vigean, a distance of 4,820 metres, 220 of which only are in Bordeaux itself; the remainder of the line follows the Route du Medoc. The rails are of the Humbert and Vignole type, laid upon steel ties, at a gauge of one metre. The grades are insignificant and the curves few. The line is single track, with seven turnouts, exclusive of those at the extremities. The smallest distance between turnouts is 300 metres, the greatest one kilometre. The stations, *i. e.*, where transfers are delivered, at or on the Boulevar, the Chemine de la Charmille, the Chemin des Ecus, the Chemine de Bruges St. Germaine and finally at Vigean. The overhead construction is purely American, the trolley wire being suspended from galvanized iron span wires stretching between side poles.

The motor cars are constructed for forty persons, and have no "Imperiale." Each is fitted with a W. P. 30 General Electric single reduction motor, controlled by two of the latest type series parallel controllers. The speed has been fixed at an average of twelve kilometres per hour, but this is exceeded on the less frequented portions of the line. Twenty cars each way perform the daily service, and on Sundays and holidays each motor car is coupled to a trailer. The cars are from the shops of M. Gustave Carde, at Bordeaux, and are mounted on trucks of American pattern, built by M. J. Leclaire, of Montreuil sur Bois, near Paris.

The installation of this road is a veritable triumph for this country. It shows that so far as the industry has progressed in Europe no motors nor generators have yet been constructed which can successfully compete with those made by the General Electric Company. The character of this installation and its immediate success are due to the care which the General Electric representatives in France have taken to make it combine the perfection of the American practicality with the good taste of the French. M. E. Hospitalier, of *l'Industrie Electrique*, in commenting on this road, says: "During the past four years one electric road per year has been inaugurated in France. This will be increased tenfold this year."

The Street Railway Strike at Bridgeport.

A strike, which, at one time, looked as if it would be very serious, occurred last month on the lines of the Bridgeport Traction Company, of Bridgeport, Conn. The street railway system in this city, as will be remembered, was purchased some time ago by a syndicate, in which Newark capitalists are largely interested. The lines are now operated by horse power, but rights have been granted to change to the trolley system, and the company is preparing to equip some fifty miles of electric road. The company has suffered a good deal from dishonest employes in the past, and some time ago took vigorous measures to discover the culprits, and as a result nine employes were discharged for cause.

The employes improved the occasion of the absence from the city of the president of the company, Colonel Heft, on January 20, to tie up the road, although there had been a standing agreement with them that there should be no strike on less than one week's notice. Fortunately Andrew Radel, general manager of the Newark & South Orange Railway Company, who is also largely interested in the Bridgeport Traction Company, was in Bridgeport, and immediately telegraphed to the Reliable Detective Agency, of New York, to send some of its men to the assistance of the company. This detective agency had been largely instrumental in proving the charges against the discharged men.

The employes made a desperate effort to prevent the running of cars, and used violence to attain this end. The police seemed powerless to repress the trouble. Several trips were made January 21, however, and on January 23 the regular service of the road was resumed with Agency detectives on each car, acting as driver and conductor. This resolute stand had its effect, and on the afternoon of the 23d the employes decided to give up the strike. The terms laid down by the company were accepted by the men, comprising their employment as individuals and not as the members of any union, and including the dismissal of the nine men who had brought themselves into disfavor.

A little further trouble was experienced after the 23d, but at the date of going to press the cars were running regularly with non-union operatives.

Two Power House Breakdowns.

Our correspondents furnish us with the details of two power house accidents which happened recently.

The first of these breakdowns was in the power house of the Des Moines Street Railroad Company, Des Moines, Ia.

Everything was running smoothly about ten o'clock in the morning of December 23 when, without warning, the flywheel of the 30 × 60 engine went to pieces. The cylinder of the engine was not damaged in the least, but the flywheel was a total wreck, and some of the minor parts of the engine were broken. The accident is said to have been caused by a flaw in the casting. Fortunately no one was killed although two men were in the room at the time of the accident. None of the other machinery was hurt in the least, and in an hour after the accident the reserve engines were connected to the line shaft and were running the road.

The second occurred at Sedalia, Mo., in the power house of the Sedalia Railway Light & Power Company, and was in the form of a double breakdown. This company has two 125 H. P. engines. On December 24, the main valve of one of them broke, causing a breakdown of that engine. A new valve was immediately sent for and was in transit when, on December 28, the back end of the connecting rod of the other engine broke, causing the piston to punch out the back cylinder head, and the breaking of the crosshead and guides. The valve for the first did not arrive until twelve hours later and the road was obliged to shut down for that time. This was the first shutdown experienced in the four years of operation of this road, and coming in the middle of the holiday season caused some inconvenience.

Personal.

Mr. John A. Brill called at our office last month while in New York.

Mr. R. A. Crawford, of the R. A Crawford Manufacturing Company, called on us last month. He reported an increased demand for the Crawford fender.

Mr. F. J. Loinaz del Castillo, secretary of the Puerto Principe Street Railway Company, of Puerto Principe, Cuba, was a visitor at our office last month.

Mr. F. S. Terry, has severed his connection with the Ansonia Electric Company, and has accepted the position of secretary of the Sumbeam Lamp Manufacturing Company, of Chicago.

Mr. C. Densmore Wyman, general manager of the General Electric Launch Company, proprietors of the electric launches which plied upon the lagoons at the World's Fair last summer, has moved to New York City, and has headquarters now at 44 Broad Street.

Mr. W. A. H. Bogardus, who has been secretary of the Brooklyn City Railroad Company for a year, has been made general manager, owing to the increase in the number of lines caused by recent consolidations, and Cyrus P. Smith will succeed him as secretary. There will be two superintendents, instead of one, hereafter. Superintendent Cameron will have charge of the lines in the central and southern parts of the city, and William Morrison, who has been superintendent of horses, will have charge of the Eastern District lines.

Obituary.

Col. Thomas C. Boone, treasurer of the Buckeye Engine Company, died at his residence in Salem, O., December 20. Mr. Boone was related to Daniel Boone, and was born in Adams County, Pa., in 1823. When he was four years of age the family removed to Ohio, settling first near Damascus, and later removing to Salem, where he received his education. He engaged in several business enterprises until the breaking out of the war, when he entered the service as lieutenant-colonel of the 115th Ohio Volunteer Infantry. He was soon promoted to the rank of colonel, and served throughout the war with credit. At the close of the war he became a member of the firm of Boone & Gormer, at Salem, and remained in that connection until 1870, when he went into the then newly organized Buckeye Engine Company, being elected secretary at the first meeting, in which capacity he served until his death. Mr. Boone was connected with several other enterprises, and was a member of a number of organizations.

New Publications.

Catalogue of the McGuire Manufacturing Company's Electric Street Car Trucks.

This is a tastefully gotten up catalogue containing views and descriptions of the different forms of improved trucks manufactured by this company, and thirty two half-tone views of cars on different roads throughout the country that are using these trucks on their cars, together with many words of commendation of their good riding qualities from the management of the roads. A list of 290 roads that are using these trucks, to which this company respectfully refers, is also printed.

Points on Perforated Electric Belting. Published by Charles A. Schieren & Company, of New York.

This catalogue is of handy size, handsomely printed, and contains a great deal of information in regard to the perforated electric belting of Charles A. Schieren & Company, which has achieved such a high reputation. Engravings are given showing a portion of the hide used in its manufacture, as well as a number of engravings of large belts supplied by the company. Among the list of customers we notice a large number of electric railway companies, showing that there is a large demand for Schieren belts in this line, and that street railway men are fully alive to the merits of perforated electric belting.

Elementary Lessons in Steam Machinery and the Marine Steam Engine. By J. Langmaid and H. Gaisford, MacMillin & Company, London and New York. 262 pages.

These lessons were prepared for the naval cadets in H. M. S.

"Britannia," by the authors, who are both engineers in the Royal Navy. The theory of steam machinery is treated in a simple but thorough manner, and a great deal of practical information is given on the details of construction and the mechanism of a marine engine. The volume concludes with a short description of the construction of a battle ship. The work is fully illustrated, handsomely bound and printed, and should form a valuable text book for the use of students of marine engineering.

Zeitschrift fur Kleinbahnen, for January, 1894, Vol. 1, No. 1, published by Julius Springer, Berlin, Germany.

The first number of this new German periodical, is in the form of a neatly printed eighty page pamphlet with a light blue cover. This journal is intended to furnish a record of the progress and details of the practice of the rapidly growing German tramway industry. By its prospectus it aims to cover all branches of the field and to keep fully up to the times on all lines of tramway practice. Among the articles of the first number is an article on "The Condition of the Street Railway Industry in North America," by Dr. Kollman, director of the Frankfort railways, who visited this country last summer; and one on the operation of tramways by steam motors, etc. An especially valuable feature of the publication, which will be continued in each number, will be a series of abstracts of articles concerning street railway and engineering practice, taken from the principal technical journals of the world, in which the American press is prominently represented.

The Horse in His Relation to Economic Agriculture and the Industries of Transportation. By E. Lavalard, manager of the General Omnibus Company, of Paris, member of the National Agricultural Society of France, etc. Two volumes, 938 pages.

This work, which forms one of the valuable Bibliothèque de l'Enseignement Agricole published under the direction of the National Agricultural Institute, of France, contains a most thorough discussion of horses, with practical hints as to the selection of animals, their care, treatment of diseases, method of shoeing, etc. Stables, their construction, arrangement and best methods of ventilation and heating are also discussed in a very thorough manner. Mr. Lavalard is a well known authority on this subject, and his position at the head of the largest omnibus and street railway company in France enables him to speak with practical knowledge of the subject. Among other interesting experiments made under Mr. Lavalard's direction was one on determining the actual power expended by the horses on the Paris street cars and omnibuses. On the former it was found that the average work performed by each street car horse while in service, was 592 ft. lbs. per second. The average coefficient of traction of the loaded car was, in this case, 19.6 lbs. per ton of 2,000 lbs. The average daily work of the horses was a little over 3,330,000 ft. lbs., with an average speed of 9½ ft. per second. With the two horse omnibuses it was found that there was an average expenditure of 685 ft. lbs. per horse per second at an average speed of 7½ ft. a second. The total daily work of each horse was about 4,350,000 ft. lbs. With the three-horse 'busses the daily work of a horse was found to be about 3,835,000 ft. lbs., with the same an average speed of 7½ ft. per second.

Equipment Notes.

The Billings & Spencer Company, of Hartford, Conn., has disposed of its interest in the Spencer nail puller to C. M. Spencer, of Windsor, Conn.

The Curtis Electric Manufacturing Company, has closed a contract for the equipment of ten cars with the Electric Traction Company, of Philadelphia.

The Shultz Belting Company, of New York, has gotten out a very handsome and tasteful calendar advertising its Shultz patent sable rawhide belting. This calendar is handsomely lithographed in colors, and would make an ornament to any office wall.

The Complete Electric Construction Company, of New York, has opened a Western office at 1,401 Monadnock, Chicago, and placed Clift Wise in charge. Mr. Wise is well known to the electrical men, and is meeting with a cordial welcome in Chicago and the West.

J. A. Hanna, Eastern manager of the McGuire Manufacturing Company, has opened an office at 1050 Drexel Building, Philadelphia. Mr. Hanna is well known in the street railway field, and he writes us that he would be pleased to have all his friends call at his new quarters.

The Eastern Electric Cable Company, of Boston, has recently declared its quarterly dividend of 2 per cent. This company has no difficulty in obtaining orders, and we understand has made arrangements for handling promptly the large influx of business expected in 1894.

The Simplex Electrical Company, of Boston, has moved from 620 Atlantic Avenue to handsome and commodious quarters at 75 to 81 Cornhill. Mr. Mason, the manager of the company, will be very glad to welcome any visitors interested in street railway appliances at this new office.

William Sellers & Company, incorporated, of Philadelphia, are building a fifty ton traveling crane for the Cataract Construction Company, of Niagara Falls, N. Y. Some very interesting particulars in regard to this crane are published in a recent issue of the London *Engineering*.

Stern & Silverman, of 707 Arch Street, Philadelphia, Pa., have been appointed agents for the Ball & Wood engines in Philadelphia. This firm is doing a large business, and was one of the contractors, as mentioned in our last issue, for the overhead work of the Philadelphia Traction Company.

Currier, Mayo & Company, of Boston, have succeeded J. A. Grant & Company as New England representatives of McIntosh, Seymour & Company, of Auburn, N. Y., whose engines are well known. These manufacturers report business as improving, and that the prospects are excellent for the coming year.

The Safety Car Heating & Lighting Company, of New York City, has lately equipped 103 cars for the North Chicago Street Railway Company, which are giving excellent satisfaction. It is the intention of the North Chicago Company to equip its entire road, consisting of about 900 cars, with this system in the near future.

The Goubert Manufacturing Company, of New York City, reports a good business in its improved feedwater heaters, the sales for 1893 being over 100,000 H. P. This company is also the sole manufacturer of the popular Stratton steam separator, the sales of which during 1893 were nearly double those in former years.

The Euphrat Life Saving Car Fender Company, of New York, has moved its New York office to Room 254, 29 Broadway, New York. George W. Lockwood, the general manager of the company, reports an increasing interest being felt in this fender which seems to answer all the requirements of a life guard for cable and electric cars.

The Fiberite Company, of Mechanicville, N. Y., is meeting with the usual demand for its appliances. This company is sole manufacturer of fiberite interior electric wire ducts and fiberite street railway line insulators. The value of the fiberite compound has been demonstrated by continued use, and its popularity is constantly increasing.

A. Groetzinger & Sons, of Allegheny, Pa., have prepared for their friends and customers a neat little souvenir of the new year, consisting of a handsome paper weight. This is not only useful but ornamental, and is a decided addition to a desk, reminding the user at the same time of the excellent Dermaglutine gears and pinions manufactured by this well known firm.

The New Process Raw Hide Company, of Syracuse, N. Y., held its annual meeting January 9, and the following directors and officers were chosen: Directors. T. W. Meachem, ex-Mayor W. B. Kirk, Emil Laass, Mayor Jacob Amos, C. H. Duell, C. L. Stone, A. C. Vosburgh. Officers: President, T. W. Meachem; vice-presinent, Hon. W. B. Kirk; secretary and treasurer, A. C. Vosburgh.

E. F. DeWitt & Company, of Lansingburgh, N. Y., are meeting with a very favorable reception for their sand box. This appliance has been installed on a number of roads, and is giving good results in a large number of the principal cities in the East. One of the latest orders received by Mr. DeWitt is one for Bangor, Pa. The cars for this road are described elsewhere in this issue.

The Ellis Car Company, of Amesbury, Mass., builder of street railway cars, all sizes and styles, for summer or winter service, writes us that it has the following cars in stock that it can finish out and ship at short notice: Five nine bench, open car bodies with closed ends, ten ten bench, open car bodies with closed ends, five sixteen foot box car bodies, ten nineteen foot box car bodies and one twenty-five foot box car body.

The Frost Veneer Seating Company, of New York, has no trouble in retaining the wide popularity which its veneers enjoy. These are used extensively for car seats, ceilings and settees, and are found most desirable for this purpose. The chief claims of advantages made are, that it is much easier to keep clean, more durable and desirable. This company received the first premium on veneers at the World's Fair.

Wm. T. Dulaney, of New York, has been granted permission by the Board of Aldermen, of Brooklyn, to excavate one mile of streets within the limits of that city to lay a conduit and wires on a new system. Models are being prepared for the railroad commission and Mr. Dulaney is to appear before that body and to explain definitely his method, for the purpose of receiving its consent to operate street railway cars in the principal cities of the state.

Best, Fox & Company, of Pittsburgh, Pa., who installed the pipe work at the power station of the Worcester Traction Company, of Worcester, Mass., also performed all the installation of piping at the power station of the Philadelphia Traction Company at 15th and Mt. Vernon Streets, Philadelphia, including the steam exhaust and water piping. This firm does a large business, and its works at 25th and Railroad Streets, Pittsburgh, cover a considerable territory.

George Westinghouse, Jr., of Pittsburgh, Pa., has acquired absolute control of the Westinghouse Machine Company, one of the most profitable of the several Pittsburgh corporations comprising the Westinghouse industries, by purchasing outright Ralph Bagaley's stock in the company. Mr. Westinghouse's holdings now amount to nine-tenths of the company's stock. Ralph Bagaley has been identified with the company since its organization in an official capacity as treasurer and general manager.

Eugene Munsell & Company, of New York, dealers in mica for electrical purposes, are having a large demand for sheet mica. This is manufactured and sold in segments of the proper form for immediate use for repairing the following armatures: Thomson-Houston types, F. 20, F. 30; W. P. 30, W. P. 50, and for Westinghouse No. 3, and for street car rheostats. This firm also supplies all grades of sheet mica cut in assorted sizes, for electrical purposes, and will be glad to send samples upon application.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., has made its first shipment to the Philadelphia Traction Company,

of 100 wheel guard fender boards. This company will ship about 200 more about a month hence, until all cars are equipped. The Citizens' Street Railway Company, of Indianapolis, and the Pittsburgh & Birmingham Street Railway Company, of Pittsburgh, have ordered all of their cars equipped with the Crawford pick-up fenders. The first consignment will be shipped in February.

Wm. Hazelton, 3d, has secured rooms on the thirteenth floor of the Havemeyer Building, New York, where he would be glad to see his many friends in the street railway business. Mr. Hazelton has recently been appointed Eastern sales agent of the Fulton Truck & Foundry Company, of Cleveland, O., and anticipates a large demand in the East for the new appliances of this concern. Mr. Hazelton, who is also American representative for the Arbel wheels, of France, reports an increased interest in these wheels on the part of the American street railway public.

J. W. Parker & Company, of Philadelphia, agents of the Ball Engine Company, have now assumed charge also of the business of that company in New York City and its territory. This firm will establish a New York department, with a resident sales agent, but both offices will be under the direct management of J. W. Parker. The business will be known as J. W. Parker & Company, of New York and Philadelphia, general Eastern agents for the Ball Engine Company, and contractors in general for complete electric railway and lighting steam power plants. No change will be made in the location of the offices in either city.

The Baltimore Car Wheel Company, of Baltimore, Md., has issued a striking advertisement of its "Lord Baltimore" truck in the form of a two sheet folder. The covers are printed in gold on black, and the insides show finely finished cuts of two forms of this truck intended for open and closed cars. The back cover contains a description of the principal points of this truck, among which the extra long spring support, eight feet more than the wheel base, on six half elliptic springs and the placing of the brake gear above the axles facilitating removal of the wheels. A number of other points of advantage are also clearly stated.

The Joseph Dixon Crucible Company, of Jersey City, about a year ago issued a pamphlet on lubricating graphite. It embodied an elaborate scientific opinion by Prof. R. H. Thurston on the value of graphite as a lubricant, and much interesting information on the subject from practical men. The pamphlet has had a large circulation, and the company has been enabled to obtain from well known men a vast amount of additional knowledge on the uses of graphite. Another pamphlet, twice the size of the former, will be issued early in February, and a copy will be sent free of charge to all interested in the subject of friction and lubrication.

The Graham Equipment Company, of Boston, Providence, Philadelphia and Chicago, has been incorporated under the laws of the state of Rhode Island, with a capital of $100,000 paid up. The officers are J. H. Graham, president; G. S. A. Gardiner, vice-president and treasurer; E. G. Rogers, secretary. The main offices of the company are at 258 Washington Street, Boston, and 232 Carter Street, Philadelphia. Works have been established in Boston and Philadelphia, and orders have already been secured, which it is said will pay 10 per cent. on the capital stock. One concern alone, which is equipping four street railway lines, has given an order for 200 trucks.

Albert & J. M. Anderson, of Boston, Mass., send us a handsomely gotten up four page circular containing their New Year's greeting to their patrons. This circular is handsomely printed, and contains cuts and descriptions of their "Ætna" insulating materials and "Ajax" specialties, and their celebrated Boston trolley and steel trolley poles. It also reproduces a letter from the consulting engineer of the Brooklyn City and West End Street Railway companies endorsing their Brooklyn strain insulator, and gives the results of some very satisfactory tests of the strength and resistance of this insulator, recently made by the Massachusetts Electrical Engineering Company.

The Consolidated Car Heating Company, of Albany, N. Y., at a meeting held January 9, 1894, declared its regular semi-annual dividend of 3 per cent. payable February 15, 1894; transfer books to close from February 1 to February 16. The affairs of the company were reported in a prosperous condition. The company writes us that it has begun suit in the United States Circuit Court against the Chicago & West Michigan Railway for infringement of the Sewall coupler patents. The infringement consists of using an imitation of the Sewall steam coupler recently put upon the market. Such railway is the first to continue the use of the imitation coupler after proper notification, and the Consolidated Car Heating Company at once determined to take action to protect the patents issued to D. D. and J. H. Sewall.

The Hughes & Rigby Engineering Company, Limited, of Baltimore, Md., agent for the Siemens & Halske Electric Company, of America, writes that it is now building a road from Boonsboro to Keedysville, Md., for which it is under contract with the South Mountain Railway & Electric Light & Power Company. This is an electric road, three miles long, four feet eight and a half inches gauge, fifty-eight pound T rail. The equipment will be three motors, six trailers. The Siemens & Halske electric apparatus and the Stirling boilers will be used. The president is George W. Jacobs, Jr.; secretary, Geo. A. Davis, and treasurer, C. E. Shafer. This company also has contracts to build an electric road from Frederick to Middletown, and one from Middletown to Myersville, Md. The prospects for business for the coming year, the managers write us, are most favorable.

The Berlin Iron Bridge Company, of East Berlin, Conn., is, as usual, doing a great deal of work in building construction. We learn that the new works of the Stanley Electric Manufacturing Company, at Pittsfield, Mass., will be entirely of iron, designed and built by this company, and that it is also putting the roof on a building for the United States Government, at Fort Wadsworth, N. Y. This building is 41 × 231 ft., the roof being made entirely of iron, iron trusses covered with corrugated iron. This company has also received the contract for an iron roof for the boiler and engine room of DeLand & Company, at Fairport, N. Y. This roof will be covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron. The Citizens' Gas Company, of Brooklyn, N. Y., has also placed the order for an iron roof for its new producer house with the Berlin Iron Bridge Company. This building is 69 × 151 ft., with an iron roof covered with slate.

The General Electric Company, of New York and Schenectady, has secured a large slice of the street railway car equipment contracts awarded during the last ten days in Philadelphia. Of 250 contracted for the People's Traction Company 125 equipments with the G E. 800 motors and type K. controllers were purchased from the General Electric Company, while the remaining 125 were allotted to the Sperry Company, of Cleveland. Of eighty equipments required by the Electric Traction Company, of Philadelphia, seventy will be furnished by the General Electric Company. The People's Traction Company had already contracted for three of the great 1,500 K. W., General Electric generators. The General Electric Company has also secured contracts during the past week covering twenty car equipments for the Union Railroad Company, of New York; twenty-five car equipments for the Steinway Railroad, of Long Island; one 700 H. P. generator for the Steinway Railroad, of Long Island; eight M. P., 300 K. W. generators for Cincinnati, O., and ten car equipments for St. Louis, Mo.

The Campbell & Zell Company, of Baltimore, Md., finds that there is a good demand for the Zell improved water tube safety boilers, in spite of the general depression in trade. A view of the boiler house of the Eutaw Street power station, Baltimore, is shown on another page of this issue, with a view of the boilers supplied by the Campbell & Zell Company. Other orders recently received by this company are the following: Keiffer Brothers, New Orleans, La., 50 H. P.; Wm. Henderson, 317 H. P.; Citizens' Street Railway, Indianapolis, Ind., 1,500 H. P.; Val Blatz Brewing Company, Milwaukee, Wis., 1,164 H. P. The Zell boiler claims absolute safety from destructive explosion, rapid generation of steam and economy of maintenance and operation. There are no upright tubes in the path of the hot gas, at the rear end, through which the water circulation must be maintained upwards in a direction opposite to that naturally taken by the steam. The water drums are placed parallel to the incline of the water tubes. The steam, after disengaging itself from the water at the upper end of the water drums, passes into superheating tubes—a feature peculiar to the Zell—where any entrained water is evaporated, then passes to a steam drum supported at each end by a water leg connecting with the water drums, but well out of the path of the hot gases.

E. H. Wilson & Company, of Philadelphia, call our attention to the fact that in the description published last month of the equipment of the Philadelphia Traction Company, of Philadelphia, no mention was made that a number of Lamokin cars are used by this company. The Lamokin cars are giving very excellent results, and are very handsome and tasteful in design and finish. This company has also closed an order with the People's Traction Company, of Philadelphia, for forty ten-seat, open car bodies, and with the Concord Street Railroad, of Concord, N. H., two "Columbian" open cars, being duplicates of the open car at the Chicago Exposition in general style. Another recent order is with the Delaware County & Philadelphia Electric Railway Company of Philadelphia, for twenty-four closed cars, twenty-five foot six inch bodies, mounted upon McGuire adjustable trucks, cushion steel wheels. The company is receiving many inquiries from all over the country asking for prices and deliveries on its Columbian open and closed vestibuled cars such as exhibited at the Chicago Exposition, these being its latest styles of cars. The company is now delivering eight vestibuled cars to the Schuylkill Traction Company, and the balance of an order for the Gloucester, Woodbury & Camden Railway. It is also delivering to the East Harrisburg Railway Company some double truck, twenty-five foot cars, and has just delivered to the Springfield Street Railway Company, of Ohio, two of an order for four sixteen foot, vestibuled cars.

The Standard Paint Company, of New York, reports that notwithstanding the general financial depression of the past year, its business, electrically, especially with the electric street railroads, has been remarkably good. This company has received some very large orders from many of the best known street railroads in the United States for P. & B. compound, paint and motor curtain cloth. The latter material has taken especially well with the street railroads everywhere. Some time ago the company sent out samples to every electric road in the United States, and it received more returns from them than from any lot of samples ever sent out. The use of the P. & B. paint in Philadelphia, for covering rail bonds was mentioned last month. Although the outlook for business in general is not yet what might be termed bright, we understand the company has several good deals on hand for this year, which will largely increase its sales. This company has just completed arrangements with the Metropolitan Electric Company, 186 and 188 Fifth Avenue, Chicago, to act as its general Western agents for P. & B. electrical compound, armature and field coil varnish and P. & B. tape. The Metropolitan Company has placed with this company an order for a stock of products, which it intends to push extensively throughout the West, and will at all times carry a large supply of P. & B. goods on hand. The Metropolitan Company, through its president, Wm. H. McKinlock, is so well known to the trade everywhere in the West, that it is believed this arrangement will be of great benefit not only to the Standard Paint Company, but to the

trade in general. The Standard Paint Company has also re-opened its Chicago office at 871 The Rookery, which will be in charge of William Weierbach, who has been one of the company's Eastern representatives for the last seven years, and is, therefore, thoroughly acquainted with all of its goods.

WESTERN NOTES.

The Shultz Belting Company, of St. Louis, Mo., has just received an order from England for 2,800 ft. of belting, and an order from Russia for 15,000 ft. of belting. This company also writes us that trade is looking up and orders are coming in freely, and the outlook for business is fair.

The Chicago Electric Truck Company, of Chicago, has moved its office to room 1,436, Monadnock Building, that city. The No. A truck of this company, described elsewhere in this issue, is meeting with a large sale, and seems to be well adapted for the work for which it was designed.

The Star Electric Lamp Company, of Chicago, manufacturer of the Sunbeam lamp has changed its name to the Sunbeam Lamp Manufacturing Company. The policy of this company is to furnish lamps superior in quality. Recently some discoveries have been made, as the result of the extensive experiments this company has carried on, which are claimed to greatly improve the quality and add to the value of its lamp.

The Brownell Car Company, of St. Louis, is sending some very fine cars to the Cincinnati, Newport & Covington Street Railway Company, of Covington, Ky. They are models of the car builders' art, and are very similar in design and model to the beautiful car the car company exhibited in the Transportation Building at the World's Columbian Exposition. This is the third order the car company has received from the railway for cars of this style.

The Western Advertising Company, of St. Louis, has recently taken possession of its new offices, 316 Union Trust Building, that city, and is making a specialty of street car advertising. The company now has exclusive contracts for advertising in the street cars of St. Louis and Louisville, Ky. W. S. Hill is the general manager, and will be glad to negotiate at any time with parties who desire to avail themselves of the great advantage of advertising in street cars.

The Steel Motor Company, of Cleveland, O., is, as usual, well supplied with orders. Among the equipments now on its books are twenty street railway equipments for use in Cleveland, and three for Allentown, Pa. The company also started work on 100 controllers, thirty of which are nearly finished. The president of the Steel Motor Company is A. L. Johnson; vice-president and general manager, Samuel Harris, well known from his early work in the electric street railway field.

The St. Louis Register Company, of St. Louis, Mo., has moved its office from the Houser Building to 217 North 3d Street, that city. This company has recently secured the contract for the equipment of all the new cars of the Philadelphia Traction Company with its register. This contract was secured after long investigation of the merits of the different registers manufactured, on the part of the Philadelphia Traction Company, and the St. Louis Register Company is to be congratulated upon having secured the contract.

The Star Electric Lamp Company, of Chicago, manufacturer of the new Sunbeam incandescent lamp, with luminous vapor, claims that this lamp has two great advantages which commend its use on electric street railways. First, the lamp can be overrun without in any way injuring its quality, and, secondly, the luminous vapor checks rapid vibration of the filament, giving it all the advantages of the anchored filament lamp without its disadvantages. In all other respects these lamps are claimed to be superior to either the vacuum or gas lamps.

The Stanwood Manufacturing Company, of Chicago, Ill., describes its well known types of car steps in a recent catalogue published by the company. The catalogue is illustrated by a number of handsome engravings of the steps, diagrams giving measurements, etc. The Stanwood steps, as is well known, consist of steel strips for the step tread in a frame now made of rolled steel in place of malleable iron. The hangers, which were also made of malleable iron, are now now made of pressed steel with double flanges. The addition of a straight strip of steel extending through the center and the entire length of the step tread prevents sagging. The step is used on 468 roads.

The Metropolitan Electric Company, of Chicago, Ill., has been transacting its business heretofore under disadvantages on account of the necessary separation of the sales and ware rooms from its offices, owing to leases existing when this company bought out the Enterprise Electric Company, which are satisfied. The company has leased a new store and ware rooms that will accommodate these interests and give it more direct supervision over its affairs, with the additional advantage of increased space which will permit it to carry larger stocks of staple articles and exhibit specialties, insuring customers more prompt attention than ever before. The new address of the company is at 186–188 Fifth Avenue, Chicago.

The Bass Foundry & Machine Works, of Fort Wayne, Ind., are having excellent success with their car wheels, and many street railway companies speak in the highest terms in their favor. A sample of letters which they often receive is that written by Jas. P. McQuaide, president of the Norristown, Bridgeport & Conshohocken Traction Company, a customer of the Bass Foundry & Machine Works, who writes as follows: "We have run five cars equipped with your wheels more than 20,000 miles. We have five grade crossings and old style horse railroad wheels, which show absolutely no wear. We would recommend them for every and any condition. We will use them for all new cars no matter what the cost. Take your friends to Norristown to see our cars." Other users speak in equally high terms of the wheels.

Sargent & Lundy, Western agent for McIntosh, Seymour & Company, of Auburn, N. Y., has just installed a 215 H. P., compound, condensing engine for driving dynamos in the power station of the Belle City Street Railway Company, Racine, Wis. The engine was put into operation eighteen days after the receipt of the order. Taking into consideration the distance of the factory from Racine, and the fact that special castings had to be made and alterations effected to suit specifications, this may be regarded as a great triumph for the company, illustrating both the promptness of Sargent & Lundy, and also of McIntosh & Seymour, in filling the order. This firm has lately moved into elegant offices at No. 13 on the ground floor of the Monadnock Block.

The Charles Munson Belting Company, of Chicago, has no difficulty in finding a ready market for its oak tanned leather belting. The "eagle" trade mark of this company is generally recognized as a guarantee of good quality of material. Every belt that this company manufactures is guaranteed to be short lap; that is, there is no piece of more than four feet two inches in length including the lap. The managers of this company advise every purchaser to examine his belt very carefully and see that there is no piece of leather longer than four feet two inches in the entire length of the belting that they receive. There is a large difference in the quality of the goods, after striking the four foot two inch line on the hide. The Munson Company writes us that it would be glad to give any who inquire, full information regarding short lap belting and its advantages.

The Link Belt Engineering Company, of Chicago, Philadelphia and New York, has recently issued a neat little pamphlet describing Holmes fibre graphite for bearings, of which it has recently taken the general sales agency. The fibre graphite is made in the form of bushings to be readily fitted to hangers, pillow blocks, etc., in the same manner as babbit metal linings. This material runs absolutely without oil and will wear indefinitely. They also include dimensions and prices of a line of countershaft and plain hangers, floor stands, post hangers, pillow blocks and ball and socket boxes fitted with fibre graphite bearings and a line of cylindrical fibre graphite bushings of all sizes and dimensions adapted to be fitted to existing bearings. They also illustrate dynamo and motor brushes, fan boxes, cable road sheave and pulley bearings and a number of other specialties fitted with bearings of this compound. This material is highly recommended for bearings running at any speed, at a pressure up to fifty pounds per square inch.

The Cushion Car Wheel Company, of Indianapolis, Ind., sends us a catalogue and descriptive pamphlet of its cushion car wheels which are applicable to steam, elevated and street railway use. These wheels have a cast iron center and a heavy steel tire. The cushion is in the form of a ring, of dense combination of rubber placed between the tire and the center which are held together by rivets which fit the holes in the center closely, but have enough play in the holes in the tire to allow for the cushioning. This wheel rides easily over rough track, and wears but little on the tire. It is claimed that one of these wheels will outwear five or six ordinary cast iron wheels, with one tire. The new tires may be placed on old centers in any ordinary repair shop. A number of testimonials are published from different street railroad companies expressing great satisfaction with the running and wearing qualities of these wheels, and the excellent traction of the steel tire over the ordinary iron wheels. One set of wheels on the Citizens' Street Railroad Company's lines, in Indianapolis, have made about 50 000 miles, and show only one-sixteenth of an inch wear. Another set in Joliet, Ill., have run 51,000 miles, and show no perceptible wear on the tires.

The Link Belt Machinery Company, of Chicago, Ill., has lately moved into new quarters at 21 to 23 S. Jefferson Street. Here the managers of the company are hard at work fitting up their new offices which include an elegant salesroom. This is large and showy, giving plenty of room to display a large line of samples, and at the same time allow plenty of space to carry a good stock of the company's special machinery, such as shafting, pulleys, hangers, link belt machinery specialties, etc. The object of the company is to carry a good stock in the store, so as to be able to fill all orders promptly. The windows in this salesroom are large and of plate glass, making it very pleasant, and at the same time affording good light to show stock. Eugene J. Pearce will have entire charge of this department, where he will be pleased to meet all those in the market for special machinery. This company reports a very fair trade. It is now equipping the M. H. Purcell Matting Company, of Chicago, with complete power transmitting machinery driven by rope. The pulleys, shafting, hangers are all of this company's own designs. The company has also equipped the Chas. Counselman & Company's new elevator, at South Chicago, complete with power transmission, also a grain elevator for a steam boat of the Graham & Morton Transportation Company, Benton Harbor, Mich.

The Wallace Electric Company, is the title of a new company which has opened offices at 104 Michigan Avenue, Chicago, Ill., and which has been organized for the purpose of conducting a business in electrical goods as manufacturer and manufacturers' agent. This company's line embraces a full equipment of electrical street railway appliances and supplies, and a few carefully selected specialties, as well as lighting supplies. The officers and management of the company are well known to the trade. The general manager, J. B. Wallace, has been actively identified with electrical industries from the earliest experimental stages of electric lighting in this country. Wm. S. Hine, the president, has had a large experience in this business through his con-

nection with the U. S. Electric Lighting Company and the Westinghouse Electric & Manufacturing Company as general district agent. Max. A. Berg, secretary of the company, is well known as the former manager of the street railway department of the Ansonia Electric Company, and M. M. Wood, whose special devices are rapidly becoming the standard for street railway construction, will be the company's electrical engineer in this department. The company writes that it is not an electrical supply dealer, but as a manufacturer and manufacturers' agent, is in a position to sell directly to large consumers and the trade at manufacturers' prices, and without an intervening profit.

The St. Louis Car Company, of 3,023 North Broadway, St. Louis, has its shops well filled with work at the present time. Among its recent orders is one for sixty twenty-four foot closed cars for the Union Depot Railroad Company, of St. Louis. These are to be mounted on Robinson radial trucks. The car company has built over 250 cars for the Union Depot Company up to date. There are also some very handsome closed cars being sent to the Citizens' Street Railway Company, of Indianapolis, Ind. These are twenty feet in length, and are equipped with vestibules. They are painted a very dark red, with gilt lettering. The trucks to be used under these cars are of the St. Louis Car Company's improved type. This truck, in its form just discarded, has met with great favor among the street railway fraternity. The extended spring base was not found long enough in the discarded type, and a new casting has been adopted, so that the elliptic springs can be mounted thereon and prevent the car from pitching. There are other improvements, such as a new method of attaching the fender to the framework of the truck, so that it can be removed when broken and replaced by another, not being in the body of the truck, and thus in breaking not rendering the latter useless. The hangers for the brake shoes are a departure as regards their great strength and method of attachment. The brake mechanism has also been greatly improved upon, and presents no obstruction to the motors. The company is splicing forty-eight foot cars for the St. Louis & Suburban Railway. They will seat fifty-two passengers each, and be models of comfort.

The Walker Manufacturing Company, of Cleveland, O., has progressed quietly but rapidly in its proposal to add an electrical department to its immense plant for the manufacture of street railroad dynamos, motors and other electrical transmission machinery. The first machines to be placed on the market are now nearing completion, and within a short time the company will be in active business in this line of work. It was predicted at the time of the announcement that the Walker people would prove an unusually strong factor in the electrical field, and this prophecy is borne out by the fact that business has already been offered the company, both from Eastern and Western roads. Judging from recent reports, there appears to be no doubt in the minds of those in any way interested, of the immediate and unqualified success of the new machines. To all who have seen them, the general designs are eminently satisfactory, and the rapid progress of the work has called forth the most favorable comments. The closest attention has been paid to mechanical detail. The improvements suggested and already carried out are claimed to be a distinct advance on any existing types of the older companies, in fact, this verdict was rendered only a few days ago, by prominent railway men and future purchasers who visited the company's shops to note the progress of the work. One especially noticeable feature is the ease and facility with which the work is being done. There have been no unusual delays in assembling the various parts, and fewer annoyances in construction than generally attend the first output. Among other features, this characteristic of the Walker Company has brought forth the good opinion of experts. The wheel type idea has been followed in the designs for generators, and this plan will prevail throughout. So far it has been impossible to obtain details of construction, as the company's officers are not yet ready to give out specific information.

Wm. Sharpe, of Chicago, who is successor to the business of W. E. Reid & Company, of that city, as agent for the J. H. McEwen Manufacturing Company, of Ridgeway, Pa., writes us that he has just completed an installation of three McEwen automatic, high speed engines, single expansion, direct connected to the Waddell-Entz dynamos, of ninety horse power each, for the Chicago West Side Street Railroad Tunnel Company. These three engines are of the new style McEwen engine, being a radical change for the better from the old style, while maintaining all the good points embraced in the old style. The new style engine has some additional features which undoubtedly place the McEwen engine in the front ranks of center crank, automatic engines. Owing to the very close regulation of the McEwen engine, it is meeting with very great favor in the Chicago market, and has established a good record and a splendid reputation for itself. Among a few installations made in Chicago might be mentioned the three 12 × 14 single cylinder engines at the Windemere Hotel, direct connected to the Waddell-Entz dynamos, and also a late installation made at the LaGrange Light & Water Works station, there being a 16 × 18 at that place. Since Mr. Sharpe has had the agency of this engine he has sold upwards of thirty-five engines, from the smallest, 9 × 10, to a 250 H. P. compound. For street railroad work, the company has had a number of successful installations, which are giving excellent satisfaction, owing to their good regulating qualities and general merits. One of these is at Escanaba, Mich., and is doing very satisfactory work. Another good installation was made at the old Pittsburg coal mine, at Hymera, Ind., which is operating electric lights, mining machinery and an electric locomotive for hauling loaded cars out of the mine. This latter part of the work is very trying on any engine or any generator. The engine hauls twelve cars loaded with coal up a 5 per cent. grade for nearly one mile, without, it is claimed, the flicker of a lamp. The owners of this mine, Messrs. Buchanan Brothers, of the Tacoma Building, Chicago, speak in the highest and most flattering terms of it, and say that its regulation is something wonderful.

List of Street Railway Patents.

ISSUED BY THE U. S. PATENT OFFICE, DECEMBER 5, 1893, TO JANUARY 16, 1894, INCLUSIVE.

Prepared by E. W. Cady, Patent Solicitor, 99 Nassau Street, New York City.

DECEMBER 5, 1893.

RAIL SWEEPER—Henry A. Bruhus, Milwaukee, Wis. No. 509,871.

A street car having brackets depending therefrom and horizontal plates connected therewith, carrying in bearings a lever controlled rock-shaft which supports rotary brushes driven by clutch mechanism and gearing from the car axle.

CAR FENDER—Frederick W. Brown, Cambridge, Mass. No. 509,996.

A vehicle having sockets and provided with a car fender having wheels or the like adapted to run on a track, and also provided with hooks entering said sockets, said hooks having a loose connection with the vehicle whereby the latter can be swayed or tipped laterally without tilting the fender.

CONDUIT ELECTRIC RAILWAY—William R. De Voe, Shreveport, La., assignor of seven-twelfths to C. W. Dawley, Dallas, Texas, and Patrick B. Cash, Shreveport, La. No. 510,061.

Combines with conduit irons forming the sides of the conduit and having elongated slots therein, and insulating material supported in said slot and looped clips secured to said material for supporting the line conductor.

SANDING DEVICE FOR CARS—Herbert H. Hennegin, St. Louis, Mo. No. 510,258.

An improved sanding utensil having a sand releasing device adapted to be vertically reciprocating and simultaneously revolved.

ELECTRICALLY OPERATED RAILWAY SWITCH—Henry L. Falco, Brooklyn, N, Y. No. 510,384.

Combines with a car and an electro-magnetic switch moving mechanism, a contact maker formed of a sliding spring pressed rod, a fixed insulated contact spring, a movable contact spring carried by the rod, a yielding contact levers and contact plates.

DECEMBER 12.

CABLE TRAMWAY—Wm. N. Colam, London, Eng. No. 510,469.

Embraces a switch or rail and slot points, two arms mounted on vertical shafts one on each side of the cableway, the said arms carrying tongues or flanges adapted to engage with a projection on the under side of the slot point to pull the said point over to either side of the slot, levers mounted on the said shafts below the cableway and coupled together by a link to insure their simultaneous action, an arm mounted on one of the said shafts and connected to a bell crank operating lever by a connecting rod, spring stops mounted on the said connecting rod, a vertical shaft carrying at its top end an arm connected to the switch or rail point and an arm mounted on the bottom of this vertical shaft and having a slotted end through which the connecting rod carrying the spring stops passes and is operated by the said spring stops.

ELECTRIC RAILWAY CONDUIT—Wm. R. DeVoe, Shreveport, La. No. 510,634.

An electrical conduit provided with metallic cross ties, having central recesses located above the base of the tie, and a slotted metallic conduit located in the said recesses.

CONDUIT ELECTRIC RAILWAY—John P. Mitchell, San Francisco, Cal. No. 510,647.

Embraces a car and conductor, a vertical trolley standard having a screw threaded cap formed upon its lower end, and a hemispherical deflector slightly above said cap, a cylinder of glass having its upper end screw threaded to engage said cap, a second cap screw threaded upon the lower end of said cylinder and carrying a trolley wheel and wires passing through the cylinder to the lower cap.

AUTOMATIC SAFETY GUARD FOR CARS.—Ira P. Clarke, Alameda, assignor of one-third to John H. Kostar, Oakland, Cal. No. 510,675.

Consists of a frame or receptacle composed of C shaped arms suspended from the truck and movable backward by yielding about their upper ends, with their lower ends forwardly projecting over the roadbed, and connected by a crossbar and rollers journaled on the crossbar, and a backwardly yielding flap suspended from above and in front of the upper portion of the guard frame or receptacle.

CLOSED CONDUIT SYSTEM FOR ELECTRIC RAILWAYS—Robert H. Elliott, Birmingham, Ala. No. 510,850.

Comprises an insulated main conductor running approximately parallel to the track, a series of broken conducting pins having one portion electrically connected to said main conductor, and the other portion nominally insulated from said first portion; a conducting shoe carried by the car and electrically connected to one terminal of the electric motor or motors, a pin projecting from the roadbed and adapted to be struck by said shoe, and a lever connecting said latter pin and said broken pin, and adapted to bring the two portions of the broken pin into electrical connection with each other and with said shoe.

CLEANING DEVICE FOR RAILWAY CONDUITS—John C. Love, Philadelphia, Pa., assignor to the Love Electric Traction Company, Chicago, Ill. No, 511,341.

Comprises a bar attached to the car and extending into the con-

duit through the slot thereof, a brush or scraper pivoted to the bar within the conduit, a link pivoted at one end to the free end of the brush or scraper and having at its other end a pivotal or sliding engagement with the bar, and means for locking said link at either limit of its movement.

DECEMBER 19.

ELEVATED RAILWAY SYSTEMS—Burr F. Barnes, Circleville, O. No. 510,878.

The combination with a car having receiving and delivery doors, means for opening both, a bell crank lever adapted to be engaged and moved by the former, and a rod connecting said lever and the delivery door.

FENDER FOR STREET CARS—William B. Miles, Holyoke, Mass. No. 510,922.

A fender comprising a frame which is connected to the car to swivel horizontally, and pivotally connected to the swivel frame so that it may have an up and down swinging movement. A spring is provided for pressing the fender downward and flanged rollers are placed at the forward lateral extremities of the fender for engaging and running on the car track.

ELECTRIC LOCOMOTIVE—Charles F. Winkler, Troy, N. Y., assignor to the United Columbian Electric Company, of New Jersey. No. 510,947.

A single electric motor provided with two rotary armatures geared respectively with two car axles and with a single field magnet acting upon both of said armatures. The field magnet is formed in two parts flexibly connected together, and in combination with said car axles.

BRUSH HOLDER FOR DYNAMO ELECTRIC MACHINES—Frank E. Averill, Syracuse, N. Y. No. 510,952.

Comprises the combination of a supporting spindle, a brush holder frame loosely mounted on the spindle and having one extremity adapted to support the brush; a fixed arm mounted on the spindle and arranged between the two extremities of the holder frame, and a spring provided having one end connected to the arm and the other to the opposite extremity of the holder frame.

ELECTRIC RAILWAY SWITCH AND CROSSING—William W. Hendrix, Bowling Green, Ky. No. 511,017.

A switch or crossing consisting of stationary blocks connected with the ends of the wire, sliding blocks abutting against the stationary blocks and adapted to be moved by the jaws of the trolley, a coil spring having one end attached to the sliding block and the other to another part of the switch or crossing, the spring being adapted to pull the sliding block back in place when the block is disengaged from the jaws.

ELECTRIC RAILWAY TROLLEY—William W. Hendrix, Bowling Grenn, Ky, No. 511,018.

An attachment for trolleys consisting of two jaws hinged one on each side of the trolley, the upper ends of the jaws having their front edges beveled to the rear, while these upper ends are adapted to overlap the wire; suitable springs are provided for connecting the jaws above their hinged point.

ELECTRIC RAILWAY TROLLEY—William W. Hendrix, Bowling Green, Ky. No. 511,019.

An overhead trolley having its lower end pivoted in a swiveled boot, the trolley pole having bearing against its under side, one end of the coiled spring, the coils of the spring passing around the pivot and the other end of the spring bearing against the bottom of the boot.

STREET RAILWAY TRACK—William C. Wood, Brooklyn, N. Y., assignor to the Lewis & Fowler Girder Rail Company, same place. No. 511,068.

In street railway track comprising box rails and clamp chairs, a tongue switch composed principally of a casting approximately H shaped in general cross section, and provided at top with a laterally swinging tongue, and at bottom with an internal boss integral with its horizontal web to co-act with the pivot of said tongue, and with external clamp engaging flanges.

METAL RAILWAY TIE—Hippolyte A. De Raismes, Elizabeth, N. J. No. 511,072.

Consists of the combination with a metallic railway tie formed with end loops and provided with slots, of a chair formed with rail engaging flanges and with other flanges adapted to enter the slots in the metallic tie; locking keys are also provided.

SIGNAL FOR CABLE RAILWAYS—Joseph Sachs, New York. No. 511,163.

The combination with a vehicle and a cable for moving the same, of signal boxes adjacent to the cable, an electric circuit connecting the signal boxes with the central station and devices that can be actuated from either end of the car for operating the signal boxes by the movement of the cable and car.

RAIL SHOE AND BRACE—Andrew B. Snider and William H. Roberts, Bartholow's, Md. No. 511,170.

Consists of a plate having on one side a simple hook-shaped flange on the rail base and having on the other side a shoulder, forming between them a rail seat; spike holes are provided at the edge of the shoulder which opens into the rail seat.

ELECTRICALLY OPERATED RAILWAY SWITCH—Chas. A. Stone, Newton, and Edwin S. Webster, Boston, Mass. No. 511,173.

Comprises a main current conductor, which has sections insulated from direct electrical connection therewith, a connecting loop between the main conductor and each of the sections with a plurality of electromagnets in circuit; differentially adjusted armatures for the magnets; two or more shunt lines from the connecting loops, each having in circuit a circuit closer which is operated by one of the armatures, and a magnet of a railway switch, and a rheostat upon the car adapted to be switched into an electric circuit, in parallel with the motor circuit, for the purpose of operating the railway switch.

ELEVATED RAILWAY—John N. Valley, Jersey City, N. J. No. 511,179.

The supporting posts of this roadway are arranged in pairs inclined toward each other; the girders are adjustable vertically and project beyond the posts to form clamp sections; these clamp sections are attached to the girders both at the outside and the inside of the post.

SANDING DEVICE FOR CARS—James R. Dougherty, St. Joseph. Mo. No. 511,199.

A sand box adapted to revolve independently of its bottom and has bevel gears and shafting and frictional gearing, which when operated by the bell crank lever provided for that purpose, is brought into continuous contact with the car axle. By this means the sand box is operated so as to keep the sand in working order.

BRUSH HOLDER FOR ELECTRIC MOTORS—James J. Robison and Fred. B. Perkins, Toledo, O. No. 511,214.

A brush holder which has a practically rectangular shell, and an arm connected therewith having flanged sides; a lever is pivoted to the end of the arm, and a spiral spring connects the lever with the base of the arm; a transverse bearing is carried at the free end of the lever to bear upon the brush within the shell.

FASTENING FOR RAILROAD RAILS—Leander E. Whipple, New York. No. 511,226.

The combination of a plate adapted to be seated and secured upon the tie and provided with a flange, and clamping plates secured upon the first named plate beneath the flange with their edges in position to engage the foot of the rail.

RAILROAD TIE—Leander E. Whipple, New York. No. 511,227.

In a railroad tie, the combination with the body portion, the two curved plates united at their edges, of a vertical plate applied to the end of the body portion and extending below the same and provided with lips embracing the outer sides of the curved plates.

CLOSED CONDUIT ELECTRIC RAILWAY—William S. Smith, Berkeley, Cal. No. 511,254.

This consists of the combination of an insulated main conductor extending along the roadway, a secondary or working conductor, a branch conductor between the main and secondary conductors, a sealed box surrounding the branching point of the main and branching conductors and a switch or cut-out at both ends of the branch conductor, one inside of the box and one outside thereof.

METALLIC TIE AND FASTENER—Thomas M. Brintnall, Medina, O., assignor of three-fourths to Blake Hendrickson, same place, Rollin S. Giffin, Cleveland, and Howard C. Bradley, Warren, O. No. 511,317.

Comprises a railroad rail fastener for securing one flange of a rail, comprising a channel block, dog spike and a key, the channel block being provided with an upper and a lower gripping jaw and side lugs, and across its back with a lug or bead near its lower end and a groove near its upper end to receive the key; and the dog spike provided with an outwardly extending shoulder and having its lower end reduced in thickness to give it a spring action and formed across its back with a recess near its lower end and a groove near its upper end to receive the key.

DECEMBER 26.

CONDUIT RAILWAY TROLLEY—John C. Love, Chicago, Ill., assignor to the Love Electric Traction Company, same place. No. 511,342.

Embraces an electric conductor and vehicle, a travelling contact device comprising a grooved contact piece or shoe, and means for supporting the same, comprising a main arm adapted to swing in a vertical plane, and consisting of two parts connected by a transversely arranged pivot adapted to allow lateral oscillatory movement in the outer end of the arm, a horizontally arranged arm pivoted to the outer end of the main arm and adapted to swing in a vertical plane and to which the said shoe is connected by a vertical pivot and springs yieldingly sustaining said main and horizontal arms.

TROLLEY FOR CONDUIT RAILWAYS—John C. Love, Chicago, Ill., assignor to the Love Electric Traction Company, same place. No. 511,343.

Comprises a car, slotted conduit and conductor, a traveling contact device embracing a bar extending through the slot of the conductor, a support for said bar mounted on the car, and laterally movable thereon, a vertically movable trolley or contact piece supported on said bar and bodily movable laterally with reference to the part of said bar, and a spring applied to throw said trolley or contact piece upwardly into contact with the said conductor.

TROLLEY BAR CARRIER FOR CARS—John C. Love, Philadelphia, Pa., assignor to the Love Electric Traction Company, Chicago, Ill. No. 511,346.

Embraces a trolley bar carrier capable of lateral movement at both ends, and means for automatically confining the advance end of the carrier when the direction of movement of the car is reversed.

LIFE GUARD FOR STREET CARS—Charles W. Howe, Waltham, Mass. No. 511,428.

Comprises a fender supported in engagement with slideways on the car body, and a lever and rod connection between the fender, the

car truck and the car body, whereby the vibrations of the car body do not affect the position of the fender, relative to the surface over which the car moves, and the fender is maintained in substantial parallelism with such surface.

Life Guard or Fender for Cars—James F. Ingraham, West Peabody, Mass. No. 511,432.

Comprises a swinging guard, consisting of a frame provided with independent, vertically movable bolts or rods, a pivoted or hinged scoop guard, and connections between the swinging guard and scoop guard, whereby when the former encounters an obstruction, it may unhinge or release the latter.

Conduit for Electric Railways—Henry D. Oler, Paterson, N. J. No. 511,452.

Consists of a conduit with wooden blocks fastened in the same the entire length of the conduit, in which blocks is formed a groove extending the length of the conduit, a conductor held in said groove, a part of which conductor is insulated and the remaining part exposed, sliding blocks in the groove, plates hinged in the conduit and connected with the sliding blocks, a wheel passing through the slot of the conduit and adapted to act on the hinged plate, a shaft for said wheel and spring bearing blocks mounted on parts of the car, in which bearing blocks the said shaft is mounted.

Car Fender—George E. Cates and Diederrich Renschenberg, Brooklyn, N. Y. No. 511,586.

Combines with the brake applying mechanism, a semi-circular fender pivotally connected at its rear end to a fixed support beneath the car, springs connecting the fender with the car in advance of its pivotal connection, a bearing located upon the fender in advance of its pivot, and a bearing on the truck which is located lower than the fender bearing, the brake chain extending rearward over such fender bearing and under the truck bearing.

Cable Railway—Charles I. Earll, New York. No. 511,596.

Embraces a grip slot having successive oppositely disposed lateral curves, a pair of cables located below the grip slot, and a cable shifter in position at said curves for shifting the cables from and into the path of the grip.

Cable Railway—Charles I. Earll, New York. No. 511,597.

Embraces a grip slot with successive deflections, a pair of driving cables, a laterally movable cable shifter in position at said deflections and having two sheaves set out of alignment as set forth, for shifting said cables into and out of the path of the grip, and means for actuating the cable shifter to carry the cables transversely of the tracks.

Fender for Street Cars—David Flanders, Watertown, Mass. No. 511,604.

Consists of a tilting two-part frame hinged together and to the car, and means to hold the parts in extended position, a spring adapted to tilt the frame into operative position, a notched bolt secured to the frame, and a locking dog to normally engage said bolt and hold the frame in inoperative position against the action of the spring.

Car Fender—James W. McKinnon, New York, assignor of two-thirds to Sarah B. McLeod and Ann M. Downs, same place. No. 511,640.

Consists of a fender adapted for pivotal or hinged engagement with the car at its rear ends, spring cushions carried by the fender and adapted to be interposed between it and the car, and an adjusting mechanism connected with the forward portion of the fender, whereby it may be raised and lowered.

Street Railway Car—George Moore, Boston, Mass., assignor of one-half to G. Waldon Smith, same place. Reissue No. 11,396.

A car constructed with upright frames of circular form from near the floor on one side of the car to a corresponding point on the opposite side of the car, and movable side sections on the opposite sides of the car, arranged to slide upon said upright frames and to partly pass each other and overlap when in their raised position under the roof of the car.

January 2, 1894.

Railway Frog—Walter C. Meeker, Jersey City, N. J., assignor to the Lewis & Fowler Girder Rail Company, Brooklyn, N. Y. No. 511,784.

A railway frog constructed of two box girder rails, halved together, the web of one of said rails being cut and bent, instead of being entirely cut away, so as to bear against the outside of the web of the other rail, and secured thereto.

Trolley Mechanism for Electrically Propelled Vehicles—Curtis H. Veeder, Lynn, Mass., assignor to the General Electric Company, of New York. No. 511,824.

Combines with a stationary socket, a stationary contact standard concentrically arranged therein, a tubular post rotatable in the socket and carrying a cap to make contact with the standard, a trolley arm pivoted on said post, and insulated electrical connections between the trolley and the cap.

Street Railway Special Work—William C. Wood, Brooklyn. N. Y., assignor to the Lewis & Fowler Girder Rail Company, of same place. No. 511,831.

Combines in a frog or other piece of street railway special work, constructed mainly of box girder rail, a rail continuous at top excepting a shallow intersection notch or notches, an adjoining rail connected with the rail first named at the intersection, a wedge or wedges interposed between the rails within the crotch or crotches, and horizontal bolts uniting wedge and rails.

Trolley Catcher—George E. Gay and John H. Parsons, Augusta, Me. No. 511,941.

Embraces in a trolley rope reel, a fixed shaft, a disk or arm having one or more projections on its side and rigidly attached to said shaft, the reel winding springs, a spring connecting sleeve, a casing or drum adapted to revolve on said shaft, and a dog adapted to engage with the projections on the disk or arm when thrown outward by rapid turning of the reel, in connection with the trolley rope or cord.

Heating and Ventilating Apparatus for Street Railway Cars—Joseph A. Long, Brooklyn, N. Y., assignor to Aaron H. Eastmond, same place. No. 511,961.

Comprises a casing adapted to set beneath the seat of the car and having a lining of asbestos or similar material, and air pipes extending laterally from the same beneath the car seat, a frame having openings and forming the base for the casing, a heater supported by the frame, and having an ashpit below the heater accessible from outside the car, and a fuel hopper and door accessible from within the car.

Cable Grip—Alfred N. Humphreys, Irwin, Pa. No. 512,112.

A grip comprising a frame terminating in a jaw, an arm pivoted to the frame and terminating in a jaw which is opposite the frame jaw, a screw carried by the frame and engaging the jaw, and a coupling bar secured to the frame and provided with coupling heads.

January 9.

Method of Laying Railway Rails in Paved Streets—George C. Warren, Utica, N. Y. No. 512,343.

A T headed rail, a support therefor, a retaining wall parallel with and a little removed from the head of the rail, a concrete grouting resting in whole or in part on the base web of the rail and partially filling the space between the retaining wall and side of the rail, and an elastic mastic resting on the concrete grouting and occupying the space between the side and head of the rail and the retaining wall.

Street Pavement—Bedford P. Thiebaud, Springfield, O. No. 512,568.

A pavement consisting of paving blocks having recesses or incisions, and railway rails provided with flanges or ribs at a point between their tread and base, adapted to enter the said recesses or incisions in the blocks.

Street Pavement—Bedford P. Thiebaud, Springfield, O. No. 512,569.

A pavement consisting of a plurality of blocks having recesses in their adjacent vertical faces, and a separate key insertable into matching recesses, in combination with a railway rail and anchor devices secured adjacent thereto and extending into the recesses of the adjacent blocks.

Car Brake—Harry Thompson, Brooklyn, assignor to himself and John F. Ambros, New York. No. 512,588.

Combines with the brake levers and brakes of a car, a screw of quick pitch capable of being slid without turning, an internally threaded pinion arranged to turn on the screw, but prevented from sliding thereon, a spur wheel and a crank shaft for operating the internally threaded pinion and the brake connections.

January 16.

Life Saving Device For Tramways—Louis Martineau, La Roche, France. No. 512,836.

Comprises clasping arms adapted to be held on the front of a locomotive or car, means for holding the arms normally open, and a yielding releasing device for the holding means.

Cable Car Transfer Device—John T. Schweizer, Wilmington, Del., and Jacob H. Burger, Philadelphia, Pa. No. 512,910.

Comprises in connection with a cable beneath a railway track, passing below a transverse cable, and a chamber beneath the lowermost cable, an endless sprocket chain, idler wheels supporting the chain which is depressed below the transverse cable, mechanism within the chamber driven by one cable and actuating the sprocket chain, and two spaced pivoted arms on the side of the car that may be set to engage the sprocket chain.

Electric Railway Trolley—Walter Van Benthuysen, New Orleans, La. No. 512,923.

Embraces a tubular swinging arm, a sliding jointed rod mounted therein, a trolley wheel carried by the sliding rod, and springs for holding the tubular arm in a central position and for projecting the sliding rod.

Cable Grip—Frank T. Hogg, Brownsville, Pa. No. 513,014.

Consists of hinged jaws, a shaft arranged in one of said jaws, an eccentric formed on said shaft, a wheel attached to one end of said shaft and a pawl pivoted to lock the same, and a suitable means for operating the said wheel, and to attach the grip to the under side of a vehicle.

An Electric Railway Trolley—George W. Mackenzie, Beaver, Pa., assignor of two-thirds to Moses P. Sloan and Thomas C. Sloan, same place. No. 513,023.

A trolley having independent rollers with inclined downwardly converging surfaces. Said rollers having removable wearing surfaces, and are so located as to form a tapering opening between them to receive the trolley wire.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. The Street Railway Publishing Company, Havemeyer Building, New York.

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Jan 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	113	114
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	100	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	100	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	100	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	100	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102	.....
" " " Debenture	1891	200,000	M. & N.	6	1901	112	.....
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	108	111
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	108	111

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Jan. 18. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	1,000,000	Quart.	3	.....	80	90
Union Pass. Ry. Co	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	16¾	17

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry	1882	250,000	J. & J.	6	1912	107	108
" " " cons. mort	1892	500,000	.....	5	.....	109	109½
Union Ry. Co. 1st mort	.....	50,000	M. & N.	6	.....	102	105
City & Sub. Ry. Co. gen. mort	.....	1,500,000	J. & D.	5	1922	103½	104
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	108	109
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	100	100¼
" " "	1891	1,250,000	M. & S.	6	1901	102¼	102½
City Pass. R. R. Co	1891	2,000,000	"	5	1911	110¾	111

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange, Jan. 18. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,400,000	J. & J.	4	1887	76	77
West End Com'n	50	9,085,000	J. & J.	3	1890-1892	47½	48

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Jan. 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co	10	6,000,000	Q.—J.	2	.....	160	.....
Brooklyn Traction Co., pref	100	3,000,000	.....	...	1893	.....	60
" " common	100	6,000,000	.....	...	1893	14	.....
Coney Island & Brooklyn R. R. Co	100	500,000	Oct. 1.	4	.....	.....	155
Long Island Traction Co	100	30,000,000			1893	19	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co	1893	3,000,000	.....	...	.....	.....	.....
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	.....	102
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	.....	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	104	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st	.....	3,000,000	J. & J.	5	July, 1916	108	.....

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Jan. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	0	.....	.....	70
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	7

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 167 Dearborn Street, Chicago, Ill., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	325	326
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	244	244½
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	148¾	149

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	100	.....
Chicago Passenger	1883	400,000	F. & A.	6	1903	102	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" "	.....	1,850,000	M. & N.	4½	1927	96	.....
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100½	.....
West Chicago Street	.....	4,100,000	M. & N.	5	.....	100½	.....
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	100	.....
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	101¾	101½

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Jan. 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,750,000	Q.—J.	5	.....	98⅝	99½
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	100	100¾
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	50	65
" " " Pref.	100	100,000	.....	6	.....	75	85
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	.	.....	18½	20

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1894	100	.....
" "	.....	50,000	J. & J.	7	July, 1895	101¼	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	97½	100
" "	.....	150,000	J. & J.	5	.....	100	103
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	111½	112½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104¼	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	105	109
" " "	.....	300,000	J. & J.	6	Jan. 1914	101	101½
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	.....
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	111	112½

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Jan 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co	100	12,000,000	.....	....	1893	49	51
The Cleveland City Ry. Co	100	8,000,000	.....	....	1893	53	55

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	.05	1910	101	102⅛
" " City " "		2,349,000	.....				

DETROIT STOCKS.—Corrected by Cameron Currie & Co., Bankers and Brokers, 82 Griswold Street, Detroit, Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. Mackintosh & Co., Bankers, Holyoke, Mass. Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	225	250
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	225	250
Northampton Street R. R.....	100	50,000	.....	...	.....	100	125

LOUISVILLE STOCKS AND BONDS.—Corrected by Almstedt Bros. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	84	85
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	32	33

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	96	96½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	112	113
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	112	113
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. Warren & Co., Bankers and Brokers, New Haven, Conn. Jan 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$400,000	J. & J.	4	.....	50	55
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	...	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

Bonds.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Jan., 1894	104	.....
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by George Le Sassier, 174 Common Street, New Orleans, La., Jan. 22. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.....	100	1,200,000	Quart.	1½	1867	125	.....
Crescent City R. Co.....	100	1,150,000	"	1½	.866	96	98½
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	40	43
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	119	124
Orleans R. R. Co.....	50	185,000	"	2	1868	50	60
St. Charles Street R. R. Co..	50	600,000	"	2½	1863	70	75

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	105	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	100½	.....
do do new	1886	40,000	M & N	6	1896	100½	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	114	.....
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
St. Charles Street R. R. Co...	1881	120,000	J & D	6	'92-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by Gordon Strathy & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, Jan, 18. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$2,000,000	M. & N.	4	May, '91.	161½	163

Bonds.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....

NEW YORK STOCKS AND BONDS.—Corrected by James McGovern & Co., 6 Wall St., New York, Dec. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	.....	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	.....	180
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	135	.....
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	135	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	120	125
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4	.....	300	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	.....	67
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	240	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	.....	102
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	.....	215
Third Avenue.....	100	5,000,000	Q.—M.	4	.....	138	140
23d St.....	100	600,000	Q.—F.	2½	.....	.....	300
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	123	.....
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	.....	108
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	100	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	100	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	100	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	90	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	115	.....
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	105	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	.....	.....
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	108	.....
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	.....	65
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	.....	102
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	105	.....
23d St.....	.....	250,000	M. & N.	7	May, 1893	100	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	103

PHILADELPHIA SECURITIES.—Corrected by Huhn & Glendinning, 143 South Fourth st. (Bullitt Building), Philadelphia, Jan. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	265	270
Continental.....	50	1,000,000	J.—J.	6	1873	126	130
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	335	340
Germantown.....	50	1,500,000	Q.—J.	2¼	1858	109	112
Green & Coates.....	50	500,000	Q.—J.	3	1858	120	125
Hestonville.....	50	2,050,000	.....	...	1859	33	38
Lombard & South.....	25	500,000	A.—O.	8	1861	90	90
People's Traction Co.....	50	10,000,000	.....	...	.....	28	29
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	151½	153
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	79	79
Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	93⅝	94
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	221	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	199	210
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	225	225
Union.....	50	1,250,000	J.—J.	9½	1864	195	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	100½	101
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	106¾	107
Baltimore Traction.....	25	5,000,000	.....	1	1889	16⅝	16⅞
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	40	55
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	16	17

Bonds.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	108	109
" " Imp.	1892	1,250,000	M.—S.	6	1901	102⅝	103
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100	101
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	....
BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250.000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 306 Times Bldg., Pittsburgh, Pa., Jan. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	..	.....	19	20
Citizens' Traction R. R. Co.	50	3,000.000	J. & J.	3	.....	58½	59
Pitts. & Birmingham R. R. Co	.....	3,000,000	.....	...	.....	14¾	14⅝
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	55	57
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	17⅝	18
Pittsburgh, Allegheny & Man	.....	3,000,000	.....	1¼	.....	37¼	38
West End R. R. Co.	50	200,000	J. & J.	...	.....	.....	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	..	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	150.000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	.....	3,000,000	.....	...	.....	20¾	21
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O	5	.927	107½	.....
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	104	.....
Pitts. & Birmingham Traction Co.	1892	.....	.....	7	.....	94½	95
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500.000	J. & J.	5	1931	102¾	104
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	98½	100
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1922	100	102
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.. ....	6	1901	..	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incl'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	.	.....
Monongahela Incl'e Plane Co	1887	50,000	A. & O	5	1892	....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS, Bankers, Providence, Jan. 18.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	..	.....
BONDS.	Date of Issue	Amo'nt Out-stand'g	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	..	100
Newport St. Ry. Co..	.....	50,000	.....	5	1910	102½	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Jan. 18.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	24	30
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	40	44
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	20	25
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	23	25
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	.....	80
do do Common.	100	4,000.000	.....	...	1892	13	20
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	.....	90
do do Common.	100	3,000,000	.....	...	1892	20	30
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	35	40
BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	88	95
Buffalo (N.Y.) Ry.	1891	5,000.000	F & A	5	1931	95	99
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	89	90
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	85	90
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	85	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Jan. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	5	....	.....	105
Central R. R. Co.	100	1,000,000	.....	...	.....	.....	.....
Geary St., Park & Ocean R.R.Co	100	1,000,000	.....	1	.....	.....	100
Market Street Cable Co.	.....	.....	.....	...	.....	31	32¾
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	.....	.....
Omnibus Cable Co.	100	2,000,000	Monthly	4	.....	.....	.....
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	..	.....
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House R. R.	.....	650,000	M. & S.	6	1914	95	100
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	117	121
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	.....	115
Powell Street R. R.	.....	700.000	M. & S.	6	1912	.....	118
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	.....	110
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	93½	.....
Cal. St. Cable R. R.	.....	.....	.....	5	.....	100½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., Jan. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	50	60
Citizens'	100	1,500,000	Oct. '93	4	1887	75	85
Jefferson Avenue.	100	112,000	Dec. '88	2	1885	125	150
Lindell	100	2,500,000	.....	...	1890	68	70
Missouri.	100	2,000,000	Q.—J.	2	1891	180	200
People's.	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis.	100	2,000,000	J. & J.	3½	1890	155	160
Fourth Street & Arsenal.	50	150,000	.....	..	1872	5	10
Union Depot	100	4,000,000	.....	...	1890	150	200
St. Louis & Suburban	100	2,500,000	... .	...	1891	25	35
Southern, Pfd.	.....	800,000	.....	...	.....	90	92
" Com.	.....	700,000	.....	...	.....	82	85
BONDS.	Date of Issue	Amount Out-stand ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	96	98
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	102	103
Fourth St. & Arsenal.	1888	50.000	J. & J	6	1898–1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895–1910	98	99
Missouri Cable.	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	100	101
" 2d mort.	1886	75,000	M.& N.	7	1902	100	105
People's Cable.	1889	800,000	J. & J.	6	1889–1914	90	95
St. Louis Cable.	1890	1,500,000	M.& N.	5	1900–1910	100	102
Union Depot.	1890	4,000,000	A & O.	6	1900–1910	104	105
Southern.	1884	200,000	M. & N.	6	1904	100	102
Southern.	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban.	1891	1,400,000	F. & A.	5	1921	95	97
St. Louis & Suburban (Incomes)	1891	300,000	.....	6	.....	70	75

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Jan. 18. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	300	325
Metropolitan R. R.	50	750,000	Q. J.	2	1864	83	96
Columbia R. R.	50	400,000	Q. M.	1	1870	.....	.....
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	.....	33
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	.....	33
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	33
Rock Creek R. R.	100	401,700	.....	...	.....	..	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'ton & Geo'town conv't.	'83–'91	3,000,000	J. & J.	6	1899-1929	135	155
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	....	100
Capitol & North O St. R. R.	1921	240,000	J. & J.	6	1921	.....	90
Metropolitan R. R. convert.	1901	200,000	J. & J.	5	1901	103½	104
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....
				6			

Financial.

CORNELIUS SWEETLAND has been appointed receiver of the Interstate Street Railway Company, of Pawtucket, R. I.

$ $ $

THE earnings of the Cincinnati (O.) Covington & Newport Street Railway for the quarter ending December 31, are given as $52,-113.67.

$ $ $

T. W. WRENNE has been appointed by Judge Lurton, of the United States Circuit Court, receiver of the United Electric Railway, of Nashville, Tenn.

THE consolidation of the Brooklyn (N. Y.) City Railway system and that of the Brooklyn, Queens County & Suburban Railway Company, which includes the Broadway and Jamaica systems was effected January 15.

$ $ $

AT the annual meeting of the stockholders of the Brooklyn City Railway Company, held January 9, S. L. Husted, Jr., was elected director to take the place of Mr. Lyman resigned. The rest of the old Board was re-elected.

$ $ $

THE Massachusetts State Board of Railway Commissioners has granted leave to the Union Street Railway Company, of New Bedford, to issue $350,000 worth of new stock and $350,000 of bonds, authority to do which was recently petitioned for.

$ $ $

THE Buffalo (N. Y.) Railway Company submits the following statement of its operations for November: Gross earnings, 1893, $122,-297.87; 1892, $110,810.85; increase, $11,487.02. Operating expenses, 1893, $72,664.49; 1892, $68,399.68; increase, $4,264.81. Net earnings, 1893, $49,633.38; 1892, $42,411.17; increase, $7,222.21.

$ $ $

THE Columbus (O.) Street Railway Company submits the following statement of its operations for December: Gross earnings, 1893, $43,529.19; 1892, $43,217.39; increase, $311.80. Operating expenses, 1893, $27,384.80; 1892, $29,898.21; decrease, $2,513.41. Net earnings, 1893, $16,144.39; 1892, $13,319.18; increase, $2,825.21.

$ $ $

THE Buffalo (N. Y.) Railway Company submits the following statement of its operations for December: Gross earnings, 1893, $123,634.22; 1892, $114,809.72; increase, $8,824.50. Operating expenses, 1893, $76,541.86; 1892, $73,615.96; increase, $2,925.90. Net earnings, 1893, $47,092.36; 1892, $41,193.76; increase, $5,898.60.

$ $ $

THE Hudson (N. Y.) Electric Railway Company has filed its report with the Railroad Commissioners for the last quarter. The gross earnings from operation were $4,808.69; operating expenses, $2,477.30; net earnings from operation, $2,331.39; net income, $1,479.88. For the corresponding quarter last year the net income was $2,487.57.

$ $ $

THE Pittsburgh (Pa.) & Birmingham Traction Company submits the following comparative statement of its operations for November: Gross earnings, 1893, $23,216.49; 1892, $27,809.46; decrease, $4,592.97. Operating expenses, 1893, $13,666,18: 1892, $14,374.32; decrease, $708.14. Net earnings, 1893, $9,550.31; 1892, $13,435.14; decrease, $3,884.83.

$ $ $

THE following statement shows the operations of the Brooklyn (N. Y.) Traction Company for the month of December: Gross earnings, 1893, $76.945.09; 1892, $58,073.16; increase, $18,871.93. Expenses, 1893, $47,723,78. Net earnings, 1893, $29,221.31. We have no data showing the operating expenses and net earnings for the corresponding month of 1892.

$ $ $

THE Kansas City (Mo.) Cable Railway Company reports for the six months ending December 31, 1893: Gross, $239,992; operating expenses, $157.226; net, $82,765; a decrease of $15,084 as compared with the same period last year; income account for the six months shows balance to credit of surplus of $421 after paying interest on bonds and dividend of 3 per cent. on stock.

$ $ $

THE North Shore Traction Company submits the following statement of its operations for November: Gross earnings, 1893, $81,180.67; 1892, $76,915.46. Increase, $4,265,21. Operating expenses, 1893, $55,-616.79. Net earnings, 1893, $25,563.88. We are unable to give the operating expenses and net earnings for 1892, as the various companies now comprising the system were operated separately.

$ $ $

ON January 20 the Union Trust Company of St Louis, filed suit against the Richmond (Va.) Electric Street Railway Company, asking judgment on the bonds of the company, amounting to $212,000, and asking for the appointment of a receiver to take charge of the road and operate it under the direction of the court. By agreement the present superintendent, A. D. Titsworth, was appointed receiver.

$ $ $

THE North Shore Traction Company reports as the results of its operation for December, 1893, as follows: Gross earnings, 1893, $78,-556.19; 1892, $80,194.44; decrease, $1,638.25. Operating expenses, 1893, $58,786.23. Net earnings, 1893, $19,769.96. We are unable to give the operating expenses and net earnings for 1892, as the various companies now comprising the system were operated separately.

$ $ $

THE annual report of the Portsmouth (Va.) & Port Norfolk Railway for 1893 shows a marked increase over the earnings of 1892, notwithstanding the hard times. The County Fair grounds have been located on the line of road, and a bridge connecting West Norfolk is in immediate prospect. $5,500 worth of stock was recently sold at par, and it is now probable that enough stock and bonds will be sold to convert the motive into electricity.

$ $ $

THERE has arisen a controversy between the tax department of the city of Baltimore and the street railway companies of that city, regarding the taxation of the tracks of the several companies and assessing them as real estate. The city claims that the tracks of the Baltimore Traction Company are assessable and taxable as real estate, and has increased the assessment from $3,500 to $53,800 per mile. The company disputes the claim and declares such method of taxation unjust and oppressive. The courts will decide.

$ $ $

AT the annual meeting of the Frankford & Southwark Railroad Company, of Philadelphia, a brief report was submitted, in which it was stated that from January 1 to July 1, 1893, the last date being the time the road was leased to the Electric Traction Company, 20,882,896 passengers were carried by the lines of the system. There was an increase in receipts from passengers of $31,589.93, and $36,159.63 was added to the construction and equipment account. In regard to the trolley, the report stated that it was believed that this year will see the new system nearly, if not entirely, finished.

$ $ $

THE annual meeting of the Wilkesbarre (Pa.) & Wyoming Valley Traction Company was held last month. Reports of officers show that during 1893 the gross receipts from passenger traffic were $310,927 and other receipts swell the total to $312,190. The operating expenses were $149,240. The total mileage is forty-three and a half miles, of which eleven and an eighth miles were built during the year, and six and a quarter miles reconstructed. The rolling stock consists of eighty-eight car bodies and sixty-six equipments. The average daily receipts for the year were $851.85.

$ $ $

THE annual report of the Toronto (Ont.) Railway Company for the year ending December 31, 1893, shows: Passengers carried in 1892 19,122,022; passengers carried in 1893, 21,215,010; transfers in 1892, 5,592,708; transfers in 1893, 8,477,147; passengers increased in 1893, 2,092,988; transfers increased in 1893, 2,884,439. The earnings were as follows: Gross in 1892, $820,098.48; net, $229,765.23; gross in 1893, $900,232.59; net, $362,635.44.

The gross earnings of 1893 show an increase of 9.7 per cent. over 1892, and the net earnings show an increase of 57.8 per cent. over 1892. Instead of declaring dividends, the company will put the surplus into increasing the number of cars, shops, extension of service and an increase of power.

$ $ $

HORACE E. ANDREWS has been elected president of the Cleveland Electric Railway Company, vice Henry A. Everett, whose increasing duties in connection with his Canadian street railway interests have prevented his giving the time to the Cleveland road which he desired. Mr. Everett was elected vice-president of the Cleveland Electric Railway Company. The other officers elected were: Treasurer, James Parmalee; secretary, R. A. Harman; assistant secretary, L. E. Beilstein; adjuster, H. J. Davies; electrical engineer and purchasing agent, C. W. Wason; general superintendent, John J. Stanley; chairman of board of directors, Tom L. Johnson; chairman executive committee, A. L. Johnson; executive committee, A. L. Johnson, H. A. Everett, H. E. Andrews, C. W. Wason, R. A. Harman.

$ $ $

THE annual meeting of the Portland (Me.) Horse Railroad Company was held January 15. The annual report, which is for the year ending December 31, 1893, includes the following items: Gross passenger earnings $200,016.32; earnings from other sources, $760.50; total gross earnings, $200,777.82. Operating expenses, $169,274.36; taxes, $4,855,32; total, $174,129.68. Net earnings from business, $26,647.14; rents (less additions and repairs), $748,29; total, $27,395.43. Less interest paid, $10,372.81; total, $17,022.62. Dividends, $15,000.00; surplus, $2,022.62.

The total number of passengers carried during the year was 3,659,-126, the traffic for the last six months showing a decrease of 53,234 from a corresponding six months of last year. 676,247 miles have been run, 378,078 by horse and 298,169 by electric cars.

$ $ $

THE annual meeting of the Hestonville, Mantua & Fairmount Railway Company was held January 8. The annual report stated that 6,546,437 passengers were carried during the past year, an increase of 58,000 over the preceding year. The receipts for the past year were $325,126, showing a net increase of $9,000. During the year $42,000 were expended for betterments. The report stated that the company will have arranged its financial plans for trolleying the road within a short time, but it is probable that no outside work will begin before the first of April, except, perhaps, in the construction of the power house on the site of the Race and Vine Streets depot at the Callowhill Street bridge It is thought that the entire system will be trolleyed and in operation by the close of this year. The cost, including the cars, will not, it is estimated, exceed $1,500,000, and about seventy-five cars will be run over the route.

$ $ $

THE Atlanta (Ga.) *Journal* says: "The Atlanta Consolidated Street Railway Company has defaulted in the payment of the interest on its bonded indebtedness. The bonded indebtedness, $1,833,000, is held mostly in Eastern cities. The Old Colony Trust Company, of Boston, is the trustee for the bondholders. The bonds bear interest at the rate of 6 per cent. per annum, payable in January and July. The January coupons were payable January 1. In November last a large number of the bondholders met in Boston to examine a statement of



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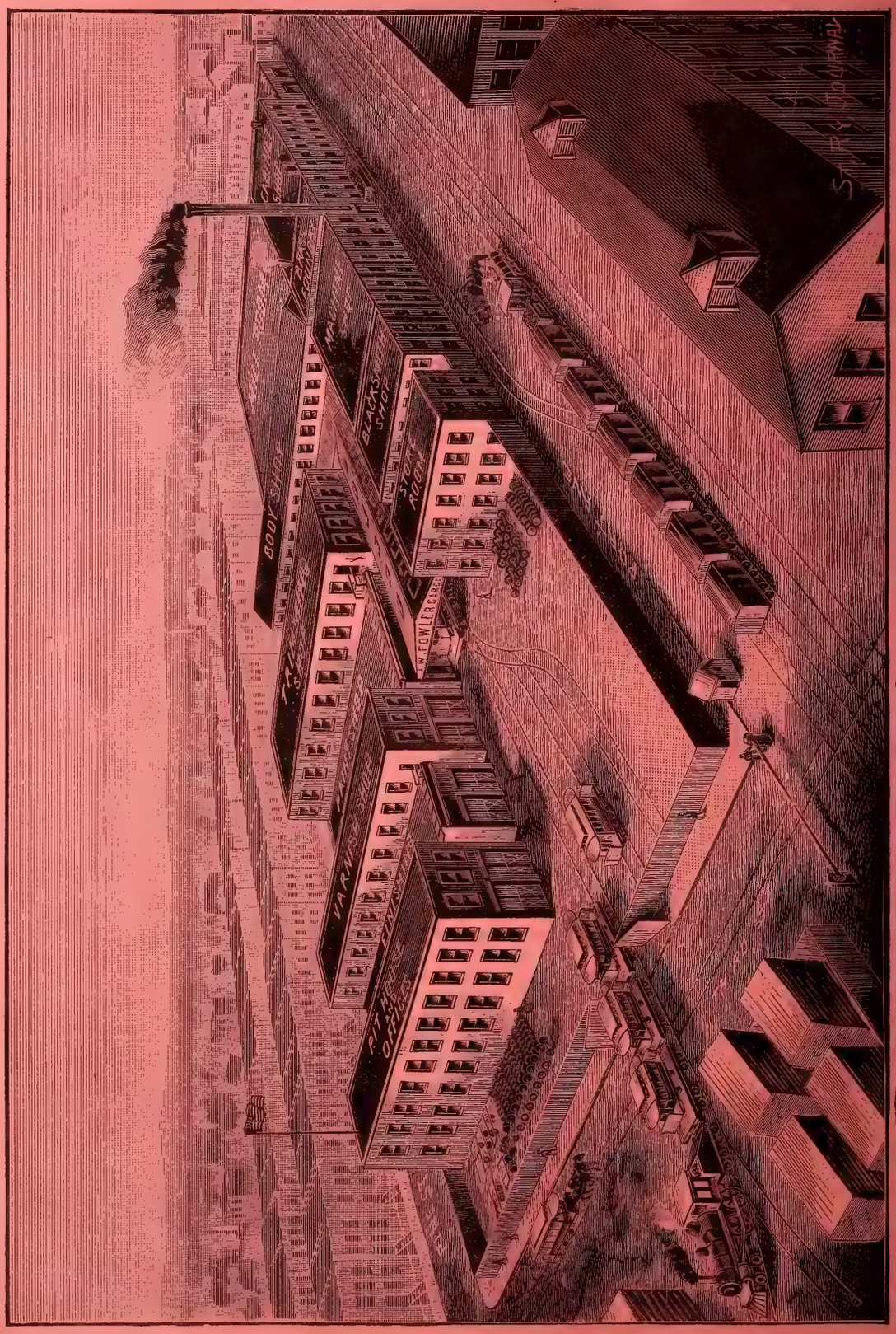
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the financial condition of the company presented by President Hurt. The bondholders prepared an agreement, to be signed by 90 per cent. of the bondholders and shareholders, providing for the cancellation of the entire floating debt, and a reduction of the rate of interest on the bonds. If the shareholders raise money to pay off the floating indebtedness, the bondholders agree to accept 3 per cent. interest on their bonds during 1894 and 1895, and during the balance of the life of the bonds they will accept 5 per cent. The shareholders are to be assessed for the purpose of raising money to liquidate the floating indebtedness, and are to receive for the assessment income bonds. It is said that the holders of about 80 per cent. of the outstanding bonds have agreed to accept this proposition.

$ $ $

THE Scranton (Pa.) Traction Company submits the following statement of its operations for the months of November and December during the last two years:

NOVEMBER.

	1893.	1892.		
Gross Earnings.....	$20,783.15	$16,087.80	Increase	$4,695.35
Operating Expenses..	10,938.31	10,308.80	"	629.51
Net Earnings.....	$9,844.84	$5,779.00	"	$4,065.84

DECEMBER.

	1893.	1892.		
Gross Earnings.....	$22,142.79	$17,491.05	Increase	$4,651.74
Operating Expenses..	11,450.30	11,203.05	"	247.25
Net Earnings.....	$10,692.49	$6,288.00	"	$4,404.49

$ $ $

A COMPARATIVE statement of the net earnings of the City & Suburban Railway, of Baltimore, Md., ended October 31, 1893, and for the corresponding period last year shows an increase this year of $22,147. The statement by months is as follows;

	1892	1893
May.....	$16,564	$14,718
June.....	12,555	15,882
July.....	11,833	15,164
August.....	12,389	14,234
September.....	11,848	16,732
October.....	9,448	20,054

$ $ $

THE annual meeting of the Chicago & South Side Rapid Transit Railroad Company, familiarly known as the Alley L road, was held January 4. W. W. Gurley and Vice-President Hopkins, representing the Chicago City Railway holdings, and Edward L. Lobdell were elected directors. The general manager's report stated that it would be necessary for the company to make extensive repairs of its rolling stock at a cost of $27,750, and eventually it would need more cars, The report said that, after paying interest due January 1 on the $3,000,000 of second section bonds, there would be left in the treasury about $400,000. These bonds were negotiated at about seventy-five cents on the dollar. The general manager's experience as to the cost of operating trains was summed up as follows: The cost of running a five-car train for eight hours is $25; a four-car train, $21.65; a three-car train, $18.30; a two-car train, $12.45; a one-car train, $11. The report concluded with the statement that further extensions of the road were positively essential to its well being.

In the following statement is shown the operations of the road since the company took possession December 16, 1892. The returns are given for fifteen days of December, 1892, and for each month of 1893. The number of passengers carried, income and expenses were as follows:

	Receipts.	*Expenses.*	*Passengers.*
December 16, 1892....	$ 32,684	$ 29,863	653,000
January, 1893.....	52,556	49.705	1,051,000
February.....	52,822	48,810	1.056,000
March.....	63,716	53,969	1,274,000
April	78,049	53,393	1,560,000
May.....	165,224	90,814	3,306,000
June.....	171,733	84,964	3,474,000
July.....	152,130	77,524	3,042,000
August.....	162,047	67,327	3,241,000
September.....	196,592	82,004	3,931,000
October.....	268,811	93,961	5,376,000
November	72,883	56,509	1,457,000
December.....	64,168	57,647	1,283,000
	$1,535,471	$846,495	30,709,000

The following table shows the percentage of earnings to operating expenses each month, and the actual cost of carrying passengers each month:

	Percentage.	*Cost per Passenger.*
December 16, 1892.....	91.2	.0457
January, 1893.....	94.5	.0473
February.....	92.5	.0462
March.....	85.0	.0424
April.....	68.5	.0349
May.....	54.5	.0274
June.....	48.5	.0242
July.....	50.9	.0255
August.....	41.6	.0208
September.....	41.7	.0209
October.....	35.0	.0175
November.....	77.6	.0388
December.....	89.9	.0443
Average.....	55.9	.0276

Mileage Table.

In the comparative tables of cars and miles of road for the years 1892 and 1893 published in our January issue, we find that several typographical errors have crept in, in the 1893 table.

The important ones are as follows: The number of electric cars in Delaware should be 50 instead of 56. Cable cars in Maryland should be 209 instead of 809. Total miles of road in Missouri should be 497 instead of 482, and in Nebraska 218 instead of 208.

The totals need changing in a few instances The corrected totals should read as follows: Miles of horse road, 3,497; horse cars, 16,845; miles of electric road, 7,466; electric cars, 18,233; miles of cable road, 657; cable cars, 4,805; total miles of all roads, 12,187; total number of all cars, 39,499.

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Annual Meeting of the Swan Lamp Company.

The annual meeting of the stockholders of the Swan Lamp Manufacturing Company was held at its offices in Cleveland, O., on January 16. The following officers and directors were elected: S. M. Hamill, president and general manager; B. F. Miles, vice-president and treasurer; S. E. Cox, secretary and superintendent; E. P. Roberts, electrician. The directors elected were: W. H. Lawrence, B. F. Miles, L. H. Rogers, Webb C. Hayes, S. M. Hamill.

Florida Winters.

The "Clyde Line" is the only line making the trip between New York and Jacksonville without change. Six beautiful, fast steamships, the "Algonquin," "Iroquois," "Cherokee," "Seminole," "Yemassee" and "Delaware" are assigned to this service, and they leave Pier 29, East River, Mondays, Wednesdays and Fridays at 3 P. M. By this line all the dust and annoyances incidental to railroad travel are avoided. A pleasant feature of the trip is the stopping at Charleston, S. C., for half a day. The visit to this "Venice of America" is certain to be amply repaid. The steamships have the most complete modern fittings and accommodations, including elctric light, call bells and elaborate aloons and cabins.

Write the "Clyde Line" for one of their "Facts About Florida," as they take pleasure in furnishing them free of charge.

Of Interest to Travelers.

The Baltimore & Ohio Railroad announces that it has placed on sale round trip tickets at reduced rates to the winter resorts in Florida and the South, and also to such points of interest as Luray, Natural Bridge and Gettysburg. This company has also arranged to place on sale excursion tickets to San Francisco and other points in California, on account of the Mid-Winter Fair, at unusually low rates. Excursion tickets are now on sale to Baltimore and Washington via the famous Royal Blue line.

With its vestibuled train service, via Washington, to Cincinnati, St. Louis and Chicago, the Baltimore & Ohio is in the best of condition to handle Western and Southern travel. That the line is a popular one, is attested by the immense World's Fair business handled this summer.

Those contemplating a trip West or South this winter should write to C. P. Craig, general Eastern passenger agent, 415 Broadway, New York, for rates and other information.

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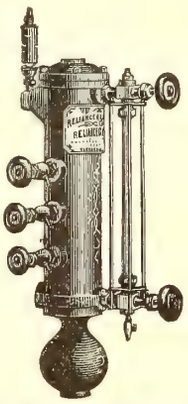
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Lynn & Boston Railroad.....Chelsea, Mass.
Northampton Street Ry. Co...Northampton, Mass.
Steinway Railway Co.....Long Island City, N. Y.
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THE STREET RAILWAY JOURNAL

Vol. X. *NEW YORK & CHICAGO, MARCH.* *No. 3.*

The Trolley Cars in Bremen.

Among the progressive communities of Northern Germany, the flourishing city of Bremen, with its white houses and well kept streets, was one of the earliest to adopt electric traction. The steady horse car had for many years carried the staid burgers of the old Hanse City by the Weser, along its narrow, picturesque streets, crowded with historical memories, when to be a city of the principal Hanseatic League meant almost to be a republic. But the expansion of the town by the growing trade of the world, a goodly part of which has chosen Bremen as its inlet to the vast markets of the North German territories, determined a beneficial change in transportation methods, and electricity has been chosen to replace the horse on its street railway system.

The noble Rathhaus of Bremen, with its statues of seven electors and one emperor of the Holy Roman Empire, and the Rolandsäule, erected in 1412, probably look down with surprise from their position on the Marktplatz, upon the swift moving trolley cars, the most modern method of transportation. It was in 1891 that the Bremen Strassenbahn Gesellschaft began seriously to consider the question of changing its system of traction. After considerable discussion, the Bremen Company finally decided to adopt the Thomson-Houston system as the most practical, and the contract was accordingly awarded to the Union Electricitäts Gesellschaft, of Berlin. In May, 1892, the road was completed, and the electric cars were doing business.

The length of the line is 6.21 miles, of which 4 miles is laid with single track, and 2.21 miles with double track. The entire system consists of two lines, one running from the Bürgerpark to Freihafen, and the other from Horn to the Hohen Thor, the lines from the railroad station to the corner of the Langen and Kaisers Strassen being common to both systems.

The power station for the generation and supply of current is located on the Schlachthof, near to the line to the Bürgerpark. It is a brick building constructed in three parts, one containing the engine and generator room, the second the boilers, and the third and smallest the coal bins. It covers 4,777 square feet of ground space. The roof of the engine room is of iron, wood and waterproof material; that of the boiler room and coal house is of corrugated iron. A 118 foot smokestack overtops the whole.



FIG. 1.—ELECTRIC CARS PASSING THE MARKET PLACE—BREMEN, GERMANY.

The steam plant consists of two Babcock & Wilcox water tube boilers, furnishing steam through jacketed pipes brought through the wall of the engine room to three McIntosh & Seymour high speed engines. To these are directly belted three standard 100 K. W. Thomson-Houston multipolar generators. In addition, there are two smaller engines driving two Thomson-Houston arc light dynamos, and furnishing current to the lamps in the Bürgerpark 500 yds. away.

The track is substantial and solid, laid down with that thoroughness which characterizes continental street management. It is laid in channeled girder rails resting upon longitudinal stringers and cross ties, the whole upon

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a solid concrete foundation. The rails are brought flush with the surface of the street, and are carefully bonded for the return.

On account of the many narrow streets through which the cars have to pass, and the numerous curves and turnouts, the construction of the line is peculiarly striking, and none the less effective on account of its novelty, the electrical cars running, starting and stopping with no more difficulty than the discarded horse cars. The Langenstrasse and the Geeren are, perhaps, the narrowest streets on record along which electric cars have ever traveled. Another remarkable part of the line is that running from the Lögestrasse into the Schüsselkorb, where a curve and a turnout are found together at the corner of two extremely narrow streets.



FIG. 2.—STREET SCENE—BREMEN, GERMANY.

Along these passages between houses—for they seem nothing more—the current is carried on trolley wires suspended by the usual insulating appliances from galvanized iron span wires, which are, on account of circumstances of location, stretched between ornamental suspension devices fastened to the sides of the houses. In the broader streets, the span wires stretch between tall steel poles set on both sides of the road. These, as in that part of the line farther from the Börse, are almost hidden by the trees, and only the slender overhead wires above the track can be seen. The outermost portion of the line, that running into Horn, is carried on ornamental side brackets, which are also to a great extent concealed by the foliage of the trees.

At the Marktplatz all the lines converge. Here the overhead and track construction becomes full of turnouts and switches, and is a fine example of perfect work in that direction.

At the present time the Bremer Strassenbahn Gesellschaft has twenty-five motor cars, eighteen of which are operated on week days and twenty-two on Sundays and holidays. The car bodies of the motor cars are to some extent the same as were used originally in the horse car service, but they have been properly altered and strengthened to meet the modern requirements. Each car is equipped with one of the well known W. P. 30 type of Thomson-Houston motors, motion being communicated to the axle through a single reduction gear, enclosed in a casing and running in oil. Control is secured through rheostatic controllers. The maximum speed in the city

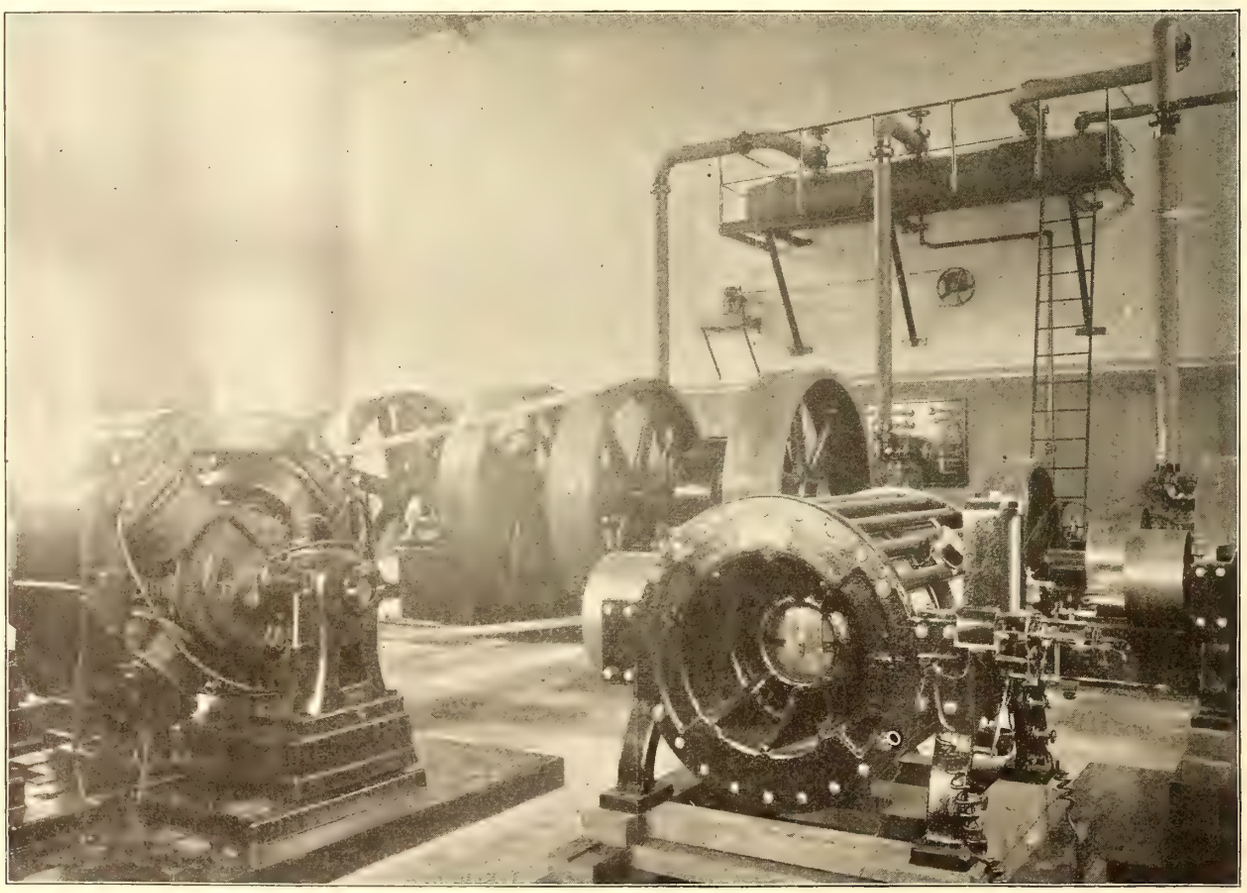


FIG. 3.—INTERIOR OF RAILWAY POWER STATION—BREMEN, GERMANY.

limits has been fixed at from nine to twelve kilometres (5.6 to 7.5 miles) per hour, and on the line nearer Horn, at from twelve to sixteen kilometres (7.5 to 10 miles) per hour. At this speed each motor car is able to draw after it one of the old tin horse cars, as a trailer. The motormen and the conductors are dressed in a semi-military uniform.

A few figures will suffice to show that the public is appreciative of the change. In 1891 the road to Horn was operated by six horse cars, while it is now operated by five electrical cars, the time occupied in the journey remaining the same; yet taking 1891 and 1892 and comparing the incomes, we find that only 71,119.70 marks, were taken in the former year, while in the latter the fares reached 86,950.30 marks, exclusive of extra cars and commutation tickets. This shows an increase in the business of 15,830.60, marks, or 22.2 per cent. by the abandonment of horse traction. The entire expense for the past eight months amounted to 32,284.97 marks, or 36 per cent. of the income. This result was, of course, vastly modified in 1893, as all the lines have since been equipped with electricity, and the station expenses are now distributed over a larger number of cars.

In conclusion, the Bremen road is now an example to continental cities, and, should they follow it, they will find it probably as productive of as excellent results as shown in the foregoing.

THE Cleveland Electric Railway Company intends to carry out the promises made by the East Cleveland Railroad Company, one of the old lines recently consolidated, with regard to the distribution of money prizes to the men working on that line. The amount was $3,000, one-half of which was divided last July. The remainder will be distributed as soon as possible.

THE formal transfer of the property of the West Side Railway Company of Milwaukee, Wis., to the Milwaukee Street Railway Company took place January 29.

The Repair Shops and Car House of the Albany Railway, Albany, N. Y.

The repair shops of the Albany Railway, and the car house for the Troy and Albany division, are located at North Albany, near the corner of Broadway and Erie Street. The buildings were originally the car house and stables of the Watervliet Turnpike & Railroad Company, but since the latter company has come under the management of the Albany Railway, they have been enlarged and adapted to the requirements of the electric system. Fig. 4 shows the exterior of the two buildings, the one at the left being the repair shop. The car house, the front of which is also shown, is 70 × 200 ft. It has seven tracks. Between the rails of four of these tracks steam pipes are arranged, as shown in the interior view, Fig. 1.

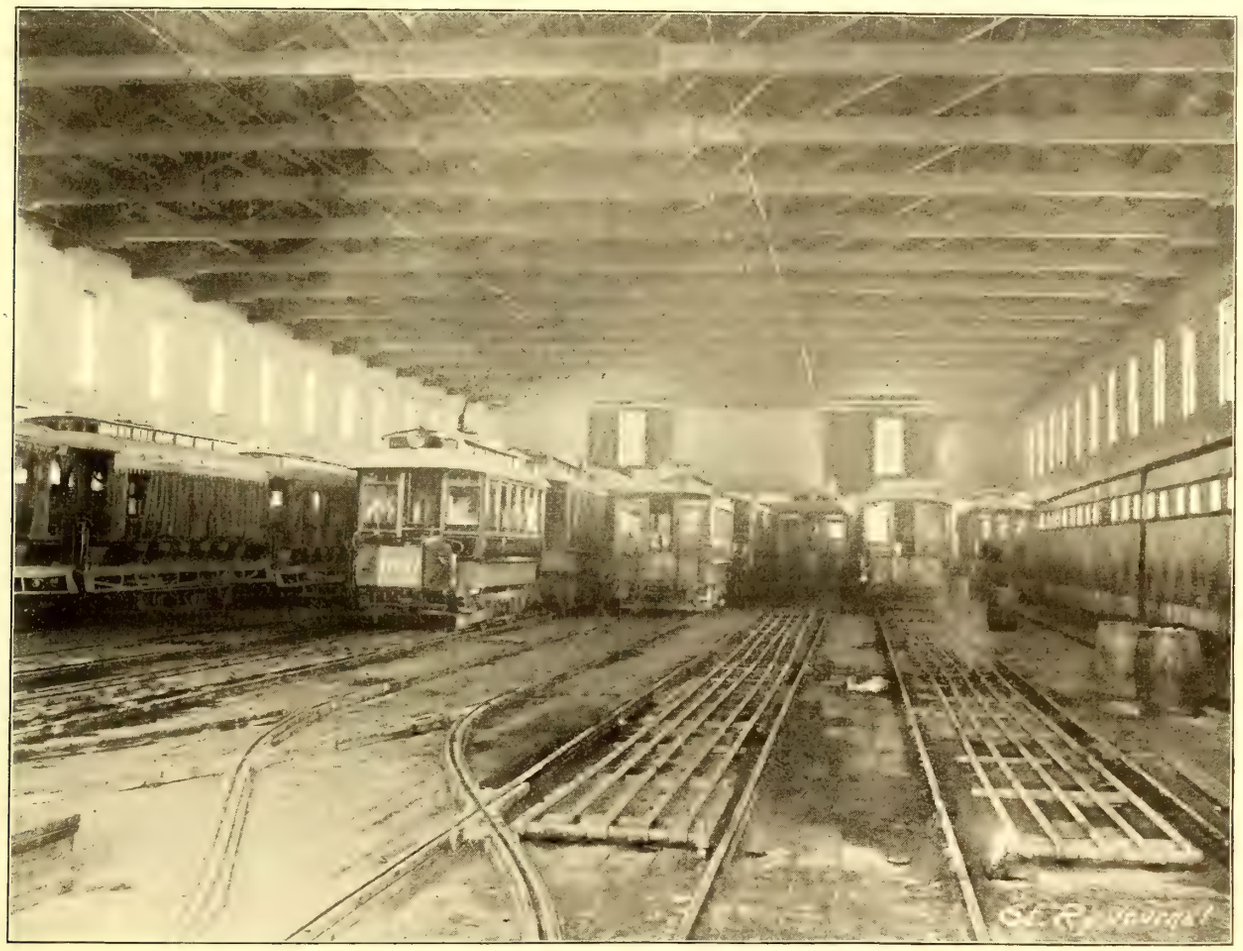


FIG. 1—INTERIOR OF CAR HOUSE, ALBANY RAILWAY—ALBANY, N. Y.

The repair shop, a plan of which is given in Fig. 3, is 80 × 160 ft., and is fitted with tools and appliances for doing all the heavier repairs of both the Albany and the Troy divisions. Two brick walls running from front to rear separate the building into three sections. On one side are the carpenter and paint shops; on the other the armature room, machine and blacksmith shops. The middle section is used for the repairing of cars and trucks. It is provided with pits beneath the track, and is accessible either from the front or rear of the building. Tracks are secured to the walls by brackets; on these run two traveling cranes of 6,000 lbs. ultimate capacity; each with two self-sustaining 3,000 lb. hoists to each crane. The cranes were furnished by T. Shriver & Company, New York. Fig. 2 shows a car raised from its truck; also the means for taking hold of the body with the hoists.

The usual method of operation is to fit up a truck on the right hand track; then with the four hoists, one to each wheel, the truck is transferred to the left track. The car body is hoisted clear of its truck. The old truck is pushed ahead, and with the new one in its place the body is lowered upon it; the old truck is then transferred

to the left track to be overhauled, the whole transfer being easily and quickly done by four men. In each pit is a Cleveland hydraulic motor lift, made by the Fulton Truck & Foundry Company. With these the armatures and motor cases are handled with the greatest facility. The pits are heated by steam.

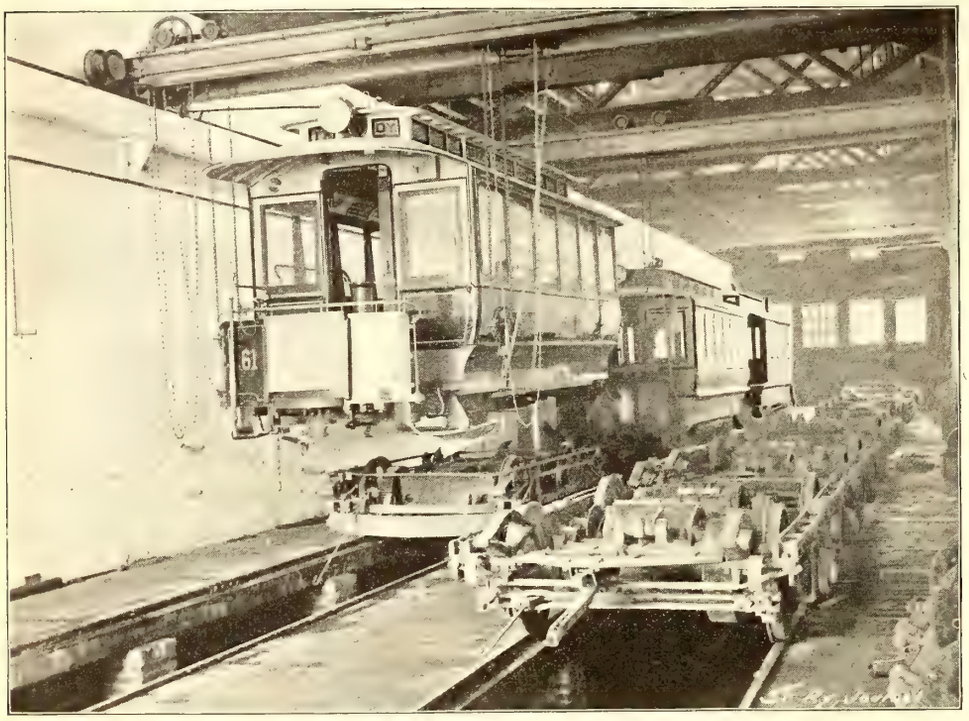


FIG. 2.—LIFTING CAR BODIES FROM TRUCKS—ALBANY RAILWAY.

In the machine shop there is one twenty inch and one forty inch upright drill; one 22 in. × 12 ft. Reed lathe; one 11 ins. × 5 ft. Reed lathe; a 100 ton Schaffer hydraulic wheel press; one 12 in. × 6 ft. Diamond hand lathe; one Pedrick & Ayre open side shaper, besides emery grinder, buffing wheel and blower. Motive power is furnished by a fifteen horse power Short motor taking the current from the overhead system. Machine tools were furnished principally by Manning, Maxwell & Moore and the Niles Tool Works Company, of New York City.

By means of a transfer table at the rear of the building access is obtained to the carpenter and paint shops, also to the blacksmith and machine shops.

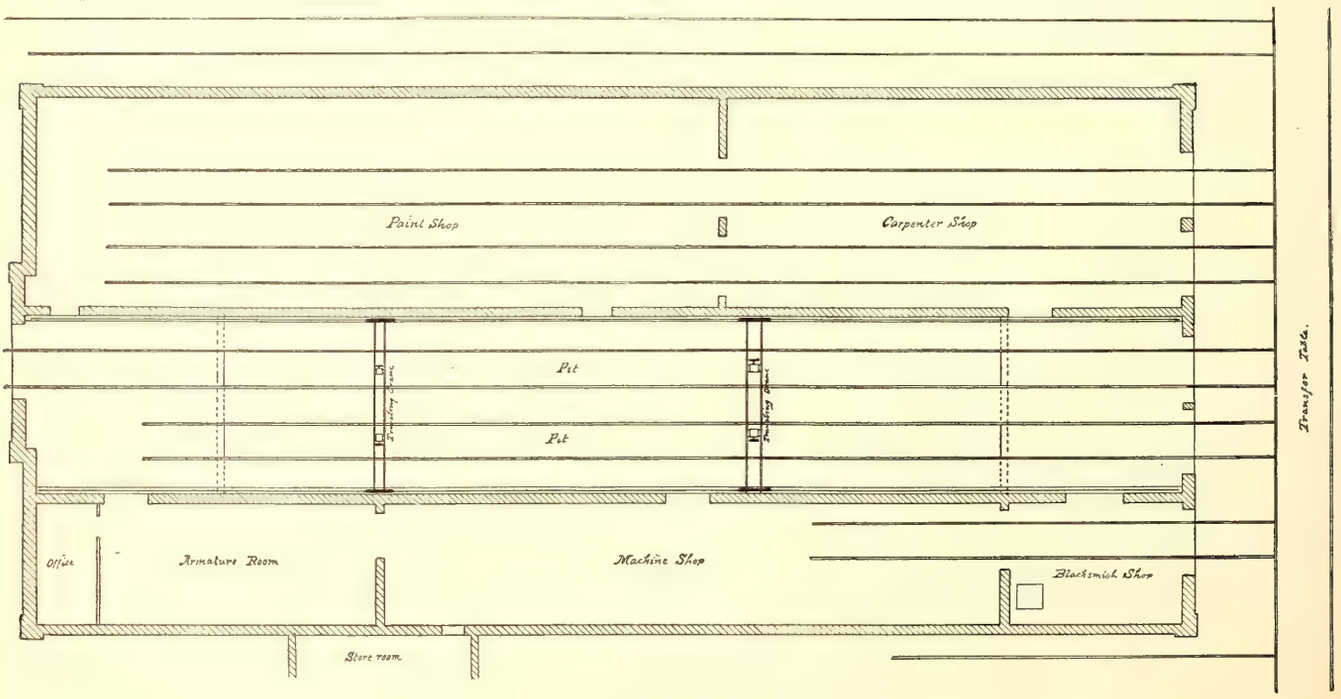


FIG. 3.—PLAN OF CAR HOUSE—ALBANY RAILWAY.

Annual Meeting of the Maine Street Railway Association.

The annual meeting of the Maine Street Railway Association occurred on Wednesday, February 7, and was quite largely attended by representatives of the street railway interests in that state. The city selected as the place of meeting was Portland, and among those present were the following: President, Wm. R. Wood, president of the Portland Street Railway Company; secretary and treasurer, E. A. Newman, general manager of the Portland Street Railway Company; Fritz H. Twitchell, treasurer of the Bath Street Railway Company; Amos F. Gerald, president of the Waterville & Fairfield Railway & Light Company; J. Manchester Haynes and George E. Macomber, of the Augusta, Hallowell & Gardiner Railroad Company; E. H. Banks, president of the Biddeford & Saco Railway Company; Everett K. Day, superintendent of the Mousam River Railroad Company, of Sanford; F. N. Laughton, president of the Bangor Street Railway Company; Frank W. Dana, president of the Lewiston & Auburn Street Railway Company, and A. K. Baylor of the General Electric Company.

Dinner was served at 2 P. M. at the rooms of the Cumberland Club. The secretary's and treasurer's reports were read and approved. Messrs Wood and Newman, officers, and the old board of directors were elected for the ensuing year.

The principal subjects discussed were fire insurance rates and taxes. The insurance rates in Maine have been arbitrarily increased by the companies from ¾ per cent., 1 per cent., 1½ per cent. to 1 per cent., 1¾ per cent. and 2¾ per cent. There has not been a fire in the state in railway power stations caused by electric current, and during the discussion no instance of one in any light and power station could be brought up. The Association has decided to protest against the action of the underwriters.

Considerable dissatisfaction was also expressed with the present tax laws, which class electric railways

for this purpose with the steam roads. The Portland road alone was taxed $700 more under these rules than before electricity was adopted, though the fare remains the same. Other topics relating to street railway interests were also discussed.

By invitation of the Rockland, Thomaston & Camden Electric Railway Company, it was voted to hold the midsummer meeting in that city. The subjects appointed for that meeting are "Grounds for Electric Railroads," and "The Care of Motors."

Rapid Transit in Vienna.

Two rapid transit systems will be constructed in Vienna during the coming year, at a cost of about 23,000,000. Of this sum 85 per cent. will be paid by the state of Austria, 10 per cent. by the city of Vienna, and 5 per cent. by the province of Lower Austria, and the lines will be operated by the government. There will be one elevated railway operated by steam locomotives and extending in a circle around the city, passing through the suburbs. Another semi-circular railway will be within the other, and will embrace part of the old city. This will be underground, and will be worked by electricity. In addition to this semi-circle, two other underground electric railroad lines will be constructed, crossing this semi-circle at nearly right angles. It is proposed to have both systems in operation by 1897.



FIG. 4.—EXTERIOR OF CAR HOUSE—ALBANY RAILWAY.

Fighting the Snow in Milwaukee.

The heavy snowstorm of February 12, which created so much trouble on the street railway lines in different sections of the country, visited Milwaukee and kept the street railway officials busy in combating it. Nine electric sweepers and eighteen scrapers were kept at work all the time under the supervision of General Manager Hommell, and a number of extra men were put at work. Salt cars were also busy distributing salt throughout the city. The only line which had to be abandoned was the Wauwatosa division, and traffic on this line was suspended for only a few hours on February 12. The system was well tested, and the success of the company in coming through the storm so successfully and with such few delays to traffic, was a subject of much congratulation on the part of the citizens and daily papers.

The Development of Electric and Cable Railways in London.

BY ALEX. MCCALLUM.

The present seems to be a favorable time for calling the attention of American railway men to the enormous changes which are now on the eve of inauguration in London.

Let it be remembered that London is a city of about 5,000,000 of inhabitants. It is some fifteen miles long by nearly as many broad. On all sides railways from the different parts of the country converge, but many of these do not penetrate to the city proper, their terminal stations being a couple of miles or more away. This is notably the case with the northern and western lines. Numerous local railways and some of the other trunk lines thread the congested area, but they are quite incapable of coping satisfactorily with the local traffic, especially in the mornings and evenings. All these are ordinary steam railways and are carried either underground, as in the case of the Metropolitan & District lines, or overhead through private property as with the North London, and the Metropolitan Extension lines. It is practically certain that no more of these railways will be built in the central districts. The existing ones have proved white elephants, for though they carry as much traffic as can be run upon them, holders of common stock do not know as a rule what getting a dividend upon it means. These railways cost an enormous sum to construct, owing to the vast amounts which had to be spent on land. In some parts the cost was as high as $6,250,000 per mile.

Another evil is that owing to the density of the general traffic and the narrowness of streets in the central districts tramways are not allowed. Hence the thoroughfares are choked with omnibuses and cabs in addition to other traffic. Blocks are frequent, and but for the excellent police regulations they would be perpetual. Beyond this congested area horse tramway lines radiate in all directions, but they offer far too slow a method of locomotion where passengers wish to travel two or three miles at a stretch. Cable and electric tramways are still in the future, and besides, under English restrictions as to speed and trains, they would not solve the problem. The traveler can often find a steam railway to suit his destination, but he has probably some distance to go to the nearest station, and in many cases the route is so circuitous that the time occupied is absurd.

It has to be remembered that the difficulties in London are growing more and more acute every year. The population is increasing at an alarming rate, and the city congestion is in a similar flux. The local traffic also is increasing, despite insufficient facilities, at an extraordinary rate.

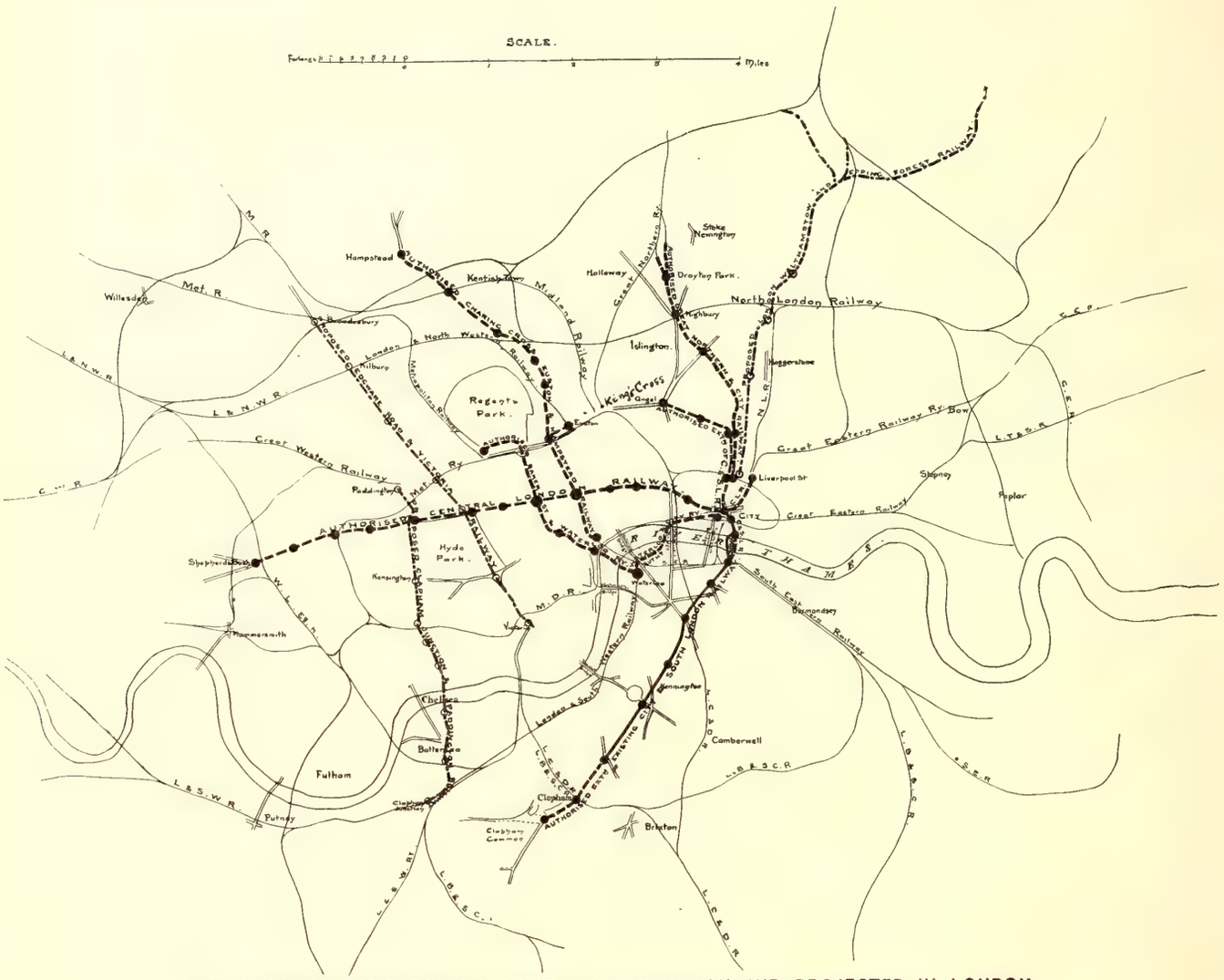
Something absolutely new, reasonably cheap and rapid, and large in carrying capacity is required in London. Necessity has again been the mother of invention, and in the Greathead tunnel scheme a bright promise is held out.

The Rapid Transit Commissioners of New York and Boston, in their reports in 1891 and 1892, rather threw cold water on this scheme so far as the needs of their respective cities were concerned. Little or no attention seems to have been paid since to the system in America, and it is necessary, seeing the wholesale approval which it has obtained from English experts, and considering that it promises to be adopted in many European cities, to refer to it in some little detail.

J. H. Greathead, the inventor, has for many years been

what may be called a specialist in the matter of tunnels. He was associated with the various schemes for carrying tunnels under rivers, such as the Thames in London, and the Clyde in Glasgow. In 1882 he proposed a tunnel for general traffic under the Thames, at the Tower of London. It was to be approached at either end by hydraulic lifts, in the same way as in the present scheme for the Clyde at Glasgow (in which the latter, by the way, an American firm, the Otis Elevator Company, is supplying the hydraulic machinery). A bill was introduced into Parliament to obtain the necessary powers, but the scheme, which would have been far preferable to the present movable Tower Bridge, and only one-fourth as costly, was thrown out.

In 1883, Mr. Greathead's idea being still maturing, he proposed a deep tunnel railway from the city to the point on the south side of the river known as the Elephant & Castle, a distance of about a mile and a half. This was the nucleus of the existing City & South London Railway. The application to Parliament for powers was met by a storm of opposition from the Corporation of the City of London, who were apprehensive of injury to London Bridge, and from all the local authorities along the route. By great good fortune, however, the bill got through in 1884. The general public then said that the thing was impossible, and so difficult was it to persuade investors that the scheme was feasible and likely to be profitable, that it was not until well on in the year 1886 that any steps were taken to begin the actual work of construction. It was then stated quite confidently that the whole capital of the company would not be sufficient to carry the two tunnels, one for the up, and the other for the down town line, under the Thames. For a beginning it was therefore decided to construct this part of the tunnels before any land for stations was bought, and before beginning any works elsewhere on the route. The first step was to sink a shaft in the bed of the river itself, and to drive both the tunnels from the shaft. It was about sixty-five feet deep from the surface of the water, and penetrated far into the London clay. At this point the tunnels were placed one above the other, and the upper tube was driven first. These are the tunnels now in use. As soon as they were completed, land was acquired at the points where the stations were to be situated, and the remainder of the tubes was constructed. Before the work was done, the company obtained power to extend its undertaking southwards as far as Stockwell, and the whole route is shown in the map accompanying this article. The original proposal was to work the road by cables, but owing to the great progress which was being made at that time in electric traction, it was decided to equip the railway electrically on the ground that greater train speed would thereby be attained. Having sketched the matter historically, it is time now to explain generally and as briefly as may be, the principles of the Greathead tunnel.



MAP SHOWING RAPID TRANSIT ROUTES IN OPERATION AND PROJECTED IN LONDON.

The City & South London Railway, the experimental pioneer of the Greathead class, was opened in the end of 1890, and has been working well ever since. In its essentials the scheme for such railways is this: First, the tunnel must be at a considerable depth below the surface, so as not to interfere with sewers, pipes and buildings, and to obviate the expense of buying land, except for stations. In London a depth of from forty to sixty feet has been found to be the most convenient. Each railway has two tunnels, one for the up and the other for the down track. This obviates any risk of a block on both lines should a train be derailed or meet with other accident. The railway must not have any physical junctions with other lines, so that trains may be run without any delays on an an exceedingly short headway. The tunnels, for the sake of economy, and in order to insure good ventilation, must

not be very much wider than the cars which thus force out the air in front of them, and the fresh air rushes in behind. Cable or electric power is used, thus ensuring a pure atmosphere. Very little surface land is required for stations, as only a ticket office, elevators and staircases have to be provided for. The easement to run through the subsoil costs little. The line may go either under streets or buildings, as there is neither noise nor vibration on the surface. The tunnels are cut generally through the London clay, which everywhere forms the subsoil, by means of a shield forced forward by hydraulic power. They are then lined with iron throughout, with a layer of watertight cement between the iron and the surrounding clay or other material. Water-bearing strata can be pierced, where necessary, in the same way, with arrangements for enabling compressed air to be used for keeping out the water till the work is finished. The following summarizes the advantages of the method:

(1.) It does not involve disfigurement of the streets nor surface noise and vibration. (2.) Blowholes or ventilating openings are not required. (3.) It provides a mode of transit more rapid than the underground railways of London, the elevated railways of New York, or the cable railways of Chicago, and nearly three times as rapid as the omnibuses and tramways in London. (4.) It can be carried out without the slightest interference with the streets or traffic during construction. (5.) It does not involve abstraction of street surface. (6.) It can be carried out without the wholesale demolition of property involved in the construction of ordinary railways. (7.) While economical in construction, it gives a rateable value to the subsoil of the streets. (8.) By adding a second story, as it were, to the streets, it will tend to reduce the congestion of street traffic. (9.) It will not derange existing sewers, pipes, etc. Passengers also find the advantages of pure air, owing to the absence of steam locomotives, comfortable cars, warmth in winter and coolness in summer, certainty of service in all weathers, and even when in frost, snow and fog all other conveyances fail.

The Boston Rapid Transit Commissioners objected to the system on the ground, *inter alia*, that the temperature in the tunnels in summer is apt to cause chills to passengers. But this temperature, which is pretty nearly the same all the year round, is admittedly not lower than 50 degs. Fah. In the past hot summer the City & South London Company actually found it to its advantage to put up notices at the entrances to its stations, calling attention to the cool atmosphere. Complaint was also made by the Boston Commission to the noise while the train is running, but in reality this is not excessive, and in the case of all the lines about to be constructed it will largely be obviated by a modification of the tunnel lining. The sharp curves on the existing line which give rise to disagreeable jerks at times, especially near the termini, will not exist on any of the forthcoming lines, and the gradients will not be so severe. It must be remembered that the City & South London Railway was built as an experimental line, and that from it a great deal has been learned.

The success of this railway led to the organization of companies to build other roads. We present here a map which shows the principal steam railways in London, the existing City & South London Electric Railway, the authorized deep tunnel railways, and the proposed lines of the latter class. To avoid complication on the map, the minor steam lines are not shown. It has to be borne in mind that the greater part of the area in question is densely built over. The thin lines are the steam railways, the thick continuous line the City & South London, and the thick dotted lines the prospective deep tunnel railways. The position of a few of the more important thoroughfares where they cross the new lines is indicated. Stations are also marked on the coming railways.

It is proper to mention that as regards the London, Walthamstow & Epping Forest Railway, which is to be promoted in the coming session of Parliament, only three and a quarter miles of the total is to be in tunnel and worked by electricity, the rest being in the country and in the open, and it will be operated by steam locomotives. Near the point where the railway emerges on the surface, as a glance at the plan will show, there are junctions with several lines, so that the continuation of electricity would be impracticable. But making this allowance, it will be seen that the total mileage on all the railways proposed to be operated by electricity or cable is thirty-eight miles. If we take this on the American plan of reckoning every mile of double track as two miles, the total of the roads to be worked is seventy-six miles. This when completed will be a glorious achievement, but even then it is doubtful whether London will have in proportion to its population a system of local communication approaching that of many of the cities of the United States. However, success will lead to extensions.

The following is a complete list of the authorized and proposed lines, with the lengths of each:

AUTHORIZED.	Miles.
Central London Railway	6½
Baker Street & Waterloo Railway	3
City & South London Railway, Islington & Clapham extensions	3¾
City & South London Railway as presently open	3¼
Great Northern & City Railway	3
Hampstead, St. Pancras & Charing Cross Railway	5
Waterloo & City Railway	1½
Total	26 Miles.

PROPOSED.	Miles.
Clapham Junction & Paddington Railway	4¼
Edgeware Road & Victoria Railway	4½
London, Walthamstow & Epping Forest Railway	14
Total	22¾ Miles.

The Central London Railway, of which the engineers are Sir John Fowler, Sir Benjamin Baker and J. H. Greathead, was the first of these railways to be authorized, and in many respects it is the most important. The stations will be at some of the busiest centers of London activity. It is intended at first to run trains, each seating 336 passengers, at intervals of three minutes. The total journey will be accomplished in about twenty-five minutes. Assuming each train to take on half as many passengers as it could seat at one time (as is the case on the City & South London), and that the working hours were 110 per week, a five minute service would carry twenty-four and a half million passengers per annum, while a two minute service would convey sixty-one and one-third million. This calculation for a railway three miles long will enable readers to have an idea of the capacity of the other projected lines.

Electric Railway Construction in Europe.

The *Allgemeine Elektricitäts-Gesellschaft*, of Berlin, has sent us the following list of electric railways which it had installed or was installing October 11, 1893. The first six are in operation; the remaining eight are in course of construction :

Name of Town.	Started.	Put in operation.	Length of street in km. (.62 mile.)	Length of track in km.	Gauge in meters (39.37 ins.)	Maximum grade.	System.	No. of Motor cars.	No. of Trail cars.	No. of Motors.
Halle	1891	1891	7.74	9.67	1	1.20	trolley	25	13	50
Halle extension to Wittekind-Trotha	1892	1892	4.82	7.24	1	1.20	"	10	....	20
Gera	....	1892	9.4	10.7	1	1.20	"	18	16	26
Kiew	...	1892	3	4	1.512	1.9.5	"	6	....	12
Breslau	....	1893	17.66	28	1.43	1.40	"	40	25	80
Essen, Altendorf-Borbeck line	....	1893	12 3	13.5	1	1.16	"	13	6	26
Essen, Nordstern & Essen B. Bredeney line	1893	....	6.78	9.15	1	1.35	"	7	....	14
Chemnitz	1893	....	11.7	20.8	.915	1.30	"	24	20	48
Dortmund	1893	...	10.5	11.95	1.435	1.40	"	26	20	52
Christiania	1893	....	6.5	7.5	1.435	1.15	"	11	7	22
Lubeck	1893	....	9.87	13.63	1.100	1.20	"	24	20	48
Berlin	1893	....	.....	.....	1.435	level	accumulator	3	....	3
Kiew Extension	1893	....	7	9	1.512	1.14.4	trolley	22	....	44
Plauen	.....	...	3 5	5.8	1	1.12	"	8	...	16

The Altoona & Logan Valley Electric Railway.

The line of the Altoona & Logan Valley Electric Railway Company, of Altoona, Pa., is an interurban one, as will be seen from the accompanying engraving, which shows the route of the road. As the company owns 3,600 of the 4,000 shares of the City Passenger Railway Company, of Altoona, and operates the road of that company, it thus controls the entire electric railway system of Altoona. The line of the company is divided into three sections: Hollidaysburg, extending from the public square in Hollidaysburg to the 12th Street Bridge, Altoona, a distance of 6.6 miles; the city division, comprising the entire electric railway system in Altoona, twelve miles in length, and the Bellwood division, which passes through Juniata and Blair Furnace to Bellwood. This is now in course of construction, and will be, when completed, six miles in length. The entire system serves a population of about 60,000.

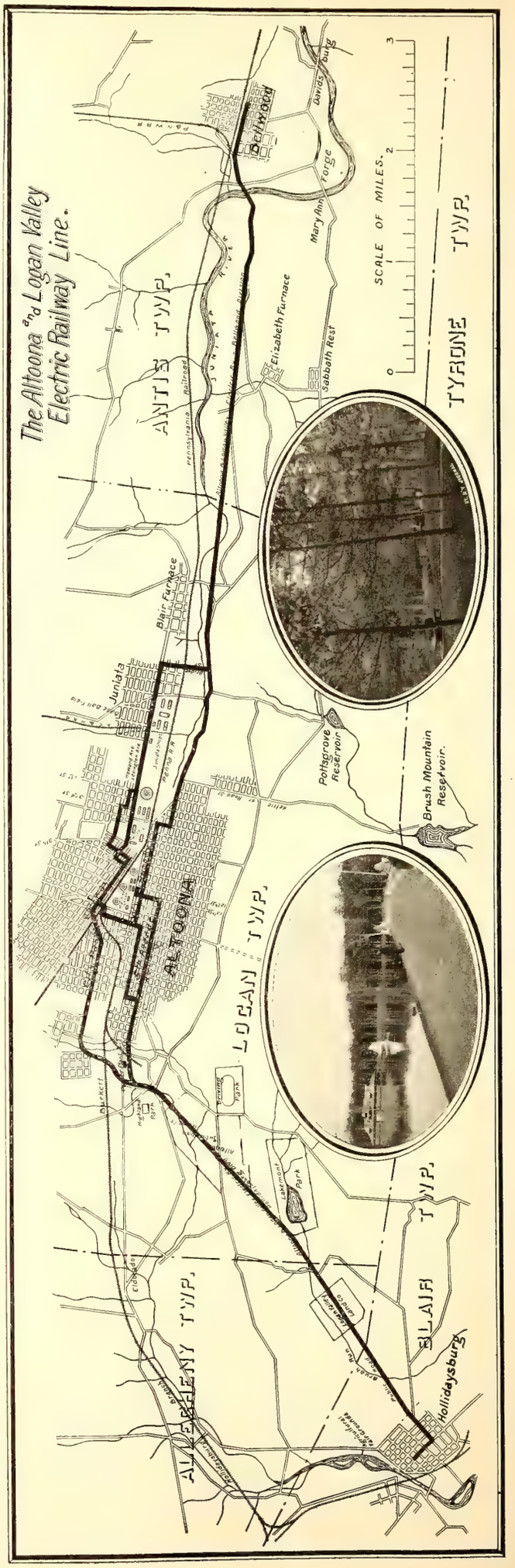
The power station is located about 1.8 miles from the center of Altoona, as shown on the map, and with the car house is contained in a building 118 × 105 ft. 6 ins. This structure is of brick with a slate roof, and was designed by W. B. Powell, of Philadelphia. The stack is of sheet iron, 100 ft. in height and five feet inside diameter. The engine room measures 42 ft. 6 ins. × 72 ft. 6 ins., and contains two 200 H. P., compound engines with cylinders measuring 20 × 24 ins., supplied by the Altoona Manufacturing Company. These engines are direct belted by means of sixteen inch Munson belts to two 200 K. W. General Electric multipolar generators. The switchboard is of the standard slate panel type, manufactured by the General Electric Company, and supplied with switches, automatic circuit breakers, etc. The boiler room measures 40 ft. 2 ins. × 35 ft. 6 ins., and contains two 250 H. P. Heine safety boilers and one 800 H. P. National feed-water heater. The piping is covered with asbestos covering. The station, being in the midst of the coal region, no condensers are used. Fuel costs $1.25 per ton of 2,000 lbs., and is delivered from the cars directly above the furnace doors, where it is shoveled into the furnaces.

The car house, which adjoins the station, as mentioned above, is separated from it by fire walls, and measures 34 × 118 ft. It contains three tracks with pits to facilitate the inspection of motors, running gear, etc.

The track is laid with seventy pound girder and fifty-six pound T rail, an eighty-five pound rail being used at the curves. The girder rail is used in the city limits of Altoona and the borough limits of Hollidaysburg, and the T rail across the country. The ties are of 6 × 6 ins. × 7½ ft., and number fourteen to a thirty foot rail. Wharton spring switches are used with the girder rail, and Pennsylvania Steel Company's point switches with the T rail. The joint connections are made with six hole, angle splice bars. The joints are then double bonded with No. 0 copper wire connected with channel pins. Each fifth rail is also cross bonded to the opposite rail with No. 0 copper wire, and ground plates are buried each 1,000 ft. The company cares for the pavement between the rails and for eighteen inches on either side. The paving is of brick and cobble stones, and the track is surfaced with engine cinders and ballasted with stone.

The overhead construction is carried on round chestnut poles thirty feet in length. The trolley wire is No. 0 B. & S. gauge, hard drawn copper, and the feed wire is No. 0 triple braided, weatherproof. All the line appliances are of the General Electric type.

The motor cars operated by the company are thirty-four in number, fifteen belonging to the Altoona & Logan Valley Railway Company and nineteen to the City Passenger Railway Company. The trail cars, of which there are fourteen, are divided, eight and six respectively, between the two companies. The gauge is five feet three inches. Both motormen and conductors are paid twelve and a half cents per hour. The cars are mounted on Brill rigid, No. 21 trucks. The motor equipment is the Edison sixty horse power, and the Westinghouse fifty horse power type. The interior furnishing of the cars is very tasteful, the seats being of mahogany covered with Wilton carpet. Lewis & Fowler registers are used.



The cars are heated by both stoves and electric heaters, the Consolidated Car Heating Company's apparatus being employed in the latter case. The company buys its wheels of the Lobdell Car Wheel Company and has adopted a thirty-three inch wheel with a two and a half inch tread. The rolling stock of the company also includes some snow plows supplied by the Brooklyn Railway Supply Company, of Stamford, Conn.

In its machine shop the company has installed a large lathe, vices, block and fall, etc., for making all ordinary repairs.

Two views of attractions established by the company for stimulating traffic on the road are given in the ovals in the engraving. These are views of Lakemont Park between Altoona and Hollidaysburg owned by the company, and where a first class pleasure resort has been created. The plan of improvement during the coming year at this point contemplates the erection of a gravity railroad, a merry-go-round, the purchase of electric launches, and the supplying of a baseball diamond. In addition to these attractions a considerable part of the park has been left in its wooded condition, so that every variety of pleasure seeker, whether anxious for rest or activity can be suited.

The officers of the Altoona & Logan Valley Railroad are: President, John Lloyd; secretary and treasurer, C. A. Buch; superintendent, C. L. West. The chief engineer is A. C. Shand, and the electrician W. H. Markland.

DURING January a contract was closed between the French Government and Mr. Berlier, the well known French engineer, relating to the construction and operation of electric underground railroads in Paris. About twenty-five miles of line will be built.

THE long projected railroad up the slopes of the Jungfrau, will, it is said, at last be constructed, permission having been obtained from the Swiss Federal Council. The rack system, in connection with electricity, will be employed.

A CONTROLLING interest in the Nashua (N. H.) Street Railway Company has been secured, it is said, by Boston capitalists.

The Pittsburgh, Allegheny & Manchester Traction Company.

The Pittsburgh, Allegheny & Manchester Traction Company of Pittsburgh, incorporated July 25, 1891, was formed by the consolidation of the Pittsburgh, Allegheny & Manchester Passenger Railway Company, a street railroad company dating from 1859, and the Pittsburgh Union Passenger Railway Company, incorporated in 1879. The charters and franchises granted to the Pittsburgh, Allegheny & Manchester Traction Company have a life of 999 years, as have those granted to the roads entering into the consolidation. The districts through which the lines of this company run, include the business part of Pittsburgh and Allegheny City, as well as the most desirable residence portion of Allegheny, while two of its branches serve a section of the city in which many of the large manufacturing establishments are situated. Connection between Allegheny and Pittsburgh is obtained by two bridges across the Allegheny, which are controlled by the company. One of these bridges, shown with its Pittsburgh approach on this page, is the most modern of the many Pittsburgh bridges, and claimed to be the finest bridge structure in Western Pennsylvania.



FIG. 1.—NEAT OVERHEAD WIRING—PITTSBURGH, ALLEGHENY & MANCHESTER TRACTION CO.

The road was operated as a horse road until 1891, when horse power gave way before electricity, and the road underwent entire reconstruction. In August, 1890, the reconstruction of the tracks was begun, and the heavy girder rails, sixty-three pounds per yard, laid upon a permanent roadbed with a concrete foundation. At the same time the entire length of all its branches was laid in block stone.

Desirous of escaping the many difficulties and dangers incident to overhead wires and accidents which might happen to them, a more than ordinary substantial overhead structure was determined on. The iron poles used are in three sections of extra heavy tubing of six, five and four inch iron respectively, put together in the following lengths: Six inch section twenty feet long, five inch section seven feet long, four inch section five feet long, making a pole twenty-eight feet in length. These poles are set in concrete along both sides of the street. Cross suspension methods are used throughout, the cross wires of heavy iron cable being fastened to the securing

devices on the poles by being bent round brass thimbles and then soldering the free end fast into a brass sleeve. The whole wiring system is divided into four main sections, and these sections are again further divided on the streets through section boxes. The insulators and overhead devices of all kinds are of General Electric manufacture, and are retained as standard by the road, and have given good satisfaction. Fig. 1 shows the approach to the new Sixth Street bridge across the Allegheny River, connecting Pittsburgh to Allegheny. The intricate special work shown in the foreground, built by the Johnson Company, is of its welded construction. All crosses, mates, etc., have been provided with removable floor plates, so as to prolong the life of otherwise expensive track maintenance.

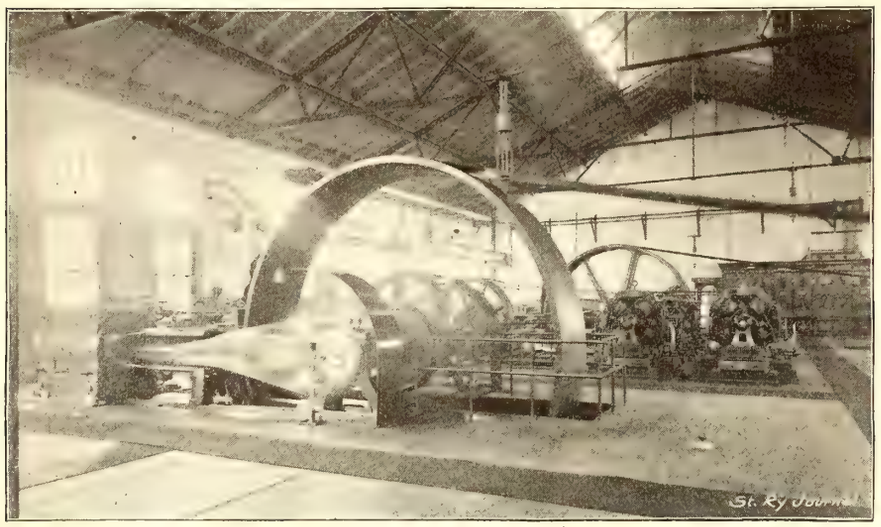


FIG. 2.—ENGINES—PITTSBURGH, ALLEGHENY & MANCHESTER TRACTION CO.

The power station of an electric railway company having been built, the cost of operation depends largely upon its location, design and equipment, and if any one of these elements has been overlooked or carelessly selected, the resulting increased cost of operation will remain a fixed charge always, from which there is no escape. In considering the matter of the power station, the Pittsburgh, Allegheny & Manchester Company decided to locate its plant on the lines of two competing steam railroad companies, and on the Ohio River, for reasons which are obvious. The boiler plant consists of two batteries of four horizontal water tube type boilers, equipped with locomotive shaking grates, built by the Robert Wetherill Company. The coal is delivered to the boiler room from drop bottom cars, run on an elevated trestle, and arrangements have also been made to obtain a coal supply direct from the river. The engine plant consists of two compound, condensing Wetherill-Corliss engines, and two smaller engines manufactured by Russell & Company of Massillon, O. Keystone injectors and Epping-Carpenter pumps are used.

The generator equipment consists of four General Electric multipolar, 300 K. W. generators, and four multipolar, 75 K. W. generators of the same make. Coupled together and belted with one Munson belt to each Corliss engine are two of the 300 K. W. generators, and belted tandem to each of the smaller engines are two of the 75 K. W. generators. Considerable attention has been given to the matter of foundations and alignment, so that the large generators, coupled and driven in the manner described, run without the slightest trouble. The entire generating plant, including boilers, piping, engine and generators, are in duplicate.

As brought out forcibly at the last Street Railway Convention, the greatest economy of operation can best be obtained by operating the engines and generators at their rated capacity, and this method is closely followed in the plant under consideration. When the load is light, one Corliss engine suffices, but in the morning and evening, when the travel is heavy, one of the smaller engines is thrown on, and, as more cars are put on, still a third engine is added, so that the plant is kept at work at its most efficient point under all conditions.

Special attention has been given to the station wiring to make it compact, accessible and safe. The wires from the generators reach the switchboard by conduits, and leave on permanent brackets. The switchboard is equipped with the usual main switches, ammeters, voltmeters, automatic circuit breakers with electrical reset, and recording wattmeters. Between the two smaller engines is a jackshaft carryingtwo pulleys. This shaft can be coupled to either of the small engines. From it the arc machine is run, which is used for lighting the power station, car station, repair shops and yards. All the electrical apparatus in the station was built and installed by the General Electric Company.

The car stations are located at the corner of Beaver and Island Avenues, Allegheny and Ohio and Chestnut Streets. The main car station has a capacity of sixty cars, and is designed with the special end in view of handling the cars rapidly. No repair work is done in this station. In order to facilitate the handling of the cars, an electric transfer table is used, power being applied directly on the axles by two railway type, three horse power each, motors, current being taken from a conduit in the center of the transfer table tracks. These motors are operated by the ordinary street car rheostat and reversing switches. This transfer table has proved a great saver both in time and labor, one man being able to handle the entire equip-

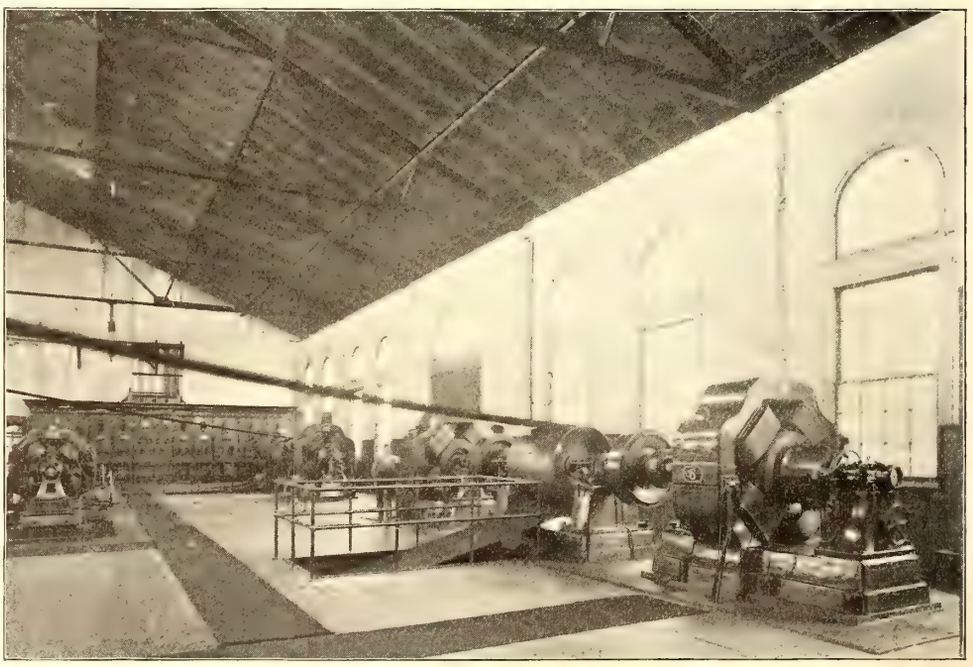


FIG. 3.—GENERATORS—PITTSBURGH, ALLEGHENY & MANCHESTER TRACTION CO.

ment of cars by its use. It is of special service in adding or taking off trailers as demanded by the variations in the traffic demand at different times of the day. There are two other car stations with a capacity of storing forty cars. The rolling stock consists of fifty-eight motor cars, fourteen trail cars, two snow sweepers, one sprinkling car, salt cars, etc. The motor cars are equipped with the General Electric motor, G.E. 800, which has been adopted by the Pittsburgh, Allegheny & Manchester Company on account of its lightness, efficiency and the perfect protection afforded in its construction from rain, snow or dirt. Control is effected by the series parallel controller.

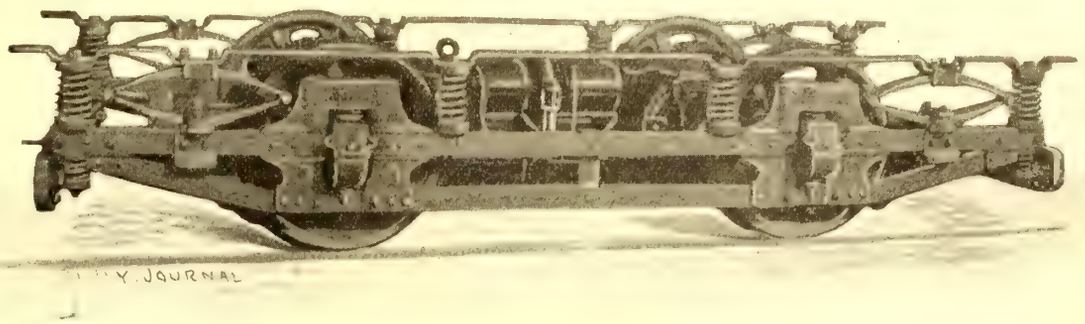


FIG. 1.—TWIN SERIES MOTOR TRUCK—UNION RAILWAY, NEW YORK CITY.

In addition to the power station a repair shop has been built, having in it paint shop, wood working shop, blacksmith's shop, assembling floor and machine shop. There is also a spacious store room, and the company is in a position to repair and maintain its entire equipment and power house, rolling stock, track and buildings. The tools in the machine shop and wood working shop are operated by electric motors, and all the buildings are heated by steam, which acts as a preventive on the charge of too high rates by the insurance companies.

Street railways operating through thickly settled cities, especially sections through where large manufacturing industries are carried on, are subjected to numerous annoyances, such as vehicles breaking down and blocking the tracks, fires and accidents of all kinds. To provide against such contingencies, an emergency wagon has been built, supplied with tools, jacks, hoists and various other devices. This wagon is operated on the same principle as a police patrol or ambulance, and is accorded equal rights on the streets with them. The comfort and convenience of the employes has also been looked after, and a nicely furnished, well lighted room has been provided for them. Well equipped wash rooms, etc., are also provided, and employes are required at all times to present a neat and business-like appearance. One of the novel features introduced by the road is the use of trail cars as smokers to take care of a constantly increasing traffic. They are a source of considerable traffic profit to the company and comfort both to smokers and non-smokers.

In the equipment of this road, the perfection of its operation and maintenance, the reliability of its service, the company has achieved for itself a most enviable record. That it has the universal good will of its patrons is perhaps the best evidence of the satisfaction it gives.

The capital stock of the company is $3,000,000, with a bonded indebtedness of $1,500,000. The officers are: J. H. Dalzell, president; Joshua Rhodes, vice-president; A. M. Neeper, secretary; William Montgomery, treasurer, and G. F. Greenwood, general manager.

THE Lewiston (Me.), & Auburn Street Railway has changed hands; the purchaser is Edward E. Proctor, of Wakefield, Mass.

The Twin Series Motor in New York.

One of the twin series motor equipments manufactured by the United Columbian Electric Company, of Kingston, N. Y., has been in operation for some time on the line of the Union Railway, of New York City. The motor, which was described in our November issue, is of fifty horse power, with two armatures geared directly to the axles. The truck used is a Peckham, type 6A, with a six foot wheel base, and the car employed is the St. Louis car, eighteen feet in length. The characteristics of the equipment are ease of riding and going around curves, with ease of starting. The car makes good speed, and shows particularly no slowing down on ascending a 6 per cent. grade. Some recent tests have been made of economy of current in comparison with motors of other types, which show very well for the twin series equipment. Fig. 1, shows the truck with motor equipment, and Fig 2, the car now in New York City. The handsome building in the background of the latter engraving is the car house of the Union Railway Company.

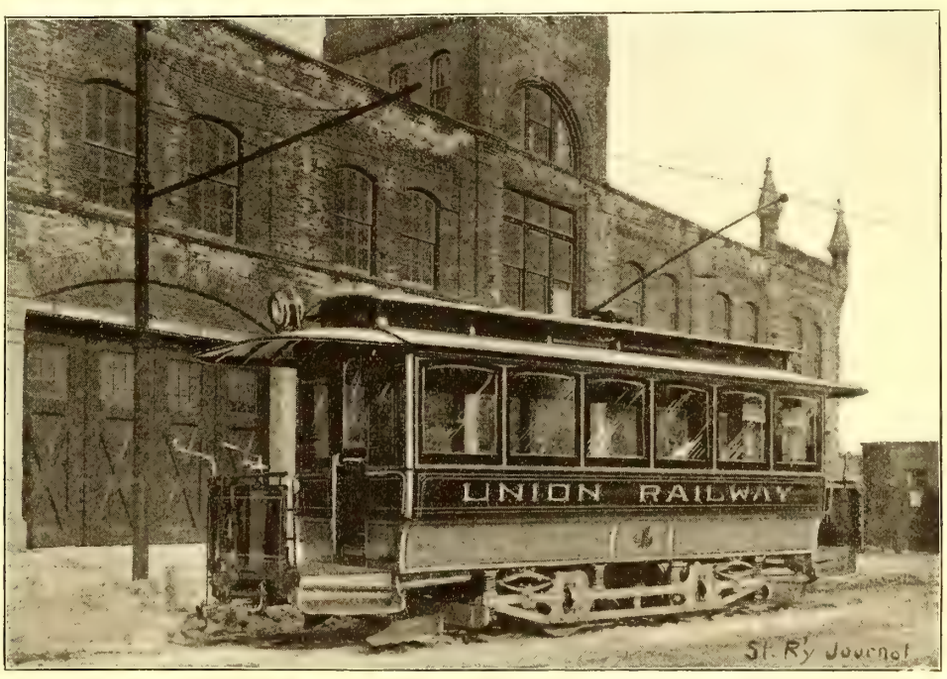


FIG. 2.—CAR EQUIPPED WITH TWIN SERIES MOTOR—UNION RAILWAY, NEW YORK CITY.

Four cars equipped with this type of motor have been in use in Mobile, Ala., for some time, but though operating under quite severe conditions, the amperage has rarely risen above fifty.

THE Shamokin (Pa.) & Bear Valley Electric Railway Company has been incorporated, with a capital stock of $100,000. The president of the company is E. C. Hamilton, of Shamokin. Others interested are: G. W. Smith, W. W. Ker, of Philadelphia; Charles M. Clermont, of Sunbury, and Martin Markle, of Shamokin.

THE TRANSFORMATION OF BALTIMORE.

PART II.

BALTIMORE TRACTION COMPANY.

Some important work in both cable and electric construction has been done by the Baltimore Traction Company during the past two years, and the mileage of the system has been largely increased by the absorption of other roads and the construction of new lines. Of the seventy-five miles of track now included in the system of this company, thirty-five miles are operated by electricity, fifteen miles by cable, and twenty-five miles by horses.

The Druid Hill Avenue cable line, which has been in operation since May 23, 1891, was the first step towards rapid transit on the part of this company; in fact, it was virtually the beginning of rapid transit in Baltimore. The Gilmor Street cable line, which runs West from the center of the city and then North to Druid Hill Park, is built upon the same general plan as the first line, with some changes in the driving machinery. The strictly unique feature of the Gilmor Street line is its power house, the "Epworth" power station, as it is called from the fact that the machinery is installed in what was formerly the Epworth Methodist church, at the corner of Gilmor and Mosher Streets. As this vacant church seemed to be the only property obtainable for the purpose, it was decided to transform it into a power station. The spire still stands, there is a great circular stained glass window in the front wall, and the chandeliers, gallery, etc. are undisturbed. A boiler house of the same style of architecture adjoins the church building, and an extension in the rear contains the tension run. Francis H. Hambleton, the chief engineer of the Traction Company, found it no simple problem to get the driving machinery inside the church walls, but he did it nevertheless, and the plant has been running smoothly for nearly a year and a half.

The driving machinery is placed on the old floor level of the church, high enough above the street level to give abundant daylight in the lower part of the building. The engine room is 79 × 58 ft., the tension room is 51 × 72 ft., the boiler room is 41 × 104 ft., and the coal room is 41 × 47 ft. The machinery consists of two plain Corliss engines, 36 × 60 ins., built by the Corliss Steam Engine Company, of Providence, R. I., and driving gear for two ropes, built by the Robert Poole & Son Company. The steam plant consists of three batteries of two boilers each, room being left for an additional battery when required. All the steam piping and connections in the engine room are beneath the floor. Owing to the scant width of the building, one engine stands outside the original church wall in an extension, the twenty-four foot flywheel being inside the engine room, and clearing the arches of the roof by a scant inch. The two cables, 10,000 and 22,000 ft. in length, are driven at the same speed —eleven and a half miles—but each has its independent driving gear. A rope drive of twelve ropes is used, the driving pulleys being ten feet in diameter, and the driven wheels twenty-four feet. In this rope drive, Mr. Hambleton has introduced a device for equalizing the strain on the cables. Instead of driving the two twenty-four foot pulleys of each set of gears from a single ten foot pulley on the main engine shaft, the driving pulley is split and provided with a compensating gear on the order of the Whit-

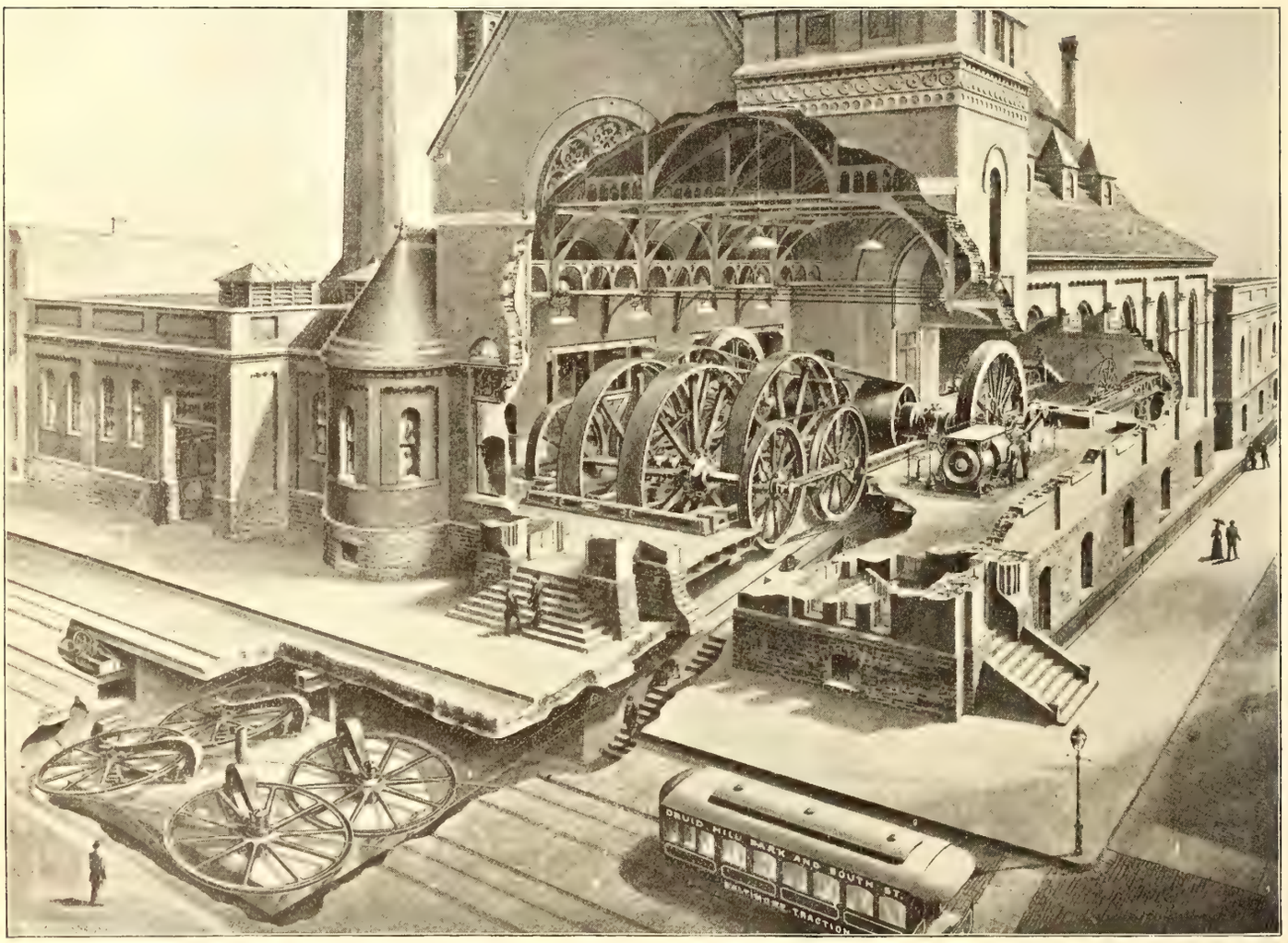


FIG. 1.—GILMOR STREET CABLE POWER STATION—BALTIMORE TRACTION CO.

ton gear for cable drums. With this compensating gear on the rope drive, and the Walker differential cable drums, a complete equalization of the power is assured. The cable drums are thirteen feet six inches in diameter. The tension device, which was designed by the engineers of the company and the builders, the Robert Poole & Son Company, consists of the usual traveling carriage and weights rising and falling in a fifteen foot pit. The tail rope of the carriage passes over a fixed sheave at the extreme end of the run, through a sheave on the weight, and up again to a geared drum, by which any abnormal variations in the tension or length of the cable can be met. By this arrangement the entire length of the run is utilized and the somewhat limited space is used to the best advantage. This plant has capacity in excess of its present requirements, but it was designed with a view to future needs and possible extensions of the line.

The suburban lines of the Traction system form an interesting feature. The Pikesville line, which starts at the terminus of the cable lines at Druid Hill Park, follows the turnpike to Pikesville, a distance of about seven miles. This line was first changed from a horse road to a single track electric line in 1892, by E. D. Smith & Son, but soon afterwards it was double tracked for its entire length by E. Saxton. It is laid with fifty-six and fifty-eight pound T rails, from the Pennsylvania Steel Company, and is rock ballasted. Wooden center poles are used, and the overhead work is especially noteworthy, because of the care with which it was done. The roadbed, too, is in excellent condition, and the entire line is a good example of first class suburban construction. The line passes several race tracks and other resorts which furnish a heavy summer travel, and the country traversed promises to be the scene of important suburban development, a feature that has hitherto been almost wholly lacking in Baltimore. Lewis & Fowler sixteen foot cars are used on this line, with two twenty-five horse power Westinghouse motors to each car. When travel is heavy trailers are used. About midway on the line a double track spur runs to Arlington, a small suburb, and it is probable that the importance of the road will be largely increased by the construction of other feeders.

Power for the Pikesville line and portions of the other lines is furnished from a small plant in the power house of the Druid Hill Avenue cable road. This plant contains a 250 H. P. Westinghouse direct coupled unit, a 250 H. P. McIntosh & Seymour engine belted to an Edison generator, and two 150 H. P. Ball engines, with two 150 H. P. Edison generators. From this station is also supplied a portion of the current for operating the Carey



FIG. 2.—VIEW ON DRUID HILL AVENUE—BALTIMORE TRACTION CO.

Street electric line, which was changed to its present power during the last fall. This line runs from Druid Hill Park to Fort McHenry at the extreme southeastern limit of the city, using the cable tracks of the company for a portion of the way to the center of the city. Lewis

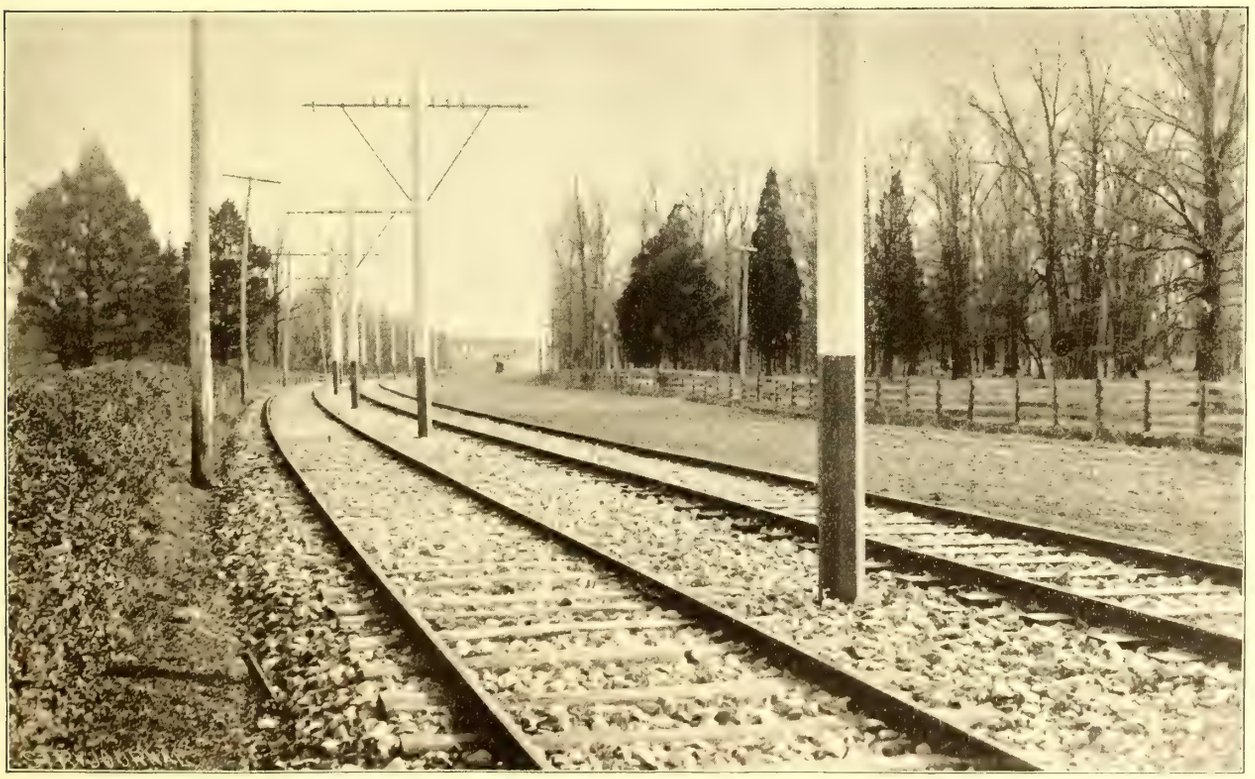


FIG 3.—PIKESVILLE ELECTRIC LINE—BALTIMORE TRACTION CO.

& Fowler and Lamokin cars and Westinghouse equipment are used on this line. Last June the Traction Company purchased the Curtis Bay electric road which commenced operations in May, 1892. This line starts from the lower part of the city and runs across the Patapsco River to Curtis Bay, a manufacturing suburb of considerable importance located about five miles below the city limits on the water front. The Carey Street line of the Traction Company gives this road a city connection and makes it an important link in the system of the company. The Curtis Bay line has its own power plant on the south side of the Patapsco River, consisting of three 250 H. P. McIntosh & Seymour engines and Edison generators, and three 150 H. P. Baschor boilers and two 300 H. P. Climax boilers. Below the city limits this road runs chiefly through a rural section and is laid with fifty-

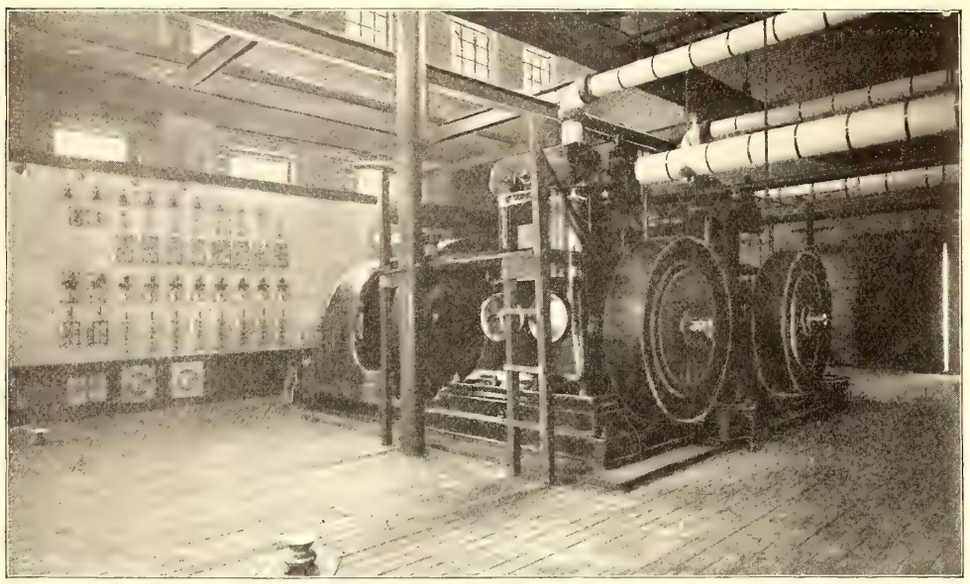


FIG. 4.—CHARLES STREET POWER STATION—BALTIMORE TRACTION CO.



FIG. 5.—JUNCTION OF CABLE LINES—BALTIMORE TRACTION CO.

eight pound T rails. This line has twenty-five sixteen and eighteen foot Lewis & Fowler cars, each with two twenty-five horse power Edison motors.

The Linden Avenue and Huntingdon Avenue lines are two short north and south lines in the center of the city, both of which have been rebuilt and changed to electricity. On both, Johnson eighty pound, six inch, girder rails on two inch chairs, are used. These two lines have Brownell "Accelerator" cars, and, like the other lines which have been equipped by the Traction Company, have Westinghouse apparatus. The Edmondson Avenue line, an important crosstown road, is now being changed to electricity, and its construction and equipment will be the same as the two just mentioned. Starting from the northwestern terminus of the Edmondson Avenue line, the old Powhatan horse railway extends out into the country a distance of about four miles. This is still an example of primitive transit, but its reconstruction in the near future is probable.

On South Charles Street, near the center of the city, the construction of a central station for the electric lines of the company has been commenced, and power is already being furnished from this point for a portion of the system by two 250 H. P., direct-coupled Westinghouse units, to which steam is supplied by two 500 H. P. Climax boilers. This plant will be increased by the addition of a 500 H. P. Westinghouse direct-coupled unit, which is now under construction. The location of this station will enable it to serve conveniently the principal lines of the company, and it has been planned upon a comprehensive scale, although only a portion of the plant is now being installed. When completed this station will have a nominal capacity of 2,000 H. P. In this house there is a magnificent white marble switchboard, 30×12 ft., with a handsome equipment of instruments.

At the corner of Mt. Royal Avenue and McMechin Street, in the upper part of the city, foundations have been laid for a handsome car barn to accommodate the lines embraced in the North Baltimore division of the company, the Linden Avenue, Huntington Avenue and Fremont Street lines. There will be room for about ninety cars.

All of the work done by the Traction Company shows regard for economical operation and long life. Doubtless some of the work could have been done at a considerably less expense, but the policy of the company has been to pay more attention to future economies than to first costs.

THE CENTRAL PASSENGER RAILWAY COMPANY.

The Central Passenger Railway was first put in operation as a horse line in February, 1893. It runs southward from Druid Hill Park on the northwest into the residence portion of the city, and then crosses to East Baltimore, whence it strikes south to the water front. Its entire route is practically through the residence portion of the city without touching the business center, but the communication with the park which it has afforded to a large portion of the population has given it good traffic in addition to its regular crosstown travel. A free transfer arrangement with the Lake Roland road at the intersection of Guilford Avenue and Preston Street gives the road an entrance into the business center of the city, and there is a heavy exchange of business between the two lines. An extension of the line, for which ordinances have been introduced, will carry the tracks from their present eastern terminus to the vicinity of Patterson Park, and thence to the eastern limits of the city.

The change to electricity was made in 1892, regular operation with electric power commencing September 17. This was practically the first road in the city proper to be operated wholly be electricity. When the change was made, the entire road was rebuilt and newly equipped, and the line was extended a mile and a half from its former terminus at Fulton Station to Druid Hill Park. The line now consists of six and a half miles double track. The track is eighty pound, center bearing, Johnson girder rails, spiked to Georgia pine ties, two feet centers. There are several grades of 4 to 6 per cent. on the line, one 6 per cent. grade on Caroline Street in East Baltimore being nearly half a mile in length.

The power station is on Preston Street, about the center of the line. It is an annex to the car barn and former stable. The plant consists of four 250 H. P. McIntosh & Seymour tandem compound engines and four 200 K. W. Thomson-Houston generators. Steam is supplied from four 250 H. P. Campbell & Zell boilers. The plant is very plain and simple, but does its work satisfactorily, often carrying sixty cars. In addition to operating the cars of this road, power is supplied by this plant for a portion of the City & Suburban system.

There are now in service on this road twenty Stephenson cars with McGuire trucks, and ten Brill cars with trucks from the same builders. Two twenty-five horse power Thomson-Houston motors are used for each car. Ordinarily single cars are run, but when traffic demands, trailers are used, ten Stephenson cars that were used on the horse road being utilized for this purpose. The cars of this line are painted an orange color. President Blakistone, of the Central Company, is much interested in the car fender question, and is equipping his cars with a device of his own invention. It is a hooked fender, fastened to the front end of the platform and extending back under the platform. A light board suspended from the front edge of the platform, automatically throws the fender down to the track when struck by any obstruction, or the fender may be thrown down by the motorman. Experiments with this fender have given satisfactory results, and in the single instance in which it has had the test of actual use it has worked successfully.

A New Street Railway Motor.

We show in the accompanying engraving views of a new street railway motor, designed and built by W. E. Moore and R. J. Edenfield, both of Augusta, Ga. It is

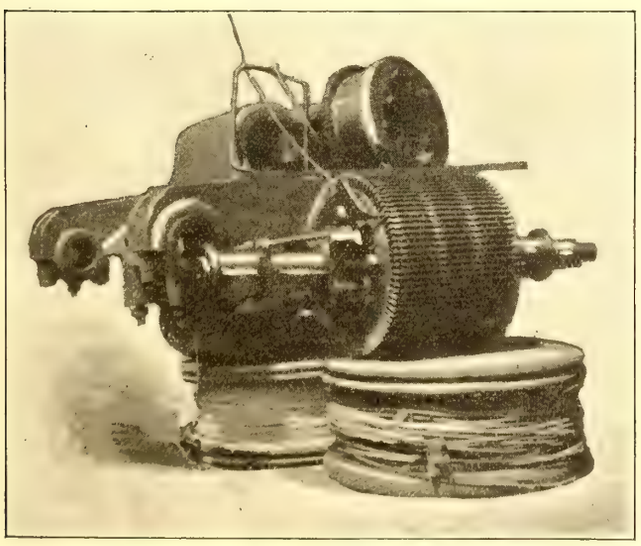


FIG 1.—GENERAL VIEW OF MOTOR AND PARTS.

a six pole, iron clad, single reduction motor of thirty horse power, designed especially with an eye to simplicity and ease of repair. The armature is of the Pacinotti ring type, made very light by reason of the six pole construction, and is wound with a modified drum winding, so arranged that any one coil may be removed without the necessity of removing any of the others. The coils are lathe wound and taped, then laid in place in the slots, each coil being of the same size, and symmetrically arranged with regard to the other coils.

As there are no wires through the inside of the armature, it is left with a very large opening which secures good ventilation and cool running.

The commutator is built in the most substantial style, being twelve inches in diameter, with a four inch face. The bars, which are made of hardened copper one and one fourth inches deep, are bedded on mica, and held by

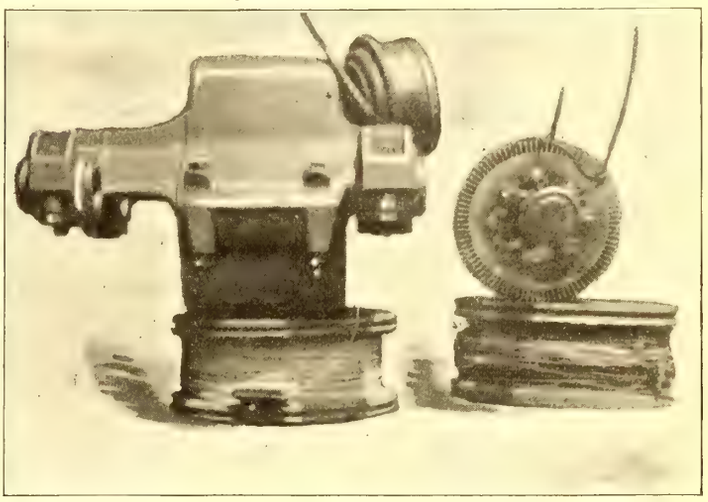


FIG. 2.—END VIEW OF ARMATURE AND MOTOR, SHOWING ONE COIL IN PLACE.

heavy clamps insulated with mica covers for the full depth of the bars, thus making it practically impossible for a bar to work loose or become "high." The attachment of the commutator is secured by four machine bolts fitting in T slots in a projection of the armature spider. This method does away with keys, keyways and loose commutators.

The armature shaft is of steel, two and one sixteenth inches in diameter and is pressed into the bearing sleeves, which are made of hardened steel four and a half inches in diameter by five and a half inches long for pinion end, and four inches long for the commutator end.

The field magnet and frame consists of but two castings, has six poles, three consequent and three salient, and carries three field coils, which are wound with a wire of rectangular section. The lower half of the field magnet

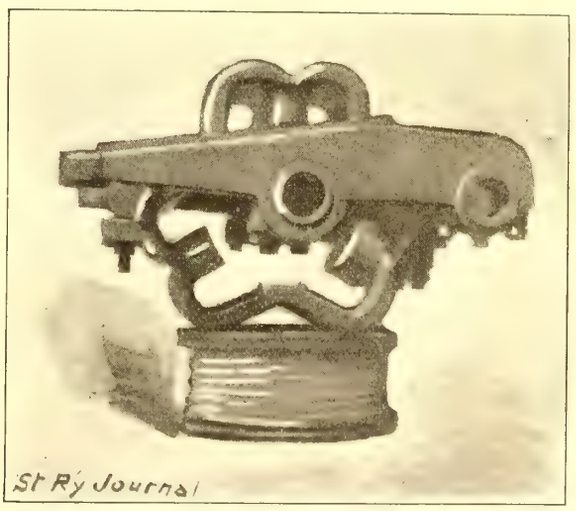


FIG. 3.—SIDE VIEW OF FIELD MAGNET FRAME.

may be swung back on eyebolts out of the way by simply taking off two nuts, thus allowing access to the field coils and armature. The armature may then be lowered into the pit by unscrewing four cap bolts. It is not necessary to remove the brushholders or disconnect any of the cables to get out an armature. The ease of removing the armature and field coils was made an especial study in the design of this motor.

The side arms carrying the armature and axle brasses

are heavily ribbed, have large grease boxes cored in them and are cast integrally with the upper half of the field magnet. Ordinary standard machine bolts have been used throughout, where it has heretofore been customary to use cap screws, so that in case of breakage, it is not necessary to drill and tap out, but is only a minute's work to put in a new bolt. All bolt heads fit into square sockets, and National nut locks are used under the nuts. The brush holders are conveniently located on top of the commutator 60 degs. apart.

The motor is suspended by means of bolts and springs under the ends of the side arms.

The disposition of metal has been carefully studied and the machine made as light as possible (1,725 lbs. without axle gear) consistent with the great strength and rigidity necessary for the rough usage of street railway service.

One of these motors under car No. 21, when running on the hill line, at Augusta, is said to have used 20 per cent. less current than another car equipped with two motors of another make, and 25 per cent. less than a third car equipped with two motors of a still different make, all three cars weighing about the same and making the same trip in about the same time.

Street Car Fenders.

By Henry Root, San Francisco, Cal.

The form of the front of the modern cable and electric car is the outgrowth of two things, viz: The pilot or cow catcher of the locomotive, and the dashboard of the horse car; but the essential requirements of a modern cable or electric car are different from either. The controlling consideration in the design of the front of such a car should be the safety to life and limb of the general public, who lawfully occupy and use the public streets in common with the street car companies, and not the safety of the motor, grip car or engine, which the pilot or cow-catcher was designed especially to protect. Again in the cable and electric car there is no need of the dashboard for the purpose of protection from the splash of animals travelling in front and drawing the car; its changed purposes are to form a safely rail to prevent people falling off the front of the car, to form the most complete, strong, and impenetrable barrier from without against the poles and other projecting parts of vehicles and their loads, also against telescoping with other cars in case of an accidental collision; but further than this the front should be of such a form and construction as to do the least possible harm to persons not passengers who might be accidentally struck by the moving car, or dragged or pushed along the ground, or run over and crushed beneath the wheels and running gear. In this respect there is certainly a chance for improvement in a majority of cases, but in my opinion the desired improvement is not so much a subject for future invention as for good judgment and mechanical skill in utilizing and adapting to local requirements and conditions what has already been invented.

There was a season here in San Francisco, some ten years ago, while the fender invention fever was on, that it seemed as if every one who had nothing else to do, no matter how little he knew of the requirements of such a device, took to designing street car fenders. Some persons had their inventions patented, but others applied to the railroad companies for a trial; not meeting with the encouragement they thought themselves entitled to, or finding that what they had invented was already old, allowed their inventions to drop out of sight. The work of the great majority of inventors in that line at the present time is merely thrashing over old straw.

There is a large number of patented revolving fenders for similar purposes, having a "street sweeper movement," but the earlier ones of this kind were designed from the locomotive pilot, and for such a purpose were a total failure. I saw one of that kind used here on a street car about ten years ago; while it would throw obstructions off the track, it raised a cloud of dust under the car and was a nuisance generally; however, I think its speed of rotation was too great, and it might have been improved.

There was a novel suggestion at that time, in connection with the fender question, which was to cover the entire front end with an inflated rubber bag. I am confident that a fender of the Bennett & Fitch or Loftis kind, illustrated in the December, 1893, issue of the Street Railway Journal is practical. I believe it will come into general use, especially where it is impossible to carry a fixed fender less than four or five inches from the surface, as in cases where it is necessary to attach it to the vibrating spring body. It does not seem as if any device operated by hand from the front of the car can prove as effective and certain as a fixed or automatically operated device, for the reason that in a majority of cases it is impossible for the operator to anticipate which way a person will dodge, as people thrust themselves into danger suddenly and without warning and appear at the most unexpected times and places. There are a few general ideas in the matter, which I believe should be followed, and of the importance of which I am fully convinced.

First.—That the front of the car as well as the fender itself, should be free from all projecting irons; that the corner should be rounded and padded as well as the drawhead.

Second.—There should be a small ledge or step projecting forward at the bottom of the fender and as near the surface of the ground as possible, even if its horizontal width is not more than three inches; that the front or projecting edge of this ledge should be soft wood, either padded or covered with rubber; and furthermore that any fender sloping from its lower edge upward and backward without any ledge step or horizontal belt near the ground to prevent bodies rolling off, if once picked up, is radically and essentially wrong.

Third.—That the front should be nearly at right angles to the track, and not V shaped like the outline of the locomotive pilot. There is more danger of injury to a body in rolling it towards the sides and wheels than directly ahead; the purpose, however, should be to pick up the body unharmed and not roll it at all; suitable soft handles should be provided across the front and on the corners to enable persons in danger to catch hold and save themselves, as they can sometimes do.

The most desirable plan seems to be to carry the fender from solid boxes, either from the bottoms of the main axle boxes or from inside boxes specially provided for that purpose, and not from the spring body, which is necessarily subjected to a large movement through the effect of variable and badly distributed loads, but in some cases it may be desirable to have a double fender, one attached to the axle boxes, the other to the spring body. In case the fender is under the front end, care should be taken to have no projecting bolt points or brake rods over the fender, as they might injure a prostrate body.

It seems to me impracticable to use any of the long, scooping devices which have been invented during the past twelve years.

It is very difficult to prevent cars from closing up to each other; if in so doing the safety guard is in jeopardy, it is a vital defect; furthermore, a large device extending any considerable distance ahead is almost certain to be damaged by some cause or other in the course of a day's run; the more iron hollow pipes or wire nettings are used in such a device, the more obstinate and unmanageable it becomes in case of any slight injury to it. The so-called improvement in substituting iron, steel and wire netting for wood for such purposes is frequently, if not generally, a step backward.

Eighth Annual Meeting of the International Street Railway Association.

The eighth annual meeting of the International Street Railway Association, which includes among its members the principal street railway managers of France, Germany, Italy, Belgium, Holland, Austria, etc., will be held at Cologne, August 25 to 30, 1894.

THE INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS.*

BY EDWARD E. HIGGINS.

THIRD PAPER.

Class III. b. Surface Railways in American Cities of from 35,000 to 50,000 Inhabitants.

There are thirty-one cities in the United States having a population of from 35,000 to 50,000 by the census of 1890. Twenty are in the Eastern States, five in the Western, three in the Central, and three in the Southern. The total track mileage now exceeds 1,000, of which 75 per cent. is operated by electricity, 13 per cent. by horses, and the balance by various systems of motive power.

Eighteen of these cities are represented in the Table of Statistics, although but twelve appear in the class now under consideration, the population of two cities with their suburbs exceeding 50,000, while four are connected with metropolitan systems so that their statistics cannot be given separately. Of the remaining thirteen, one is a purely residential city, having an insignificant local street railway system; one has undergone so many changes during the past three years that its statistics are of little value; and the statistics of the remaining eleven cannot be obtained in a sufficiently complete form for present purposes. Two cities of less than 35,000 inhabitants are also represented in the table, being brought into this class by reason of the added population of their suburbs.

At the end of the various fiscal years ending in 1890, six of the fourteen systems represented in the table were in operation wholly by horses, one was operating wholly by electricity, six were changing from horses to electricity, and one was operating partly by horses and partly by steam. At the end of the fiscal year of 1892 nine systems were in substantially complete operation by electricity, three by horses, and two were in process of change from horses to electricity. In 1890 141 miles of track were in operation by horses as against but 85 miles by electricity, while in 1892 221 miles were operated by motive powers other than horses as against but 70 miles by horses.

The fact that a majority of these systems were changing from horses to electricity as early as 1890 makes it impossible to discuss their characteristics by the methods hitherto adopted. They can best be treated by separating them into three groups based on the maximum gross earning power per capita developed up to 1892. The first group contains two systems only, which have earned less than $2.00 per capita per annum, the second group contains four which have earned between $2.00 and $3.00 per capita, and the third group contains seven which have earned over $3.00 per capita.

DISCUSSION OF TWO SYSTEMS SHOWING A PASSENGER INCOME LESS THAN $2.00 PER CAPITA PER ANNUM.

The small earning power of these two systems is easily explained. Case No. 72 operated 6 miles by horses in 1890, and 7 miles by electricity in 1892, serving a manufacturing city of 40,000 inhabitants with from 3 to 5 car miles per capita per annum. The street mileage is below the average for a city of this size, and the car service is of course much too small for large passenger income. Nevertheless, this road earned about $7,000 net in both 1890 and 1891 with horse operation, and nearly $28,000 in 1892 with electric, equivalent to a return of 14 per cent. on both the old capitalization ($7,600 per mile of track), and the new ($25,000 per mile of track). It is possible, therefore, that this road has profited by not following the prevailing fashion of pushing out extensions and greatly increasing the service when equipping by electricity.

Case No. 66 is a 9 mile horse railway serving a country district tributary to a manufacturing town of 27,000 population. It is a question if this case is not, strictly speaking, an interurban road. A service of less than 5 car miles per capita produced an income of $6,800 per mile of street, $.33 per car mile (due in part to ten cent fares between the towns), and $1.90 per capita. The operating expenses in 1890 were 83 per cent. of the passenger income, but in the following year rose to 97 per cent. and again fell in 1892 to 89 per cent. The corresponding net income was equivalent to a return of but 7 per cent., 3 per cent. and 6 per cent. in the respective years on capital liabilities of less than $10,000 per mile of track. This road is now being largely extended and equipped by electricity, and will doubtless show a marked increase in both gross and net earnings.

DISCUSSION OF FOUR SYSTEMS SHOWING A PASSENGER INCOME OF BETWEEN $2.00 AND $3.00 PER CAPITA.

It is at once noticeable that three of these four systems serve cities of 35,000 population—the smallest of the class now under consideration—while the fourth serves 49,000—the largest.

Case No. 65, as a horse railway in 1890, operated 11 miles of road and gave a car service of 22 miles per capita. Its passenger earnings were $7,100 per mile of street, $.096 per car mile, and $2.16 per capita, figures which correspond very well with several roads described in the preceding class. Its operating expenses were 91 per cent. of the passenger income and its net earnings were less than $7,000, equivalent to 1.4 per cent. on capital liabilities of $34,500 per mile of track, a part of which may possibly represent the unexpended balance of moneys obtained for change of motive power.

Case No. 68 is a much better horse railway statement. With but 7 miles of road and with a car service of 14 miles per capita, it earned somewhat more than Case No. 65, and operated at 81 per cent. of the passenger income, so that the net earnings were over $16,000, equivalent to nearly 5 per cent. on capital liabilities of $41,000 per mile of track. This is an excellent showing, and tends to confirm the evidence previously given that it is frequently unwise for these small roads to largely increase their track and car mileage.

Case No 69 is in some respects peculiar. It serves an exceedingly compact city of 35,000 inhabitants, the business district of which is centrally located both as to population and area. In 1889–90 the system consisted of five horse roads and one small electric road. The horse roads were miserably constructed and were operated in a poor and "shiftless" manner. The fact that there were 21 miles of road in the city means little when the conditions are understood. For example, one road 5 miles in length was operated by an individual owner with but a single car, of which he was himself the driver, while others were leased to parties who had no interest in keeping the property in good condition. Little reliance is to be placed on the figures of operating expenses and net earnings in 1890, but in 1892 they are believed to be correct. This system is now (1894) serving a population of over 40,000, is operated entirely by electricity, and is earning about $2.50 per capita gross.

Case No. 78 is a reasonably capitalized and thoroughly well managed property. As a horse road its passenger income was fair on a moderate car service; it operated for 75 per cent. of the passenger income, and earned 10.5 per cent. on capital liabilities of $21,000 per mile of track. As an electric road it has not yet reached its full development, but is even now earning $8,500 per mile of street and $2.76 per capita, is operating at 75 per cent. of the passenger income and returns 12.3 per cent. on capital liabilities of less than $17,000 per mile of track. It should be noted, however, that its present floating debt is equal to about $17,000 per mile of track in addition to

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TABLE III.—AMERICAN STREET RAILWAY SYSTEMS

PART I.—STATISTICS OF CAPITALIZATION.

See "Intrinsic Value of Street Railway Investments." Horse Railways are given in Roman figures.

Case Number	Miles of Track					Miles of Street	Capital Stock			Funded Debt			Capital Liabilities			Floating Debt		Case Number
	Horse	Electric	Cable	Miscel.	Total		Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Memo.	
A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T
65	13.9	.....	.....	.....	13.9	10.6	330,000	23,700	9.40	150,000	10,800	4.30	480,000	34,500	13.70	.....	.....	65
	2.0	*19.5*	.....	.....	*21.5*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
66	14.0	.....	.....	.....	14.0	8.9	144,000	10,300	4.10	.....	.....	.....	144,000	10,300	4.10	s 9,028	Net.	66
	15.0	.....	.....	.....	15.0	9.8	144,000	9,600	4.10	.....	.....	.....	144,000	9,600	4.10	10,858	"	
67	*2.4*	*11.5*	.....	*8.0*	*21.9*	*19.2*	*234,467*	*10,700*	*6.70*	*69,700*	*3,200*	*2.00*	*304,167*	*13,900*	*8.70*	.....	.....	67
	.....	*15.0*	.....	*8.0*	*23.0*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
68	8.4	.....	.....	.....	8.4	7.2	150,000	17,900	4.30	192,500	23,000	5.50	342,500	40,800	9.80	.....	.....	68
	9.0	.....	.....	.....	9.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
69	17.4	5.0	.....	.....	22.4	21.3	175,696	7,900	5.00	153,051	6,800	4.40	328,747	14,700	9.40	18,852	Net.	69
	12.5	*13.0*	.....	.....	*25.5*	*23.1*	*266,519*	*10,500*	*7.60*	*200,000*	*7,800*	*5.70*	*466,519*	*18,300*	*13.30*	*27,910*	"	
70	14.6	.....	.....	.....	14.6	11.3	200,000	13,700	5.60	.....	.....	.....	200,000	13,700	5.60	28,851	Net.	70
	14.6	.....	.....	.....	14.6	11.3	200,000	13,700	5.60	.....	.....	.....	200,000	13,700	5.60	74,778	"	
71	13.7	4.5	.....	.....	18.2	14.1	195,000	10,700	7.20	150,000	8,200	5.60	345,000	19,000	12.80	17,615	Net.	71
	4.3	*26.2*	.....	.....	*30.5*	*23.3*	*335,000*	*11,000*	*9.10*	*355,000*	*11,600*	*9.60*	*690,000*	*22,600*	*18.60*	*191,522*	"	
72	6.6	.....	.....	.....	6.6	5.9	50,000	7,600	1.30	.....	.....	.....	50,000	7,600	1.30	15,025	Net.	72
	.....	*8.0*	.....	.....	*8.0*	*7.1*	*200,000*	*25,000*	*5.00*	.....	.....	.....	*200,000*	*25,000*	*5.00*	*943*	"	
73	*10.0*	*13.0*	.....	.....	*23.0*	*11.3*	*567,600*	*24,700*	*13.90*	*240,000*	*10,400*	*5.90*	*807,600*	*35,100*	*19.70*	.....	.....	73
	.....	*37.0*	.....	.....	*37.0*	.....	*852,000*	*23,000*	*20.80*	*450,000*	*12,200*	*11.00*	*1,302,000*	*35,200*	*31.80*	.....	.....	
74	.....	*18.0*	.....	.....	*18.0*	*16.0*	*400 000*	*22,200*	*9.80*	*200,000*	*11,100*	*4.90*	*600,000*	*33,300*	*14.60*	*253*	Net.	74
	.....	*22.0*	.....	.....	*22.0*	*18.5*	*700,000*	*31,800*	*17.10*	*315,000*	*14,300*	*7.70*	*1,015,000*	*46,100*	*24.80*	*59,291*	"	
75	16.1	.....	.....	.....	16.1	13.3	260,000	16,100	6.30	93,000	5,800	2.30	353,000	21,900	8.60	12,591	Net.	75
	12.8	3.8	.....	.....	16.6	13.8	260,000	15,700	6.30	100,000	6,000	2.40	360,000	21,700	8.80	30,303	"	
76	15.0	.....	.....	12.0	27.0	25.0	60,000	2,200	1.40	450,000	16,700	10.50	510,000	18,900	11.90	.....	.....	76
	.....	*37.3*	.....	*4.0*	*41.3*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
77	*3.1*	*8.0*	.....	.....	*11.1*	*18.5*	*199,000*	*17,900*	*4.50*	*575,900*	*51,800*	*13.10*	*774,900*	*69,800*	*17.60*	*71,429*	Net.	77
	.....	*11.1*	.....	.....	*11.1*	*18.5*	*201,500*	*18,200*	*4.60*	*639,500*	*57,700*	*14.60*	*841,000*	*75,800*	*19.10*	*26,759*	"	
p 78	5.5	5.2	.....	.....	10.7	10.3	225,000	21,000	4.60	.....	.....	.....	225,000	21,000	4.60	6,237	Net.	p 78
	.....	z *16.5*	.....	.....	z *16.5*	*15.8*	*274,988*	*16,700*	*5.60*	.....	.....	.....	*274,988*	*16,700*	*5.60*	*265,622*	"	

s. Current assets exceed current liabilities. z. Approximate. p. This report does not include one insignificant horse road.

the capital liabilities, so that the true capitalization is about $34,000 per mile of track. The road will probably earn from 8 to 10 per cent. on this capitalization.

DISCUSSION OF SEVEN SYSTEMS SHOWING A PASSENGER INCOME OF OVER $3.00 PER CAPITA.

It is a pleasure to turn to the seven systems of this group, not only because they represent the highest development of the street railway industry yet encountered, but also because it is clear that we are coming "out of the woods" and into a region of values sufficiently large to be attractive to investors. It is with special interest, therefore, that we study the characteristics of these seven systems.

The passenger income of five of the seven ranges from $150,000 to $175,000; the sixth serves a city of 36,000 inhabitants and probably earned in 1892 not less than $145,000 with horses, equivalent to over $4.00 per capita; and the seventh, which serves a comparatively unimportant Western city of 41,000 inhabitants, earned $136,000, equivalent to $3.32 per capita. Two of the seven roads report earnings in 1890 only, and their 1892 figures doubtless considerably exceed those of 1890, especially Case No. 76, which was operated by horses and steam power in 1890 and by electricity in 1892. All these totals are good. It is especially gratifying to find that the largest earnings per capita were made by a system serving only 37,000 inhabitants, 10,000 of whom were in small townships tributary to a brisk manufacturing city of 27,000 inhabitants. The cause of this is partly found in the large street mileage (23) and good car service, but it is also true that the factories of this city are exceptionally prosperous, pay good wages to their employes and have fewer "poor seasons" than is found in most industries. Another city system serving but 36,000 inhabitants—Case No. 70—earns over $4.00 per capita, being the commercial metropolis of an important state.

The street mileage of nearly all of these roads is much in excess of the others of the class, and points to one cause of their greater prosperity. The population per mile of street of five of the seven roads ranges from 2,500 to 3,600, and of the other two is about 1,700. The roads are giving a service of from 14 to 19 car miles per capita, one road operating 27 miles per capita.

The roads operating the largest street mileage are earning from $7,500 to $8,000 per mile of road, while those operating from 11 to 14 miles are earning from $12,000 to $14,000 per mile. Three roads are earning from $.25 to $.30 per car mile, two from $.15 to $.20 and one (1890) but $.11.

Again we find that the horse roads in 1890 are operating at very nearly 80 per cent. of the passenger income. The electric roads appear to do somewhat better, the percentage of operating expenses ranging from 70 to 78. Case No. 73 shows operating expenses of but $.076 per car mile equivalent to 51 per cent. of the passenger income, but however true this showing may have been in 1890, this low percentage of operating expenses cannot

SERVING FROM 35,000 TO 50,000 POPULATION.

PART II.—STATISTICS OF OPERATION.

Electric, Cable and Steam Railways are given in italics.

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Case Number	Population Served	Area	Population Per Mile Street	Population Per Square Mile	Year Ending	Car Mileage Total	Car Mileage Per Capita	Passenger Income Total	Passenger Income Per Mile Street	Passenger Income Per Car Mile	Passenger Income Per Capita	Operating Expenses Total.	Operating Expenses Per Car Mile	Operating Expenses % Passenger Income	Net Earnings Total	Net Earnings Per Car Mile	Net Earnings % Passenger Income	Net Earnings % Cap. Liab.	Case Number
a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u
65	35,000	....	3,300	.....	6-30-1890	785,264	22.4	75,463	7,100	.096	2.16	68,771	.088	91.1	6,692	.009	8.9	1.4	65
	.....	....	.....	.....	8- 1893	.....	.....	.....	.....	.....	.....	.....	...	.....	.....	....	.....	.....	
66	35,000	....	3,900	.....	9-30-1890	166,291	4.7	56,802	6,400	.342	1.62	47,348	.285	83.3	10,378	.062	18.3	7.2	66
	35,000	....	3,600	.....	9-30-1892	201,040	5.7	66,275	6,800	.330	1.90	58,817	.293	88.7	8,860	.044	13.4	6.2	
67	*35,000*	....	*1,800*	.....	*6-30-1890*	*586,900*	*16.8*	*105,564*	*5,500*	*.181*	*3.03*	.....	.....	.....	.....	.....	.....	.....	67
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
68	35,000	....	4,900	.....	6-30-1890	481,800	13.8	80,229	11,100	.166	2.29	65,316	.135	81.4	16,532	.034	20.7	4.8	68
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
69	35,000	....	1,600	.....	6-30-1890	.....	.....	48,491	2,300	....	1.39	38,863	....	80.2	9,630	....	19.9	2.9	69
	35,000	....	*1,500*	.....	*6-30-1892*	.....	.....	*84,179*	*3,600*	....	*2.41*	*59,500*	....	*70.7*	*26,030*	....	*30.9*	*5.6*	
70	36,000	....	3,200	.....	9-30-1890	432,603	12.0	136,011	12,000	.314	3.77	112,330	.258	82.4	26,324	.061	19.3	13.2	70
	36,000	....	3,200	.....	9-30-1891	.....	.....	140,751	12,500	....	3.92	125,691	....	89.4	16,760	....	11.9	8.4	
71	27,000	....	1,900	.....	9-30-1890	416,853	15.4	102,647	7,300	.247	3.81	81,364	.195	79.0	22,735	.054	22.0	6.6	71
	37,000	....	*1,600*	.....	*9-30-1892*	*690,296*	*18.6*	*174,484*	*7,500*	*.252*	*4.70*	*128,310*	*.186*	*73.6*	*48,734*	*.071*	*28.0*	*7.1*	
72	40,000	....	6,800	.....	9-30-1890	125,182	3.1	33,885	5,700	.271	.85	27,541	.220	81.1	7,170	.057	21.2	14.3	72
	40,000	....	*5,600*	.....	*9-30-1892*	*186,445*	*4.7*	*64,614*	*9,100*	*.347*	*1.62*	*37,380*	*.201*	*57.9*	*27,607*	*.148*	*42.7*	*13.8*	
73	*41,000*	....	*3,600*	.....	n	*1,104,000*	*26.8*	*164,913*	*14,600*	*.150*	*4.02*	*83,746*	*.076*	*50.7*	*83,643*	*.076*	*50.7*	*10.3*	73
	41,000	....	.....	.....	*1893*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
74	*41,000*	....	*2,600*	.....	*6-30-1890*	*688,025*	*16.8*	*74,604*	*4,700*	*.108*	*1.82*	*49,098*	*.071*	*65.8*	*26,049*	*.038*	*34.9*	*4.3*	74
	41,000	....	*2,200*	.....	*6-30-1892*	.....	.....	*136,207*	*7,400*	....	*3.32*	*97,414*	....	*71.6*	*39,079*	....	*28.8*	*3.8*	
75	41,000	....	3,100	.....	9-30-1890	538,829	13.1	143,000	10,800	.265	3.49	116,702	.217	81.8	29,021	.054	20.3	8.2	75
	41,000	....	3,000	.....	9-30-1892	569,135	13.9	167,871	12,200	.295	4.10	130,491	.228	77.4	38,981	.069	23.2	10.8	
76	43,000	....	1,700	.....	6-30-1890	815,400	19.0	157,488	6,300	.193	3.65	129,844	.160	82.8	29,804	.037	19.0	5.8	76
	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
77	*44,000*	....	*2,400*	.....	*6-30-1890*	.....	.....	*128,963*	*7,000*	....	*2.93*	*91,862*	....	*71.2*	*22,298*	....	*17.3*	*2.9*	77
	44,000	....	*2,400*	.....	*6-30-1892*	.....	.....	*151,674*	*8,200*	....	*3.45*	*117,810*	....	*77.6*	*19,758*	....	*13.0*	*2.3*	
p 78	49,000	....	4,800	.....	6-30-1890	667,510	13.6	94,410	9,200	.141	1.93	70,676	.106	74.9	o 23,734	.035	25.1	10.5	p 78
	49,000	....	*3,100*	.....	*6-30-1892*	.....	.....	*135,060*	*8,500*	....	*2.70*	*100,169*	....	*74.1*	" *34,891*	....	*25.8*	*12.3*	

n. Fiscal years of the several roads end at different dates. o. From operation.

possibly be maintained under the conditions set forth in the statistics. The operating expenses per car mile in this class as in the others so far discussed are so widely different as to make it evident that no generalizations can yet be made on these figures, where so many diverse influences are at work to affect results.

We note with satisfaction that the net income of six of these systems ranges from $20,000 to $50,000, with the seventh (Case No. 73 previously referred to) showing $84,000. The net is now becoming sufficiently large to make it possible for these roads to secure good managers at a fair compensation, and thereby avoid many of the disasters which befall small properties from lack of careful and conservative handling.

Coming now to returns upon investment, we find that two of the roads have capital liabilities of $14,000 and $19,000 per mile of track respectively, and that their net earnings are equivalent to a return of from 6 to 13 per cent. upon these liabilities. Two roads are capitalized at about $21,000 per mile of track, and are earning 7 and 11 per cent. respectively upon the capital liabilities. Case No. 73 is capitalized at $35,000 per mile of track and is *apparently* earning 10 per cent. on these liabilities, but, as previously stated it is probably impossible for this road to keep up so large an earning power. Case No. 74 is capitalized at $46,000 per mile of track and is earning about 4 per cent. on these liabilities, and case No. 77 is earning but 2.3 per cent. on a capitalization of $76,000 per mile of track, and is now in the hands of a receiver because of default on the interest of its bonds.

DISCUSSION OF SIX ROADS OPERATING CHIEFLY BY HORSES IN 1890 AND BY ELECTRICITY IN 1892.

There are four fully reported systems in this class which were in operation partly by horses and partly by electricity as early as 1890; one which was in operation by horses only; and one by electricity only. In 1892 the process of conversion to electricity was substantially completed in four of the six systems, the fifth operated 26 miles by electricity and 4 miles by horses, and the mileage of the sixth was nearly evenly divided between the two motive powers. It is evident, therefore, that these roads were partially developed in 1890 and had not, in 1892, reached the full measure of their earning power. The returns for 1893 or 1894 would doubtless show a much greater increase, in both gross and net earnings, over those of 1889, than is shown in comparing the report of 1892 with that of 1890. Nevertheless, the last named comparison is decidedly interesting and in most respects satisfactory.

The total track mileage was increased from 87 (46 horse, 41 electric) in 1890, to 114 (17 horse, 97 electric) in 1892. The funded debt in 1890 was $12,400 per mile of track and in 1892 only $13,200, while the total capital liabilities which were $26,700 in 1890 were $30,600 in 1892. This average capitalization is not excessive, though above

the actual cost of duplicating tangible assets. It should be noted that the floating debt in 1890 was $129,000 and in 1892, $572,000. It is probable that the latter will be converted into funded debt later on.

The passenger income of these six roads in 1890 was $483,000, equivalent to $5,600 per mile of street and $2.00 per capita. The passenger income in 1892 was $746,218, equivalent to $7,000 per mile of street and $2.97 per capita, an increase of 54 per cent.

The operating expenses in 1890 were 74.3 per cent. of the passenger income, and in 1892, 72.5 per cent. It is probable that the returns of the following year would show some reduction of this percentage by reason of more complete electric operation.

The net income in 1890 was $121,616, and in 1892 $196,099, an increase of 61 per cent. The return on the capital liabilities was very nearly the same, being 5.3 per cent. in 1890 and 5.6 per cent. in 1892. Here again the following year will doubtless show more favorable results.

GENERAL CONCLUSIONS.

1. American cities of from 40,000 to 50,000 inhabitants will usually patronize a well managed electric street railway system 12 to 18 miles in length to the extent of from $3.50 to $4.50 per capita of passenger income. One or two Western cities of this size are earning over $5.00 per capita gross on exceptionally large street and car mileage.

2. If it were possible to construct these electric railway properties anew, according to the best engineering practice of the present day, they could be operated in most cases at from 70 to 75 per cent. of the passenger income. Unfortunately, however, many of the roads have purchased early or inferior apparatus and material, and the operating expenses cannot be kept down to these figures, but will probably average at least 80 per cent. of the passenger income.

3. Under the most favorable conditions of operation a net earning power of about $1.00 per capita is a reasonable expectation of profit, but $.75 per capita is, and will be, a more usual figure.

4. $.75 per capita is a return of 5 per cent. per annum on capital liabilities of $15.00 per capita, and of 7.5 per cent. on capital liabilities of $10.00 per capita, the latter figure representing about the average cost of building and equipping electric railway systems of from 12 to 18 miles in length in cities of this size. $1.00 per capita—which represents the approximate net earning power of a *perfectly constructed and equipped* street railway system in cities of this size—is equivalent to a 10 per cent. return upon the actual cost of its construction (apart from franchises), and it may be said, therefore, that the electric railway properties of this class are *intrinsically* 10 per cent. investments.

5. Only two or three of the properties represented in the table appear to be overcapitalized according to the standard of a 5 per cent. return on both capital stock and funded debt, although many have been overcapitalized on the basis of cost of duplicating the tangible assets.

It must be understood that all of these deductions are of the most rough and general character, and cannot be applied to individual cases without careful study of local conditions.

STREET RAILWAY INVESTMENT COMPANIES.

It may not be out of place to point out the fact that in dealing with these small roads whose comparatively petty issues of securities are not readily marketable, "Traction Companies" or "Street Railway Investment Companies" find a legitimate and profitable field when honestly and conservatively managed. Few bankers care to handle a $100,000 bond issue, not only because the expenses, time and trouble involved are nearly as great as in much larger transactions, but also because the results from mismanagement of such properties, located, as they frequently are, far away from the financial centers, are more serious than will be the case in larger systems where the margin of profit is not so easily destroyed. There would consequently be a true advantage in organizing a company for the purchase of the entire bond and stock issues of a number of these small roads after careful expert examination of each property, and for the exercise of a sharp supervision over their managements by means of a permanent representation on their boards of directors. The bond issues placed in trust would serve as security for the issue by the Investment Company of collateral trust bonds at low rates of interest. The purchasers of these collateral trust bonds would, therefore, average their risks over a larger number of underlying securities, and would have, in addition, the guarantee of the Investment Company, backed by its credit and capital stock. It is true that investment companies of this character formed in recent years to purchase as collateral real estate mortgages as well as various stock and bond issues have been somewhat discredited in conservative investing circles. This is due, however, not to any theoretical imperfection of the system, but to the gross mismanagement of many of such companies which has been shown especially in the purchase of "cats and dogs" as underlying securities for the collateral trust bonds.

The usual table follows, presenting in convenient form for study the principal information about the systems of this class represented in the Table of Statistics.

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 35,000 TO 50,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
MILES OF TRACK.				
No. of miles operated	140.7	85.2	70.2	221.4
FUNDED DEBT PER MILE OF TRACK.				
No. of miles not reporting	....	....	9.0	85.8
" " having no funded debt	45.9	....	29.6	24.5
" " " an indebtedness less than $5,000 per mile	.....	21.9	....	.....
" " " " " from $ 5,000 to $10,000 "	56.7	....	16.6	25.5
" " " " " " 10,000 to 15,000 "	13.9	41.0	....	89.5
" " " " " " 15,000 to 20,000 "	27.0	....	....	.....
" " " " " " 20,000 to 30,000 "	8.4	....	....	.....
" " " " " " 30,000 to 50,000 "	.....	....	....	.....
" " " " " over 50,000	.....	11.1	....	11.1
CAPITAL LIABILITIES PER MILE OF TRACK.				
No. of miles not reporting	....	....	9.0	85.8
" " capitalized at less than $10,000 per mile	6.6	....	15.0	.....
" " " at from $10,000 to $ 15,000 "	51.0	21.9	14.6	.....
" " " " 15,000 " 20,000 "	45.2	....	....	42.0
" " " " 20,000 " 30 000 "	26.8	....	16.6	38.5
" " " " 30,000 " 40,000 "	13.9	41.0	....	37.0
" " " " 40,000 " 50,000 "	8.4	....	....	22.0
" " " " 50,000 " 76,000 "	.....	11.1	....	11.1
POPULATION SERVED PER MILE OF STREET.				
No. of roads not reporting	....	....	1	4
" " serving less than 2,000 inhabit. per mile	3	1	....	2
" " " from 2,000 to 3,000 " "	.....	2	....	2
" " " " 3,000 " 4,000 " "	4	1	3	1
" " " " 4,000 " 5,000 " "	2	....	....	.....
" " " " 5,000 " 6,000 " "	.....	....	....	1
" " " " 6,000 " 8,000 " "	1	....	....	.....
CAR MILEAGE PER CAPITA.				
No. of roads not reporting	1	1	2	8
" " giving a service of less than 5 car miles per capita	2	....	....	1
" " " " of from 5 to 10 " " "	.....	....	1	.....
" " " " " 10 " 15 " " "	4	....	1	.....
" " " " " 15 " 20 " " "	2	2	....	1
" " " " " 20 " 25 " " "	1	....	....	.....
" " " " over 25 " " "	.....	1	....	.....
PASSENGER INCOME.				
No of roads not reporting	....	....	1	4
" " earning less than $50,000 gross per annum	2	....	....	.....
" " " from $50,000 to $75,000 gross per annum	1	1	1	1
" " " " 75,000 " 100,000 " "	3	....	....	1
" " " " 100,000 " 125 000 " "	1	1	....	.....
" " " " 125,000 " 150,000 " "	2	1	1	2
" " " " 150,000 " 200,000 " "	1	1	1	2
PASSENGER INCOME PER MILE OF STREET.				
No. of roads not reporting	....	....	1	4
" " earning less than $3,000 per mile	1	....	....	.....
" " " from $3,000 to $ 5,000 per mile	.....	1	....	1
" " " " 5,000 " 6,000 "	1	1	....	.....
" " " " 6,000 " 7,000 "	2	....	....	.....
" " " " 7,000 " 8,000 "	2	1	1	2
" " " " 8,000 " 9,000 "	.....	....	....	2
" " " " 9,000 " 10,000 "	1	....	....	1
" " " " 10,000 " 15,000 "	3	1	2	.....
PASSENGER INCOME PER CAR MILE.				
No. of roads not reporting	1	1	2	8
" " earning less than 10 cents per car mile	1	....	....	....
" " " from 10 to 15 " " "	1	1	....	....
" " " " 15 " 20 " " "	2	2	....	.....
" " " " 20 " 25 " " "	1	....	....	.....
" " " " 25 " 30 " " "	2	....	1	1
" " " " 30 " 35 " " "	2	..	1	1

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 25,000 TO 35,000 POPULATION.

	1890.		1892.	
	Horse.	E. C. M.	Horse.	E. C. M.
PASSENGER INCOME PER CAPITA.				
No. of roads not reporting	....	....	1	4
" " earning less than $1.50 per capita	2	....	....	....
" " " from $1.50 to $2.00 per capita	2	1	1	1
" " " " 2.00 " 2.50 "	2	1	1	1
" " " " 2.50 " 3.00 "	....	....	....	....
" " " " 3.00 " 3.50 "	1	1	....	2
" " " " 3.50 " 4.00 "	3	....	1	....
" " " " 4.00 " 4.50 "	....	1	1	....
" " " " 4.50 " 5.00 "	....	....	....	1
OPERATING EXPENSES PER CAR MILE.				
No. of roads not reporting	1	2	2	8
" " operating at less than 10 cents per car mile	1	2	....	....
" " " from 10 to 15 cents per car mile	2	....	....	....
" " " " 15 " 20 " "	2	....	....	1
" " " " 20 " 25 " "	2	....	1	1
" " " " 25 " 30 " "	2	....	1	....
PERCENTAGE OF OPERATING EXPENSES.				
No. of roads not reporting	....	1	1	4
" " operating at less than 60 % of pass. income	....	1	....	1
" " " from 60 to 65 % of pass. income	....	....	....	....
" " " " 65 " 70 % " "	....	1	....	....
" " " " 70 " 75 % " "	1	1	....	4
" " " " 75 " 80 % " "	1	....	1	1
" " " " 80 " 85 % " "	7	....	....	....
" " " " 85 " 90 % " "	....	....	2	....
" " " " 90 " 95 % " "	1	....	....	....
NET EARNINGS.				
No. of roads not reporting	....	1	1	4
" " earning less than $7,500 net	2	....	....	....
" " " from $7,500 to $10,000 net	1	....	1	....
" " " " 10,000 " 15,000 "	1	....	....	....
" " " " 15,000 " 20,000 "	1	....	1	1
" " " " 20,000 " 30,000 "	5	2	....	2
" " " " 30,000 " 40,000 "	....	....	1	2
" " " " 40,000 " 50,000 "	....	....	....	1
" " " over 50,000	1	....	....	....
PERCENTAGE OF NET EARNINGS TO CAPITAL LIABILITIES.				
No. of roads not reporting	....	1	1	4
" " earning less than 2½ % on capital liabilities	1	....	....	1
" " " from 2½ to 5 % " "	2	2	....	1
" " " " 5 " 7½ % " "	3	....	1	2
" " " " 7½ " 10 % " "	1	....	1	....
" " " " 10 " 12½ % " "	1	1	1	1
" " " " 12½ " 15 % " "	2	....	....	1

Electrolysis of Underground Pipes in Brooklyn.

Geo. W. Plympton and Fred. R. Lee, Commissioners of Electrical Subways of Brooklyn, submitted to the Mayor on February 27 a special report on the corrosion of water pipes, gas pipes, and telephone cables by the return current of the electric railways in that city. The report which was presented to the Hon. Charles A. Schieren, Mayor of Brooklyn, was in part as follows:

The Board of Commissioners of Electrical Subways begs leave to submit the following report as an appendix to the annual report submitted December 15, 1893. It relates to a single subject, viz., the corrosion of water pipes gas pipes and telephone cables by the return current of the trolley electric system. The following report would have formed a part of the earlier communication, but the materials for it were not then obtainable.

The injury briefly referred to in the previous report can now be more completely specified and described by the aid of the specimens submitted herewith, which include the following:

The lead covering of a telephone cable in a conduit near corner of Court Street and Fourth Place. The cable laid in pitch on the bottom of the duct. The pitch proved no protection.

The covering of a telephone cable in a conduit on Court Street between First Place and Fourth Place.

The covering of a cable in a manhole at corner of Atlantic Avenue and Smith Street. The failure of the cable afforded the first intimation of the injury. A heavy trolley current had apparently followed the cable and left for the ground at this point.

From a cable under the rail of the Fifth Avenue trolley line near Flatbush Avenue. The same cable was also badly corroded at Bergen Street.

An iron water pipe which had been in the ground under the trolley track in Second Avenue for about a year.

An iron pipe used to replace the one just mentioned which had been destroyed by corrosion. The indentation and perforation near the left hand end of the pipe, were produced in thirty days.

A lead water pipe taken from four feet below the surface on Second Avenue near 54th Street.

The experience of Brooklyn is not notably different from that of Boston and Cambridge, Mass., Milwaukee, Wis., Columbus, O., Indianapolis, Ind., and Hamilton, O. In each of these cities similar corrosions have been detected, and in none is there any doubt as to the cause. It is known to be due to the imperfections of the means provided by the trolley companies for the conveyance of the electrical current back to the generator. It was at first supposed that the rails would be sufficient, but the current declines to take that route exclusively. An account of some experiments published in *The Electrical Engineer* may be profitably quoted here: "The resistance per mile of double track road was found to be .7675 ohm in dry earth without bonds connecting the rails. Where the rails were bonded with iron wire of No. 3 gauge and cross connected without a continuous return wire, the resistance was .0797 with dry and .0717 ohm with wet earth. Where the track was formed with No. 3 copper wire bonds riveted to the rails, each bond soldered to a continuous copper wire of the same gauge and the rails cross connected every 200 ft., the resistance was .0207 ohm with wet earth. When the track was made in the same way as in the last example, but further improved by soldering the riveted bonds to the rails and spacing the cross connections closer together, the resistance, when the earth was dry, amounted to .0254 ohm. Track bonded with two No. 4 galvanized iron wires without a continuous return wire had a resistance of .0577 ohm, when the earth was dry."

These figures show that some bond is necessary, and furthermore that the resistance of the rail section is so slight that the calculated resistance of the bonds accounts for nearly all of that observed. This suggests a practical point, namely, the desirability of making the bonds larger than is now the usual practice and omitting the return wire. The effect of this wire has long been generally acknowledged to be small, and its value to be chiefly as a supplement to the bonds. There is a strong tendency now to do away with it entirely. It increases the conductivity of the return circuit somewhat, but probably not as much as if the metal in it were used to make larger bonds. This shows that water, gas and telephone mains can be protected by better track construction, which will prove as advantageous to the railway company as to the other interests. This is one of the means of protecting mains from electrolysis, and suggests the following as a second method, which, in most cases, can probably be applied without much trouble.

The second method is merely the connection by metal conduits of the water mains, gas pipes and telephone cables, to which some electricity will probably always pass, with the generators at the points where there is the least resistance to return currents. These are not necessarily the points where the distance between the pipes and the generators is the shortest, for it is possible to have this shortest line through the dry sand and a line nearly a few hundred feet longer through moist earth with less resistance. The electricity of the return current would be apt to leave the pipes at the moist places under such conditions, and it is possible that the return metal circuit should be located here, although somewhat longer than at another point. Old rails, heavily bonded, have been suggested for this use, and would probably prove satisfactory.

It should be said in regard to this second method, that in making connections with the underground systems of pipes and cables that the points of such connections would require frequent examination. A copper connection with an iron pipe underground would not long remain a reliable conductor, unless special care and watchfulness were given to it. A better way to insure the conduction of the current is, doubtless, to make the car rail continuous by welding. This method will be employed on the new trolley line soon to be built in the southern part of the city. The most complete solution of the problem is afforded by the double trolley by which the return current is provided for by an overhead wire similar to the one for the outgoing current. But it is to be hoped that it will not be necessary to resort to this method.

Some notes of experiments, obtained through the kindness of I. H. Farnham, electrician of the N. E. Telephone Company, and relating to the early experience in Boston, are here given:

"When the action of the current was first noticed, the experiment of grounding the cables to lead plates buried in manholes was tried on quite an extensive scale, but was soon abandoned as being impracticable. The quantity of electricity to be dealt with was so enormous that the buried plates offered no appreciable protection to the cables. If such a system was feasible, the expense for the constant renewal of the plates would be very large."

As there has been some misunderstanding in regard to the potential measurements made in connection with the numerous corrosion investigations, it should, perhaps, be impressed upon those who are about to carry on similar investigations, that the potential measurements between the cables and pipes, and the material surrounding them, should, in the majority of cases, only be looked upon as the direction in which the current tends to flow.

To say that the pipes and cables are even practically safe from corrosion when the measurements are below a specified figure, would be extremely misleading. These measurements are, in a certain sense, like the measurements which might be made in an electrolytic cell, between one of the electrodes and various portions of the electrolyte, so that it is possible to conceive of almost zero potentials in the immediate vicinity of the most violent electrolytic corrosive actions.

The fact should be closely borne in mind that whenever we have a current passing from an easily oxidizable metal to the liquid, such as would be encountered in the earth, corrosion is bound to occur. A large number of electrolytic experiments have been carried out, showing the extremely low potentials (measurements between the electrodes) at which corrosion is likely to take place. In many cases iron and lead were destroyed under the conditions encountered in the underground systems, at potentials considerably under .5 volt.

The conclusions fairly drawn from these notes and from our own experience is that considerable injury is being done to underground pipes and cables, and that it will continue along the lines of the trolley roads (except where the elevated railway extends above them) until better methods of returning the current to the generator are put in practice. The electricians of the several trolley roads are fully aware of the situation, and have speedily applied means of prevention in localities where the corrosion has been detected. But it is doubtful if the method of final cure of the difficulty has yet passed the experimental stage.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

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Havemeyer Building, 26 Cortlandt St., New York.

Most Gratifying Replies have been received by us in answer to nearly all requests for information for our financial supplement. It seems to be the general sentiment of bankers, street railway financiers and managers that a compilation of this kind is greatly needed, that our plans are the best and most comprehensive for the purpose, and that the supplement will be found a benefit to both the street railway companies and the investing public. New York bankers in particular are co-operating with us by advising the street railway companies in whose securities they are, or have been, interested to furnish us with full data of their roads. It will be admitted that these bankers are in a good position to weigh the relative advantages of silence and publicity, and that they decide upon the latter is not only gratifying, but significant. We respectfully ask that all reports be in by April 1, at the latest, in order to secure publication in the first issue of "American Street Railway Investments."

The Plans for Increasing Traffic, or for educating people to ride, that are efficient in some sections of the country, cannot in all cases be effectually employed in other localities, because there is a difference in existing conditions. For instance, park attractions that are so effectually employed in the West, fail when applied to some of the Southern cities, because of the existence in these communities of classes or clans, who will not mingle with each other or patronize resorts which are frequented by a rival set. This condition is not so marked in the larger cities, but does exist in some localities to an extent that is not appreciated by those who operate their lines in a more cosmopolitan community. Street railways, however, properly managed, are the most potent factors for correcting this state of affairs, and although the ingenuity of Southern street railway managers may be severely taxed to devise plans for increasing the patronage, their labors in this direction will doubtless eventually be rewarded by largely increased returns.

One of the Chief Annoyances incident to a superintendent's duties is the attention he must give to the numerous applicants, for work which besiege his office, especially during the present glut in the labor market. When his quota of employes is full, he should relieve himself as far as possible from personally meeting these people. In order to accomplish this, it is a good plan to provide a register in an ante-room, which should be in charge of a clerk, in which all the applicants should be required to record their names and addresses, with the understanding that should any additional help be required the applicants will be notified by mail, in the order in which they are registered, when they can report and fill up the necessary application blanks. This would work to the advantage of the company in two ways: It would save time and annoyance on the part of the officers, and, doubtless, reduce the number of applicants, as those who came having a chance to see that large numbers were registered ahead of them would so report, and discourage others from applying.

In Efficiency, Politeness and Honesty, the employes of street railway lines in Southern cities, so far as our observation goes, rank favorably with those of like occupations in Northern cities. In the matter of politeness to passengers they may be said to excel. On the principal street railway lines in Atlanta, the conductors, although the rules of the company do not require it, usually step down from the platform and assist ladies to board or alight from a car, and in stormy weather they take a lady's umbrella, raise it, and politely hand it to her after she has left the car. Such attentions are more or less fatiguing to the conductors, for it is hard work to step down from and return to the platform so many times during a day; but it tends to avoid accidents, and cultivates a favorable sentiment towards the company. It is found that country bred men make the most efficient and obedient car employes. Colored men are employed chiefly upon track construction and repairs, and are found to be reasonably skillful and efficient. It is gratifying to note that so-called unskilled labor, both white and colored, shows a marked improvement over former years, and that what little education the men have gotten in school and the mechanical trades, has not spoiled them as workers, as some assert, and as many shallow thinkers are ready to believe. Especially is the improvement in the native white laborer, both as to skill and industry, most encouraging. There is abundant proof that the Southern workers are fast becoming the equals of the Eastern and Northern laborers, and are readily adapting themselves to the changed condition of affairs.

The Fifty Thousand Dollar Prize offered by the Metropolitan Traction Company, of New York, for a "working system of motive power for street railway cars, demonstrated to be superior or equal to the overhead trolley" will, no doubt, result in bringing to the front many obscure inventions and schemes of would-be inventors, on which the State Railroad Commissioners will have an opportunity to sit in judgment, provided the Legislature grants them the permission to do so, and it will stimulate many others to engage in this line of investiga-

tion. But, that it will result in producing, at present, any new mechanical device or system, or in making application of old devices that shall be entirely free from all the objectionable features that now accompany electric or cable traction, we have not the slightest expectation. In the first place, it has been known for years that not only $50,000, but $1,000,000 or more awaited the successful inventor in this direction, so that if money could bring the result, it would long since have been accomplished. We are accustomed to say that nothing is impossible in the line of engineering feats. Give an engineer a banker's order and he will accomplish wonderful results. He will bridge great rivers, scale mountains, and talk under the ocean. He will devise, and has already produced, wonderful systems of transportation by means of which large numbers of people, under every possible condition, are being transported cheaply, safely and quickly to and from their homes, but this has been accomplished slowly by painful effort. The recent developments in this direction mark an epoch in human history worthy of all admiration; but while all these methods are good, none of them are without some objectionable features, and it is not to be expected that these features can at once be eliminated. At the same time the Metropolitan Traction Company is to be commended for its offer, and we trust that the Legislature, which now has the matter of deciding whether the Railroad Commissioners can act as judges, will determine in the affirmative.

Faulty Discipline, in our opinion, is more directly responsible for the recent three or four appalling street car accidents than the failure of safety appliances. Nearly all the roads upon which the recent unfortunate accidents have occurred, were covered on our tour of observation during last year, and in each instance we now recall that a laxity of discipline was noted and recorded. We do not mean that there were no rules provided for the guidance of the employes, but there was rather a neglect in enforcing the rules. Minor offences were overlooked, and there was no systematic inspection of the employes at times when they did not know that they were being watched. Recklessness upon their part followed, until it culminated in the calamities recorded. When riding on one line we remember to have been frightened as never before, from descending a long steep grade at a dangerous speed, and afterwards took pains to inform the superintendent that his men were given to reckless running when he was not present, and now that an accident has occurred we are not surprised, and only wonder why it had not occurred before. In some cases defects of discipline come about from the inability of the superintendent or manager to carefully watch his men, owing to a multitude of other duties that are imposed upon him. In other cases it is indifference. We now recall one or two cases where the superintendent's office is located alongside or above a liquor saloon, which the car men frequented without any protest on the part of the company's officers. Again, minor offences, like smoking while on duty, are overlooked, until the men learn that they can break the rules without fear of being caught, and so form a contempt for all law. Careful and frequent inspection at odd times and when the men least expect it, with a *certain* penalty for every violated rule, whether it results in harm or not, is the secret of good discipline. The worst evil that can possibly befall a street railway company is an attempt to apply a great deal of regulation to every department without providing an agency strong enough to enforce such regulation everywhere. In some cases the superintendent or manager is handicapped because he is not properly supported by his superiors, or because he has learned to become too familiar with his men; the latter condition is often a drawback to good discipline because of the fear of offending some of his friends. This condition of affairs should never arise. As an aid to good discipline, the superintendent should have an office by himself, with not even a clerk present, where he can meet his employes or others in private, and where he can administer reproof which is heard by the offending party only, and where he is not obliged to meet people who call to see his associates or other persons connected with the office. He should have regular office hours for the transaction of a certain class of business, and be at liberty at all other times for outside work, whatever it may be.

The Massachusetts Board of Railroad Commissioners deservedly stands in the front rank of those bodies appointed by the governments of our different states to exercise a supervision over the railroads within their borders. Its reports have always been marked with a painstaking care to secure reliable returns from the transportation companies, and its recommendations, based upon a careful study of existing conditions, have usually been of great value in improving railway methods and service. In no state outside of New York do the reports of the Railroad Commissioners deserve such careful attention or carry such great weight, and in no state, perhaps, have the transportation systems reached a higher stage of development or given better service. Special attention has always been paid in the state to street railways, and the Commissioners' report this year is of especial interest, inasmuch as some very striking comparisons are drawn between the financial results secured in that state by the electric system and by the operation of street lines by horse power. While showing that the net earnings per mile are 57 per cent. greater, the reported cost and capitalization per mile were 60 and 75 per cent. greater respectively, "leaving the odds in favor of the horse system." And the Commissioners in conclusion state that "taking everything into account there has been thus far no demonstration of the superior net earning capacity of the electric as compared with the horse system, but rather the reverse. It can and should be said without hesitation or qualification, that the electric system has not shown or indicated any such margin of profit as to justify the expectation of more than ordinary returns on money legitimately invested in it. The idea, which seems to have obtained some currency, that the electric railway system is a bonanza of rare and inexhaustible wealth, is clearly a delusion, and has doubtless proved to some a snare." In another part of their report, the Commissioners call attention to the fact that, as the electric roads are, for the most part, newly built, the necessary repairs and renewals for the first few years are comparatively slight, so that the operating expenses appear in even a more favorable light in the report than they otherwise would.

These, and other opinions of a like nature expressed in the report, have naturally attracted wide attention, and, where not understood, have created considerable surprise, if not alarm, among a considerable number of electric railway investors. Some newspapers have seized the opportunity to declare that the electric railway is a finan-

cial failure, giving as grounds for their statement the opinions quoted, while others, with an equal bias on the other side, impugn the reliability of the conclusions. But let us carefully consider the facts as given. Most of them in themselves are distinctly favorable to the electric system. The operating expenses have averaged during the last year less than 70 per cent. of the gross receipts, a figure about equal to the well managed steam railways of the State, and considerably less than formerly with horse power. The increase in net earnings is from .96 cents in 1888, the last year that horses were exclusively used, to 1.56 cents in 1893. With this decrease in operating expenses there has been an increase in traffic amounting, as already mentioned, to an average of 57 per cent. as the result of the employment of electricity. The only question in the minds of the Commissioners was whether this increase in receipts and greater earning power was sufficient to counterbalance the added investment incurred.

Assuming that the statistics for each system employed are strictly accurate, and that the method of computation for each was the same, it must be remembered that many of the electric railway companies in Massachusetts were the earliest in the field, and equipped their lines when the cost of electric apparatus was high, and when many of the economical devices now in use were not in existence. The improvements made in electric railway practice have been largely the results of experiments made by these companies at great expense, but through which every other railway company has been benefited. The showing made by a company now, using the latest appliances, would undoubtedly be much more favorable, and would probably under all ordinary conditions show a decided saving in favor of electricity on the capital invested. No other conclusion is admissible. At the same time this report is most timely, and should go far in disabusing the popular mind of the belief that an immense saving is made by a street railway company in changing its motive power from horse to electricity. If such a change is made and a city in consequence obtains cleaner streets, more comfortable and better cars, higher speed and in every way better service, the railway company has done all that it should do. It ought not to make any greater payments to the city's treasury, either in the form of taxes or as car licenses, than when operating as a horse railway. In fact the benefit to the city in most cases is considerably greater than to the street railway company, so that the former can better afford to pay a bonus to the railway company for making the change, than to exact, as is often attempted, payments in some form for the right to change the motive power.

* * * * *

Two other striking comparisons made by the Massachusetts Board in its annual report were in regard to the abnormal increase in capitalization in comparison to mileage, and to the decrease of the surplus of the companies. The capitalization, by which is included capital stock and bonded debt, has, in the aggregate, increased much more rapidly than the mileage. The commission recommends limiting the issue of bonds of street railway companies to the amount of paid up capital stock. Steam railroad corporations have been for many years subjected to such limitation by the general law of the state. The surplus of the companies has been rapidly decreasing, according to the commissioners, and in nine years has fallen from 13.44 per cent. of the capital stock to 2.9 per cent. of the stock. A conservative policy in regard to expenditures, and the setting apart each year of some substantial portion of the earnings as a fund for future contingencies is wisely recommended by the commission. At the same time, we do not see in this reduction of the surplus of the companies such a very alarming condition as some have assumed. The past year, which was one of great financial depression, found many street railway companies with lines but partially equipped and in an unfinished condition. It was absolutely necessary to complete these to care for the traffic; at the same time, the market for bonds was cut off. The surplus was the source naturally selected from which to make payments, and it was certainly better to draw from this than to make further issues of bonds or stock at a ruinous rate.

Convention Notes.

A meeting of the street railway and supply men of Atlanta was held on February 5, at the office of the Atlanta Consolidated Street Railway Company, in the Equitable Building, for the purpose of organizing and appointing local committees preliminary to the annual convention in Atlanta, October 17-19. Joel Hurt presided at the meeting, and the following committees were appointed:

Hotels.—Wm. W. Kingston; W. M. Kelley; S. W. Trawick.

Exhibits.—L. R. Shellenberger; N. W. L. Brown; W. M. Kelley; D. R. Bullen and H. I. Bettis.

Entertainment.—R. J. Lowry; J. Carroll Payne; T. K. Glenn; C. H. Wilcox; Wm. W. Kingston; Henry Inman and J. W. English, Jr.

Transportation.—H. I. Bettis; W. M. Kelley; C. H. Wilcox.

Banquet.—H. E. W. Palmer; J. Carroll Payne; E. Woodruff; R. J. Lowry; Henry Jackson and T. B. Felder, Jr.

Excursion.—W. M. Kelley; E. Woodruff; H. N. Hurt.

Finance.—E. Woodruff; R. J. Lowry; T. B. Felder; J. W. English, Jr.; W. T. Sanders.

It was resolved that the local representatives send a circular letter to the street railway men of all the principal Southern cities, urging them to be present at the convention, whether members of the Association or not, to welcome the delegates who are expected to be present from all parts of the country.

The committee on entertainment was instructed to communicate with a number of the representative ladies of Atlanta, and secure their co-operation in entertaining the visiting ladies who will accompany their husbands on their visit to Atlanta. A number of novel plans were suggested for providing entertainments for the delegates and ladies while in the city, and from the enthusiasm manifested on the part of the committee, and the energy with which they have set to work to make the necessary arrangements, it may be expected that the Atlanta convention will be one of the best attended and most enjoyable yet held.

It is hoped that the representatives of Southern roads will feel the importance of being present, and that all will recognize the importance of becoming members of the Association.

It is proposed in the near future to construct an electric tramway at Dublin, Ireland, from the terminus of the United Tramway Company, at Dollymount on the north side, to Howth and on the south side from the Clonskeagh terminus to Dondrum and Windy Arbour. Parliamentary powers have already been secured for the line, and it is proposed to commence the construction immediately. The manager of the Southern Tramways Company, J. Clifton Robinson, C. E., is well known in the United States, and it is to his efforts that the success of the work is largely due.

EDITORIAL CORRESPONDENCE.

CHARLESTON, SAVANNAH, AUGUSTA, CHATTANOOGA, ATLANTA—PART II.

Charleston, S. C.

Were one about to write history, he would find in Charleston and its vicinity, numerous spots prolific in historic suggestions, that would serve as links in the chain which binds the present with the past. This is the spot where the first scenes of our civil war were laid. Fort Sumter, now partially in ruins, still guards the entrance to the harbor, and to the left, on Sullivan's Island, is old Fort Moultrie, whose history takes us back to colonial times, and recalls the heroic service of Sergeant Jasper in holding aloft the flag on his gun swab, in the battle of June 28, 1776. Rambling through the enclosure of the old fort, we come across the grave (still carefully fenced and preserved) of Osceola, the Seminole chief, who was incarcerated here after the close of the Seminole war in 1836. Still nearer to the city, on the left, is Castle Pinkney, and on the right Morris Island, from which Gilmore's guns sent their missiles of destruction into the beleaguered city. The city itself bears but a few marks of the prolonged bombardment, to which it was subjected during the late unpleasantness, but it does bear some few marks of the terrible earthquake of 1886, and still more



FIGS. 1 AND 2.—SOUTH BATTERY PARK AND EAST BATTERY, CHARLESTON HARBOR—CHARLESTON, S. C

the devastation wrought by the cyclone and tidal wave on August 27, last.

But we are not to deal with history, nor with the flood, nor plagues of which Charleston has had her share. A more pleasant service invites us, and we are to write about Charleston as we find it to-day. We are told that the city has changed but little in physical appearance since the war. There is an old-time look about it, which comes from the quaint architecture employed, and the former practice of placing the houses directly upon the street line, or closing in the grounds with high brick walls. The most attractive features of the city are the East and South Batteries, which bound the point of the peninsula upon which the city is located. These consist of massive walls with wide pavements of stone flagging, which, upon the south, enclose White Point Gardens which consist of a beautiful grove of live oaks, interspersed with numerous monuments. These include the Fort Moultrie Monument, erected in memory of the defenders of this point in 1776. This is a granite shaft, supporting a bronze, life size figure of Sergeant Jasper, holding up the flag, and has bronze plates containing a brief account of the action. Another is erected to the memory of Gilmore Simms, the historian. There is also a circular shaft, about twenty feet high, composed of lumps of phosphate rock from the various phosphate deposits, which are being worked about thirty miles from the city. There are also other interesting monuments about the city, the principal one of which is known as the Calhoun Monument, near the citadel on Marion Square, and another which is known as the Washington Light Infantry Monument, in the yard of the City Hall. The Battery walls, above noted, make a delightful resort, to which large numbers of the people come of a summer's evening to enjoy the refreshing sea breezes, which never fail to come and relieve the oppressive heat of a summer's day. Along the Battery fronts are some of the most beautiful homes of the city, especially those of the old-time residents. The East Battery (Fig. 2) was entirely destroyed by the August cyclone, but it has recently been rebuilt by the city in a most substantial manner, and restored to its old-time beauty.

STREET RAILWAYS.

The street railways of the city embrace a trackage of about thirty miles out of a total of eighty miles of streets, and are controlled and operated by two companies, both of which employ animal power. There is also a short line on Sullivan's Island, but this is not embraced in the city mileage. Negotiations have for some time been pending with outside capitalists, looking to the consolidation of the two companies with a view to operating these lines by electric power, but this deal is off, we understand, and there is little probability that the present management will undertake an electric system, although there is a desire on the part of the people for mechanical traction. No opposition would be offered against the trolley system. While mechanical traction is very desirable from the standpoint of the patrons, the managers of the Charleston City Railway Company, at least, are of the opinion that there is more profit to be had from the present system.

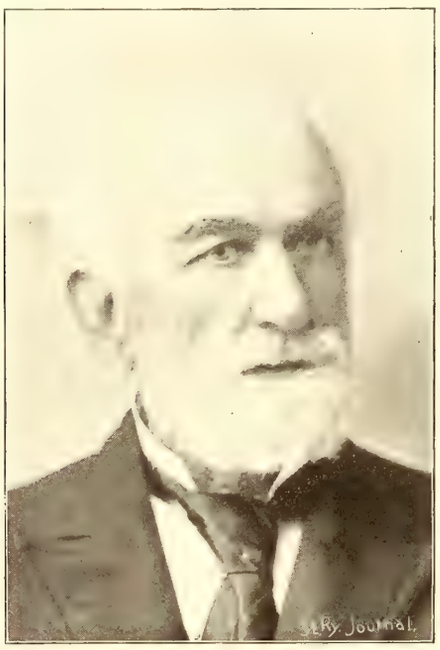
The Charleston City Railway Company,

which now operates thirteen miles of track, began operation in 1865, and has continued under the same management during the entire period of twenty-nine years, John S. Riggs having held the presidency from the first. Frank F. Whilden is secretary and treasurer, and J. H. Mohlenhoff is superintendent. The company has done a prosperous business from the first, never having missed a dividend of from 6 per cent. to 8 per cent. during all the years of its existence. The capital is all held in the city, and there are among the directors four bank presidents, the mayor of the city; also an eminent lawyer and a leading private banker and broker. In the matter of accidents the company has been particularly fortunate, having paid less than $5,000 accident charges since it began operations, and it has paid in solicitors' fees less than $1,000 during the time. The tracks run through the most desirable parts of the city, passing the principal churches, hotels and public buildings.

The company owns forty cars, about half and half open and closed, all of which were built by the John Stephenson Company, of New York. The president, Mr. Riggs, having been an intimate friend of the late John

Stephenson, has always been partial to his make of cars. The average number of cars operated daily is twenty-four, and they are run on a four and five minute headway. These are mostly one horse, fare box cars. White men only are employed as drivers, and their cars are run only until eleven o'clock at night, except on one line, where a recent ordinance requires that the cars run until 12:30 o'clock. The fare is five cents, and twenty-five tickets are sold for $1. The tickets are printed in different ways; some in coupon books, and others are simply card tickets Transfers are given to connecting lines. The colored people ride quite as much as the white people in proportion to their numbers, and are always liberal patrons of the street cars when they can get a nickel to ride with.

The original track construction of the line consisted of the old Crescent rail, fastened to stringers by means of screws and countersunk holes. About ten years ago a forty pound, center bearing rail was substituted. The soil in and about Charleston is low, level and very sandy; but little trouble, however, is experienced in keeping up



JOHN S. RIGGS,

PRESIDENT CHARLESTON CITY RAILWAY COMPANY.

the rail joints. The principal streets upon which the street cars run are paved with granite rocks or cobble, but upon others, in the suburbs, the animals wade through the sand, and as this is constantly accumulating upon the rails, the traction is exceedingly hard at times. The horses employed upon the Charleston line are among the finest we have ever seen driven to street cars, and are generally kept in excellent condition. The horses weigh from 1,100 to 1,200 lbs., and cost $140 to $160 a head. A few mules are employed, and these cost about $40 a head more than the horses; but horses are preferred for street car service, as they are generally quicker, and do not require so much persuasion from the driver, giving him more time to see that the fares are paid.

The stables at which the 150 animals of the company are housed consist of low, one story buildings, with ample ventilation, but little protection from the cold. Stalls are provided for part of the animals, but most of them are allowed to run loose in pens in lots of fifty; the pens are 100 × 23 ft. It is found that the animals do much better when allowed to run loose in the pens, than when confined in stalls. All vicious and unruly animals are sorted out and provided with stalls. The pens are provided with fodder, manger and grain racks on one side, and upon the opposite side is a water trough, to which the animals have access at all times. Sawdust is employed for bedding, and the pens are cleaned once a week. The feed consists of long prairie and North River hay which costs from $12 to $16 per ton delivered in bales. The daily ration consists of sixteen pounds of hay and fourteen quarts of grain, corn and oats, ground half and half. The grain is ground in the stables by horse power. The animals are driven about fourteen miles a day, and their average life is about five years. There is one mule, however, still in service, which has been at work twenty-five years, and it is still in good condition.

A good deal of traffic upon the pleasant days consists of colored nurses, accompanied by young children, and in the cars is posted the following notice relative to the fares: "Notice: When two seats are occupied upon these cars, two fares must be paid. Children three years old and under, ride free."

The Enterprise Railroad Company,

which is now operated under the management of T. W. Passailaigue, president, and P. J. Balaguer, secretary and treasurer, controls about fourteen miles of track. The line began operations in 1874, and was built and is owned by Northern capitalists. It was originally projected as a freight line, and in the business portion of the city runs from the Battery along the river front, connecting with the principal steamer wharves and railway depots. The gauge is five feet, to correspond with the gauge of the steam lines, so that steam cars could be run over the track. One branch crosses the city to the west near the center, and one extends nearly five miles into the country to the north, past numerous negro settlements, and through the principal truck farms, and out to the phosphate mills which are located at intervals along the Ashley River. There is also a branch running to the entrance of Magnolia Cemetery which is a very attractive place, with numerous drives shaded by ancient, moss draped, live oaks, and there are also many ornamental shrubs, including japonicas which during January were in full bloom.

The line is operated with one horse, fare box cars, with white men for drivers; but at certain hours, on the line running to the phosphate mills, two-horse cars are run to convey the crowds of workmen, morning and night, to and from their work, and these are operated by white conductors and colored drivers.

The regular fare is five cents, or twenty-five tickets for $1, but on a portion of line running to the mills, two tickets are sold to laborers for five cents. At certain hours these cars are crowded, and as the colored people look so nearly alike, the conductors often have difficulty in distinguishing who has paid fare. Checks were at one time issued, but the passengers would exchange with one another, so, as a final resort, the conductors have devised a plan of putting bits of cotton or lint upon the clothing of the passengers from whom the fare has been collected, thus distinguishing them from new comers. On this car line, a car load of phosphate hands, fresh from the mills, is about 50 per cent more odorous than a load composed of employes from the slaughter houses in Chicago and Omaha. We noted that some of the drivers were armed with heavy revolvers, as a defense while driving through some of the woody sections of the route, and also as persuaders, when a drunken negro refuses to pay his fare, as is sometimes the case. The business, it is stated, has increased about 70 per cent since the reduction of the fare, with a large increase of net receipts. Not only the phosphate hands, but the laborers on the truck farms live in the city and patronize the street cars liberally, although the wages of the latter class are only from twenty-five to fifty cents per day. There are at present vast numbers of idle colored people in Charleston, but when employed, they are liberal patrons of the street cars. About 40,000 miles per month are run on the lines of the Enterprise Company, and at an exceedingly low cost per car a mile. The animals make about eighteen miles a day. Mules are mostly driven double and horses single.

Prairie hay is fed long, and the daily rations per animal are about twenty pounds of hay, and from fifteen to eighteen quarts of grain, consisting of corn and oats, which is ground by horse power in the stables.

The pay of white drivers and conductors is $10 a week, or $1.43 per day for thirteen and a half hours'

work; while colored drivers get fifty-seven cents a day for twelve hours' work.

The city ordinance requires the company to keep the pavements repaired between the tracks and three feet outside. Granite block paving or cobble stones are employed, and paving costs the company from twenty-five to thirty cents a square yard, the material, except sand and gravel, being furnished by the city.

The offices and stables of the company are located at the corner of Shepherd and Meeting Streets; the latter being the famous shell road for which Charleston was once noted; but it is not kept up of late years as well as formerly. The stables and car sheds are plain, one story buildings, and stalls are provided for the animals. The stables are kept remarkably clean and there is an air of thrift about the whole establishment. The cars are kept in good repair, being painted once a year, and varnished twice. The salt air of the region is said to be very destructive to paint and varnish, but, by the use of good material, the rolling stock is made very presentable. The paints employed are purchased, for the most part, from Sherwin & Williams, and the varnish from Valentine.

Middle Street Sullivan's Island Railway Company.

This is a line of two and a half miles in length on Sullivan's Island, Charleston Harbor, which runs from the steamboat landing along the line of the summer cottages, where from 3,000 to 4,000 of the Charleston citizens usually pass the summer months. Only one car is run at present, and this makes the trip on the arrival of each steamer. The tracks were buried about four feet deep under the sand by the August cyclone, but this has been shoveled off, and the cars run through a trench of sand three or four feet in depth. The line has hitherto been a paying one, and will, doubtless, see better days again. The president is B. Callaghan, and the treasurer Frank F. Whilden, who is also treasurer of the Charleston City Railway Company. B. Buckley is superintendent.



FIG. 3.—LINE OF ELECTRIC RAILWAY PASSING THROUGH MARKET HOUSE—SAVANNAH, GA.

THE FUTURE OF THE CITY.

It has been said by people who have visited Charleston, that the place is slow in a business sense, and an undesirable location in which to make investments. This is not fair; for, considering the calamities that have overtaken the city, it has held its own remarkably well, and in our opinion, a prosperous future awaits the place. It is a desirable residence city, and has a great many wealthy people, and although they may be classed as conservative, they will look to it that the city has a substantial growth.

The banking interests are particularly flourishing, and during the money stringency which has affected nearly every section of the country, the Charleston banks have held their own, and there is not a failure reported. The business outlook, especially since the harbor improvements, is very encouraging. These improvements consist of a system of jetties which have been constructed by the government, and which have already deepened the channel on the bar at the entrance of the harbor, so that now there is twenty-two feet of water on the bar at extreme high tide, and twenty feet at medium high water, with fifteen feet at low water, where formerly the depth was from eight to ten feet, and it is confidently expected that the depth will be yet materially increased. As it is, there is now a straight course from the open sea to the anchorage ground inside the harbor, and vessels can enter by night as well as by day, by bringing the light of Fort Sumter, which is near the middle of the harbor, on a line with a temporary light which has been placed in the steeple of St. Philips' Church, one of the principal landmarks in the city.

The principal exports from Charleston are cotton, naval stores, lumber, phosphates and small fruits and vegetables.

In our opinion, nothing would serve to galvanize Charleston's business interests into new life more quickly than the adoption of electric power for propelling the street cars. The investment would not, doubtless, bring at once so large a return as the horse cars are now doing, but it would give the city a name abroad, and attract capital and enterprise as no other feature can; and, even if the lines are not sold, it is hoped that the present owners will yield to the pressing demand of the citizens, and adopt the modern power.

Savannah, Ga.

Savannah is a city of about 60,000 inhabitants, situated near the mouth of the Savannah River. It is an important seaport and shipping point for the products of this region, which consist chiefly of cotton and naval stores (spirits of turpentine and rosin).

Like Charleston, the surface is low, flat and sandy, but it is a beautiful city, regularly laid out, and has numerous small parks and squares located in the center of the streets, which divide and pass on either side. There are many modern houses and business blocks, and the city has a more modern appearance than most Southern coast cities. It might be styled the Monumental City, for in its various parks are located monuments erected to the memory of heroes and prominent statesmen. Among these are Jasper Monument on Madison Square, the Pulaski Monument on Monterey Square, the Green Monument, Gordon Monument and the Confederate Monument of the plaza of Forsyth Park.

The most attractive features in and about the city are the Forsyth Park, near the center of the city, which covers a large tract, most of which is shaded by an original growth of pines and oaks, with here and there a palmetto, and which is also adorned with fountains and ornamental structures. The beauty of this park is only surpassed by that of Bonaventure, a name given to the principal cemetery, just outside the city. Here are extensive avenues, shaded by rows of live oaks, with the limbs draped in festoons of the soft, gray moss for which this region is so famous. In foggy weather, a condensation drips from the pendant moss, as if the very trees were

weeping for the dead which lie buried all about. Numerous flowering and ornamental shrubs add beauty to the location, making a weird but attractive place.

The two principal hotels of the city are the DeSoto and the Pulaski House. The former is a modern structure, and is the winter home of a large number of Northern tourists, who seek to escape the rigors of a Northern climate.

STREET RAILWAYS.

The street car lines embrace forty-two miles, and they are all operated by electric power, with the exception of a short dummy line. Two companies, at present, control the street railway system. The City & Suburban Company and the Savannah, Thunderbolt & Isle of Hope, are, virtually, under one management, J. H. Johnston being president of the former, treasurer of the latter, and general manager of both. The former embraces fourteen miles of electric track and five miles of steam dummy; the other eight miles of electric track, and both are operated from the same power station, which is located at the Bolton Street junction. From this station a line also runs to Thunderbolt, a suburban settlement on the Wilmington River. The power station is a high, one story frame building, with corrugated iron covering. There is one smokestack, about 100 ft. in height, which rests upon a brick base into which the flues from the boilers lead. The power equipment consists of two 325 H. P. Cooper engines, each belted direct to a 400 H. P., M. P. Thomson-Houston generator, the shafts being forty-five feet from the engine shaft. The flywheels are twenty-five feet in diameter, with forty-one and a half inches face, and weighing 40,000 lbs. The belting employed was manufactured by the Southern Belting Company, of Atlanta. The water pumps are driven by belts direct from the engine shaft, through a train of reducing gears. The steam equipment consists of two Babcock & Wilcox water tube boilers, and a Wainwright feedwater heater. Tennessee and Alabama soft coal is employed as fuel, and is delivered by steam cars direct to the furnace room. It requires about four and a half tons a day to operate the twenty-two cars.

Some of the cars were built by the St. Louis Car Company, and others by the Ellis Car Company of Amesbury, Mass., and a few are home made. Trucks manufactured by the Baltimore Car Wheel Company, the J. G. Brill Company and the St. Louis Car Company are employed, and the motors are all of the Thomson-Houston type, W. P., 13, 7 and 25 H. P. Most of the cars have only a single equipment. Wheels are purchased, for the most part, from the Missouri Car Wheel Company. The prevalence of sand in the streets and on the tracks, tends to cut out the wheels rapidly.

Motormen are paid $1.50 a day and fifteen cents an hour for overtime.

On the line to Thunderbolt, a flat freight car is towed twice a day, carrying merchandise and other freight, returning quite an income to the company. The lines of the company are mostly single track with turnouts, and we noted that a number of the turnouts were located at the street crossings. One portion of the line, constructed with flat rail and stringers, is not standing up well under the traffic, and must, necessarily, soon be rebuilt. Most of the streets, through which the line in the city runs, are paved, but some are still unpaved, and on these, the sand is very troublesome.

Electric Railway Company.

The officers of this company are: J. S. Collins, president, T. G. Reid, treasurer, and J. W. McFarland, superintendent.

The lines operated by the company embrace twenty-five miles of track, and consist of both double and single track; most of that portion in the city being paved, while the suburban sections are along dirt streets. The lines are operated in two belts, with a line to Thunderbolt, and on some of the streets the track runs on a reservation in the middle of the street, while one line passes directly through the market house, supported on an iron bridge built on a level with the principal floor, which is approached in both directions, over a short, steep grade. There are numerous curves in the line where the streets divide to pass the parks above mentioned. In the paved portion, the construction consists of T rails placed on chairs. The average number of cars run in winter is twenty-one and in summer thirty. The cars were manufactured by the J. G. Brill Company, and are mounted on Brill and Dorner & Dutton trucks, and are equipped with Thomson-Houston, Edison and Westinghouse motors, eight equipments of the latter type having been recently purchased. Wheels are purchased, for the most part, from Whitney of Philadelphia, and some from the Missouri Wheel & Foundry Company of St. Louis.

The company is required to pay the city a license of $30 per year on each car owned, including the open and closed cars, whether operated or not. The street authorities attach a metal badge to each car, which, on the closed cars is square, and round for the open cars, upon which the date of the license is stamped.

A payment of $300 per annum is required from the street railway company, as a bonus for the privilege of doing business, and a real estate tax is imposed both by the city, state and county.

The rate of fare is five cents, and transfers are issued only at the main office. The pay of conductors and motormen is twelve and a half cents an hour.

The traffic during the last year increased more than 20 per cent. above the previous year, and the prospects of the company seem to be encouraging. The power station of the company is equipped with three Armington-Sims engines, and Edison and Westinghouse generators. The boilers are of the horizontal return flue type, and two of the four are of the Phœnix type, and two were made by E. P. Hampson & Company, of New York. The fuel consists of Alabama coal, costing $3.15 per ton, delivered, and it is hauled half a mile on wagons, requiring about eight tons a day for the twenty three cars. That portion of the track equipped with stringer rails is said to consume a much larger amount of current than the T rail construction. It costs about $10 per car per day for operating expenses. The Electric Railway Company is a consolidation of two other lines. The original Savannah Street Railway began operations as an electric road in 1889, and the other line in 1891.

Augusta, Ga.

This appears to be a New England manufacturing city transported to Dixie. It has many Northern characteristics, besides its manufactories, which consist principally of cotton mills, although there are a number of other industries. There are thirteen large cotton factories operating 160,000 spindles, and employ about 5,000 operatives, and consume yearly about 100,000 bales of cotton. The thirteen mills, with one exception, are operated by water power, and it is the abundant water power, together with ample shipping facilities, that renders this an important manufacturing center, there being eight railways and one steamboat line, which center in Augusta.

The city has a population of about 40,000, and it is situated upon the Savannah River, at the head of navigation, 250 miles from the river mouth. The city extends along the river bank a distance of about four miles, and is regularly laid out with broad streets at right angles to each other. The main thoroughfare is Broad Street, which is 168 ft. in width and nearly four miles in length. Green Street, which is parallel to Broad Street, two squares south, is 168 ft. wide, and is a beautiful residence street, being divided into two broad roadways with a park in the center, having a row of magnificent oaks and elms on either side, while there are two other rows, one on each side of the street boundary. It is claimed for these *boulevards* that they are the handsomest main streets to be found in any city in the country. The city abounds in fine streets, while the suburbs are admirably located and said to be very healthful. There is every indication of a substantial growth in and about the city, and no doubt Augusta will yet take rank with many of the large cities in the country.

The Augusta Railway Company.

This company controls the only street railway system in the city, and is known as the Jarvis-Conklin Syndicate. The same persons control the Augusta Electric Light & Motor Company, and light the city and furnish lights to private consumers, as well as power to a large number of stationary motors. D. B. Dyer, formerly of Kansas City, well known throughout the West as a United States Indian Agent, and first Mayor of Guthrie, Oklahoma, is president of both companies, and also has charge of the real estate interests of the syndicate, which has invested over $1,000,000 in the city and suburbs.

Mr. Dyer has resided in Augusta for about four years, and has become prominently identified with a number of the city's industries, and is regarded as one of her most enterprising citizens. He is also president of the Port Royal & Western Carolina Railway, and is interested in the development of Port Royal as an export city, which is claimed to have one of the finest harbors on the Atlantic coast, the channel being sufficiently deep to admit of the largest sea-going vessels. The street railway system embraces twenty-five miles of track, and the cars are operated with water power. Associated with Mr. Dyer in the operating of the street railway system are the following persons, who, with a number of the employes, are from Kansas City: C. B. Reavis, secretary; T. A. Roberts, superintendent, and W. E. Moore, electrician.

The track construction is very substantial, and consists mostly of T rail spiked to the ties. The streets are



FIG. 4.—CONFEDERATE MONUMENT, CORNER BROAD AND JACKSON STREETS, SHOWING BRICK PAVEMENT BETWEEN TRACKS—AUGUSTA, GA.

generally paved, asphalt being principally used. There is also considerable Belgian block paving and macadam, and also a cement rock called chert, which is laid on a foundation of broken stone, and which develops cementing qualities after being exposed to traffic. Broad Street is paved with asphalt, but between the tracks and rails and three feet outside, a brick paving is employed. This construction facilitates track repairs, for bricks can readily be removed and replaced. Above the ties there is but one tier of bricks, which is set edgeways on a thin layer of sand, the sand foundation being thoroughly tamped. At the street crossings the rails are placed on chairs, and here two tiers of bricks are employed. At one



FIG 5.—CURVE AT CORNER OF LINCOLN AND BROAD STREETS—AUGUSTA, GA.

crossing, however, there is a concrete foundation with one tier of brick only, set edgeways. The brick paving is giving excellent satisfaction after a year and a half of service. The material is an excellent quality of hard burned brick (not vitrified), and the paving is laid by the brick manufacturers and warranted for five years, at a cost to the company of sixty-five cents a square yard.

The company owns forty-six cars, and the average number operated in the winter is eighteen, but in summer a larger number. The rolling stock is of Brill and Stephenson manufacture, and the electrical equipments consist principally of the Edison and Thomson-Houston motors, but there is one equipment of a six pole motor, which was designed and built by W. E. Moore, electrician of the company. This machine is illustrated and described in another connection in this issue, and is said to be giving excellent satisfaction.

The power station and car sheds are all of brick, and are separated by fireproof walls and doors. These are located just west of the city, on the line of the Augusta canal, from which the power is derived. The power house proper covers 84×200 ft.; the car houses 90×120 ft., and the repair shops 50×100 ft.

The station equipment includes both water and steam machinery, the latter being employed only in case of an emergency, or when for any reason the water is turned off for the purpose of making repairs on some of the numerous mill races and flumes. The water wheels are of the Victor horizontal turbine type, and were manufactured by the Stilwell-Bierce Company, of Dayton, O. The total fall is thirty-five feet, and the water is led to the wheel case in a short, nine foot penstock. The main shell contains two wheels, of 350 H. P. each, from which the power is transmitted by belts to a countershaft. There is also a 125 H. P. wheel, having its shaft parallel to those of the other wheels, which is operated in a smaller shell, to which the water is led by a small penstock from the side of the principal shell or case, making a total of 800 H. P.

The countershaft is 150 ft. long, and mounted ten feet above the floor on brick pedestals, from which the generator belts lead down and back past the water wheel shaft of the generators. The shaft is provided with clutches, and there are three or four balance wheels which are nine feet in diameter, and weigh 10,000 lbs. each.

The water wheels are governed by hand power, no satisfactory governor having yet been devised. The attendant stands at the valve wheel constantly, and opens or closes the valve according to the indications of a voltmeter and speed recorder which is placed in a convenient position. The street railway company pays the city for the use of the water, $5.50 per horse power per year.

The steam equipment of the station consists of three Babcock & Wilcox boilers, of 250 H. P. each, and an 800 H. P. Corliss engine which is belted to the same countershaft as the water wheels. The station is equipped with both lighting and railway generators; the latter consist of three Edison 100 K. W. and one Thomson-Houston generator of the same capacity. The station furnishes power for 300 arc and 1,800 incandescent lights, besides power for a number of stationary motors.

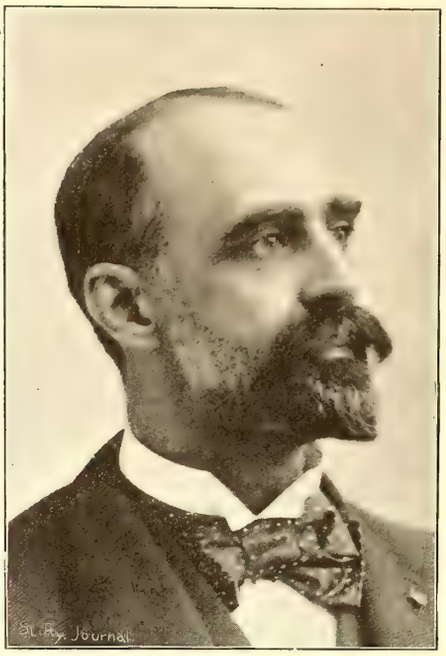
SOURCE OF POWER.

The canal from which the water supply for Augusta industries is derived, belongs to the city and cost $2,000,000. It is seven miles in length for the first level, and nine miles, including the second and third levels. The water is drawn from the Savannah River above the city, at which point is a dam of masonry and bulkheads and locks, consisting of granite walls laid in cement. The original canal was built by the city in 1845-7, but was enlarged in 1872-6 to its present dimensions, the width at the surface being 150 ft., and having a depth of 11 ft., with an estimated capacity of 14,000 H. P. between the first level and where the water is returned to the river. Of this, 9,200 H. P. is let out by the city to the mills and factories at a uniform rate of $5.50 per horse power per annum—a remarkably low charge. It is estimated that there is within twenty or thirty miles of Augusta available water power of 200,000 H. P., giving encouraging promise of what this city may yet be when the remaining power shall have been developed.

EMPLOYES AND COST OF OPERATION.

The wages of motormen and conductors are twelve and a half cents an hour for new men, but after a certain term of service, they receive fourteen cents per hour. On one or two of the lines, where the traffic is light, boys from fourteen to sixteen years of age are employed as conductors. They receive fifty cents and upwards per day, and are found to be very efficient.

The fare is five cents; no tickets are sold; transfer tickets are issued, however, at three points, and the longest ride is over five miles. No serious trouble has been experienced by any abuse of the transfer privileges by the public or employes. The company is not required to pay a car license, but pays a real estate tax of $2.25 per $100 valuation. One of the principal lines of the railway system runs out to Summerville, a suburb of Augusta, two miles to the west. This village occupies a sandy ridge 300 ft. above the city, which the cars approach over a grade of 8 per cent. This elevation commands a charming view of the city and valley of the Savannah River, which embraces an extensive region in Georgia and South Carolina. At this point is located the United States arsenal, which embraces a large tract, and which was originally located here because of the high, dry climate, rendering it particularly suitable for the storage of arms and ammunition. At the brow of the hill opposite the arsenal, on Summerville Heights is located the beautiful and celebrated hotel, Bon Air, which is surrounded by extensive gardens, shaded by magnificent oaks, pines and elms, as well as the rich evergreens (olives and magnolias) and is in the heart of Summerville, one of the most beautiful, healthy and wealthy villages of the South. The climatic advantages of the section are said to be unsurpassed,



D. B. DYER,
PRESIDENT AUGUSTA RAILWAY COMPANY.

and during the winter months, the hotel is filled with Northern visitors, who prefer the locality to the more enervating resorts upon the Atlantic and Gulf coasts. The average temperature for the winter months, is 54 degs., and the official record shows it to be the driest climate east of the Rocky Mountains.

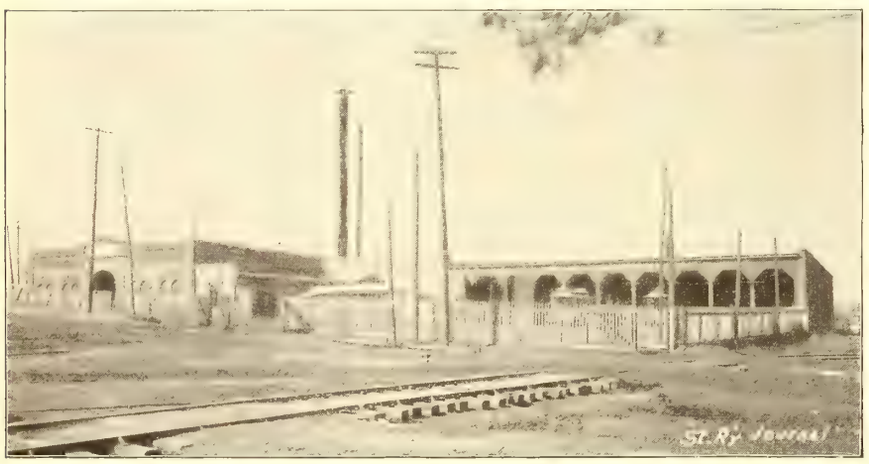


FIG. 6.—POWER STATION AND CAR HOUSE—AUGUSTA RAILWAY CO., AUGUSTA, GA.

Chattanooga, Tenn.

It was noted in our last issue, in connection with the meeting of the executive committee of the American Street Railway Association at Atlanta, that an excursion was decided upon from Atlanta to Chattanooga on the 19th of October, as a fitting close to the convention of the Association, which is to convene at Atlanta on the 17th. This action on the part of the executive committee was taken at the suggestion of the president of the Association, H. C. Payne of Milwaukee, who had made a stopover visit at Chattanooga on his way to Atlanta, and was enthusiastic in his description of the outlook from Lookout Mountain and the historical associations of the locality. Being somewhat enthused ourselves by the president's vivid recitals of Chattanooga's attractions, we resolved to visit the region, so that we might present to our readers a pen picture of the city and its surroundings, as an additional inducement for street railway men and others to be present at the Atlanta convention and join in the excursion.

Chattanooga, which is 138 miles distant from Atlanta, is connected with the latter city by two lines of railway, the principal one of which is the Western & Atlantic route, along the line of which was conducted the campaign of 1863-1864. In fact, it was for the possession of this road that the campaign was planned, and it is said to be the scene of 100 battles. The route from Atlanta is through one of the richest farming regions of North Georgia, and on the way we pass out of the cotton belt to the grain and blue grass regions of the northern counties. In October the trip will be particularly interesting, as the cotton fields will appear at their best, and the process of harvesting and fitting the crop for

market will be a novel sight for the Northern delegates. The trip being in reverse order from that in which the armies moved, the first prominent historical point, after leaving the fortifications of Atlanta, is Kennesaw Mountain, twenty-two miles distant, and Altoona Heights, which have been immortalized by the gospel hymn, "Hold the Fort; for I Am Coming," which was suggested by signal messages that were exchanged during the battle, and the attendent thrilling circumstances. There is still preserved immediately beside the track on the left side in the deep cut through which the train passes, as a mute memorial of this bloody and famous struggle, a lonely grave of a confederate soldier who was buried upon the spot where he fell, and which has been marked by a marble headstone, erected by the railroad company, upon which the following is inscribed: "An unknown hero. He died for the cause he thought was right." For years past, it is said, the track hands of the Western & Atlantic Railway have made it a sacred duty to give this grave especial attention, and to see that it is kept clean of rubbish, and that fresh flowers are regularly placed upon it.

It would require much more space than our columns will admit to describe all historical points and thrilling events of which this trip is prolific, for General Sherman said of it: "Every foot should be sacred ground, because it was once moistened by patriotic blood." So we will pass on to Chattanooga, and upon arrival, board an electric car on the line of the Chattanooga Electric Railway, which takes us out three miles to the foot of Lookout Mountain, where we transfer to the steam cars on the Chattanooga & Lookout Mountain Railway, which is known as the Broad Gauge Line, and of which W. T. Carley is superintendent. The electric car also connects with the Inclined Railway, on which the summit of the mountain may be more quickly reached, but because of the more interesting views to be had of the surrounding valleys, we prefer the Broad Gauge for the ascent, and will return by the Incline.

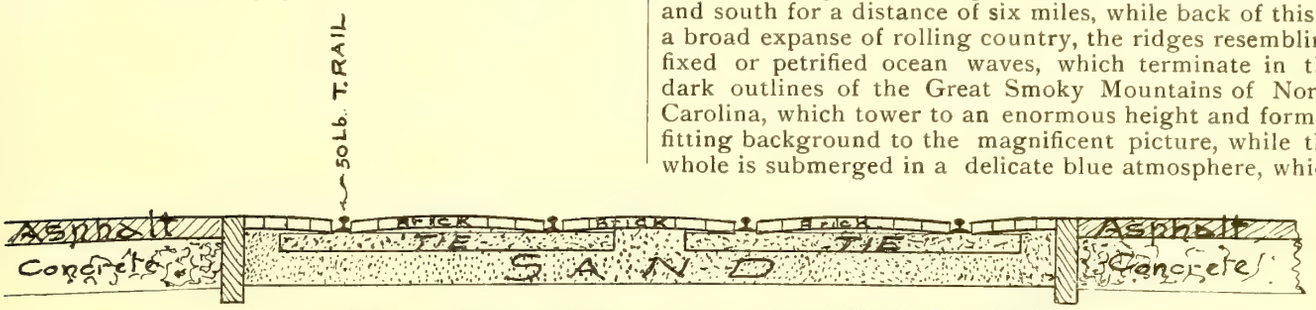


FIG. 7.—SECTION OF BROAD STREET DOUBLE TRACKS—AUGUSTA RAILWAY CO.

The length of the Broad Gauge Line is nine miles, and the ascent is made over a rocky course, and through deep cuts, on a grade averaging 3 per cent. with a maximum of 4 per cent. at certain points. The line passes twice along each side of the mountain and around the point, and twice over Hooker's battlefield, where was fought the celebrated battle "Above the Clouds." In the ascent the train makes one switch back, and at this point the engine switches past, and couples to the other end of the train, and the course is continued along beneath the face of the palisades and past the numerous cottages (summer residences) that are nestled among the trees near the summit, until the terminal is reached in front of Lookout Inn upon the highest point of the mountain, which is 1,700 ft. above the city and 2,300 ft. above the sea level. One cannot speak too extravagantly of the ever shifting scenes of the trip, as through the vista of trees, the beauties of the neighboring valleys, are alternately presented to the eye. It is reserved, however, for a view from the tower of the Lookout Inn, or from Point Lookout, for the most superb and extended prospect and for the full inspiration that comes from the sublimity of the scene. Here the vision reaches into seven states, and surpasses in beauty, it is claimed, the scenery about the White Mountains, or even in some respects the mountains of Colorado. When regard is had to the scenery alone, there is, doubtless, no more interesting and fascinating mountain views in the country, but since it overlooks the theatre of notable campaigns and battle incidents to the opening of the Tennessee, and when the names of the prominent generals are recalled, together with the trials and achievements of the thousands of brave men on either side, who dared to face death for their country, their cause, and their flag, the spot acquires an interest which cannot be surpassed in military story. The perfection with which the different battle fields are defined by the contour of the country adds much to the charm of the scene. Directly beneath, to the north, is the city of Chattanooga partially enfolded by a bend in the river, which is here three-quarters of a mile in width, with its suburbs extending out and nestling along the slopes of the neighboring ridges. Just below the city, the Tennessee River beats against the foot of Lookout Mountain and makes a remarkable turn upon itself, known as the Moccasin Bend, from the resemblance of the enclosed peninsula to an Indian moccasin. At the ankle, the distance across is only about one mile, but the shore line is nine miles. Further north the river shines out through the deep gaps in the mountains and is seen at intervals for about forty miles.

To the east and close at hand, the valley is bordered by the long line of Missionary or Mission Ridge, on which was some of the most stubborn fighting during the battle of Chattanooga. The ridge extends in a direction north and south for a distance of six miles, while back of this is a broad expanse of rolling country, the ridges resembling fixed or petrified ocean waves, which terminate in the dark outlines of the Great Smoky Mountains of North Carolina, which tower to an enormous height and form a fitting background to the magnificent picture, while the whole is submerged in a delicate blue atmosphere, which gives a placid beauty to the scene, making it, as above noted, unsurpassed by any other region.

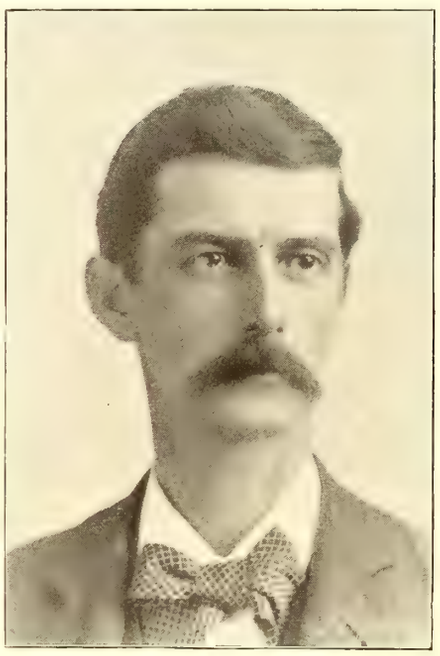
To the south the serrated peaks of the Lookout range, which extends for eighty-five miles, intercept the vision, while in the west are the neighboring Racoon Mountains, with their palisades, smaller but not unlike in appearance to those along the Hudson. Beyond are the Sand Mountains, and back of all the Cumberland Plateau, which leads the eye into the states of Virginia and Kentucky, which, together with Tennesee, Alabama, Georgia, North Carolina and South Carolina, make the seven states which can be seen from the mountain.

Besides the beautiful outlook, there is a great variety of scenery and many interesting points upon the mountain itself. The geological formation is very curious, the base of the mountain being a limestone and the top a light sandstone, some of the boulders being worn into curious and fantastic shapes. There is a natural bridge; the Old Man of the Mountain; the Garden of the Gods, and in addition a beautiful lake and waterfall, to which the visitor is shown. The prospect from Sunset Rock, where the bluff falls off precipitously for more than 300 ft. on the west of the mountain, is one of the most picturesque and marvelous of the location, and includes the Wauhatchia Valley and Grim's Gap, through which the Federal troops advanced for their assault on the heights.

Quite in keeping with the unsurpassed scenic beauty of the place is Lookout Inn, one of the largest and handsomest hotels east of the Rocky Mountains. It is a modern structure with accommodations for about 500 guests, and is equipped in the highest style of hotel art, and with exquisite interior decorations. It faces the east on the highest point of the plateau, and is 365 ft. front. The material of the first story is sandstone, which was quarried upon the mountain, while the other three stories are of wood, with shingle outside finish. The main tower is served by an elevator, and from this elevation the finest view is had. The inn is both a summer and winter hotel,

and is a great resort for Southerners in the summer and for Northerners in the winter. It is worth a visit to the regions to enjoy the entertainment furnished by the hotel, and a night spent here will by no means be the least of the attractions that will help to make up an enjoyable excursion.

Just in front of the inn, across the railway tracks, is a large building known as the War Museum, in which is found a very large and interesting collection of war relics, which have been gathered from the neighboring battlefield. From the hotel it is only a short walk to Point Lookout, beneath which is the Lookout House, reached by a series of steps down the bluff, but those who prefer can take the cars on the Narrow Gauge road, which comes up to the hotel, over a third rail, on the Broad Gauge line, and which runs around the summit of the mountain a distance of three miles to the right and terminates at Lookout Point Hotel, where connection is made with the cars of the inclined railway upon which the trips are made every twenty minutes. The incline is three-quarters of a mile in length, and is operated by a cable over an average grade of 22½ per cent., the steepest points being 33 per cent. This is one of the few inclines in the country where the cars operate around a curve, the upper portion of the line making a long curve to the right in order to reach the hotel and avoid the bluffs which border the summit on three sides. The incline is a three rail line, three foot gauge, and is operated by the Incline & Narrow Gauge Railway Company, which includes the Narrow Gauge line above mentioned, and of which T. M. Derickson is superintendent. The incline is operated by an endless cable, to which the two cars are permanently attached, and the ropes are carried around curves on sheaves tilted to an angle of about 45 degs. The power station is located at the foot of the mountain, and the rope is driven by a pair of winding drums which are both driven by an intermediate gear, but one drum is set at quite an elevation above the other, so that the ropes lead in an ascending angle to the tension sheaves in rear and above the line of the winders. The power is furnished by a duplicate engine, each piston being coupled to the end of the shaft, and which is controlled from the engineer's office in front of the building by the throttle which is connected with a rod and hand wheel. From the power house a shuttle electric car connects with the cars on the line of the Chattanooga Electric Railway, over which the return trip is made to the city.



W. T. ADAMS,
PRESIDENT CHATTANOOGA ELECTRIC RAILWAY COMPANY.

A second incline is now building some distance to the south of the one described, upon which the grading has already been done, and which will extend in a direct line to the top of the mountain near Lookout Inn, the face of the bluff having been blasted away to provide an approach to the summit.

THE CITY.

The name of Chattanooga is an Indian term, meaning hawk's nest, and was derived from the cove, or bend in the river, in which the place is located, and which looks like a huge nest, when viewed from the top of Lookout Mountain, which, in turn, is said to have derived its name from an expression of the pioneer boatmen, who, in descending the river, cautioned each other, when nearing this point, to "look out" for the Indians who were wont to lay in ambush at this point. The city proper contains a population of about 45,000. Including the suburbs, there is a population to which the street railways cater, of about 60,000. It is known as the Key City, being located at the only gap in the mountain barriers through which railroad communication can be had between the Central Southern states and the Central Northwest, making it as important a strategic point in its relation to commerce, as it was in time of war. Ten railroads center here, and the river has recently been improved, so that there is an unobstructed waterway to the Gulf through the transportation lines of the Mississippi system. Besides its transportation facilities, the city has other principal advantages for making it an important manufacturing center. The first of these is its proximity to the three principal factors that enter into manufacturing industries—iron, wood, and textile fabrics, being located almost in the center of the greatest iron producing section of the country, in the very heart of a well wooded section, and immediately upon the northern border of the great cotton belt, while it is also near to one of the best wool producing sections. The other advantages are an abundance of skilled labor, cheap living, and a climate that is said to be unsurpassed upon the continent.

The above are some of the commercial advantages, which, added to its historical associations and grand scenery, give great promise of its future growth.

STREET RAILWAYS.

The lines electrically equipped embrace about fifty miles of track, and there are forty-four miles of dummy line, besides the Lookout Mountain roads above described.

The Chattanooga Electric Railway Company,

controls forty miles of electric equipment, and operates its lines in four branches, which traverse the most desirable streets of the city, and extend to the principal suburbs, while there are a number of extensions projected and partly built. One of the principal lines runs out to Lookout Mountain and another out and along Mission Ridge. The ridge, as stated above, runs in a north and south direction for a distance of about six miles, and has an average altitude of 400 ft. above the city. This line, next to that of Lookout, possesses the greatest interest. The distance from the city to the foot of the ridge is about three miles, and the cars run on a fifteen minute headway, and upon the way pass near the celebrated Orchard Knob, on which General Grant took position, and from which he directed the movements of the troops in the principal battle. At the foot of the ridge is a transfer station, and from this the ridge cars leave once an hour and take a zig-zag course along the slope, making one switch back over a track constructed of light T rails. Upon reaching the summit, a grand outlook is presented, second only to that to be had from Lookout Mountain; in fact, the eastern view from the ridge is regarded by some as the most interesting, as one is brought much nearer to the hills and mountains in this direction, which rise range on range until they terminate in the faint blue outlines of the Smoky Mountains, ninety miles away. The line continues south near the brow of the ridge, crossing from side to side, so that the scenery is varied at every point, while every section is rich in historical association. The ridge is dotted all over with fine homes, and is said to be a most healthful and desirable location.

The Government has erected two steel observation towers upon the ridge, from which the positions held by the contending armies are easily outlined. One of these is located near the northern terminus of the ridge, and is known as "Sherman Heights," and the other further south on Bragg Hill, and near which the cars pass. Outlines of the old fortifications and rifle pits are yet to be seen, and in places the older trees still bear marks of the conflict that raged about them.

The Government is also constructing a *boulevard*, fifty feet in width, with macadam paving, along the brow of the ridge, throughout its entire length, which also extends south seven miles, and connects with the Chicamauga and Chattanooga National Military Park, which is to be dedicated in September next.

Two of the lines of this system also pass near the gateways of the National Cemetery, where are buried over 13,000 Union soldiers. The cemetery grounds are extensive, and are enclosed with a neat stone wall, upon the inside face of which English ivy is carefully trained. The main gateway is a high granite arch with pillars, and presents an imposing appearance. Besides the ordinary headstones, upon which the soldiers' names are inscribed, and the plain marble posts which mark the unknown, there are a few fine monuments erected to the memory of some of the prominent officers and others, the most interesting of which is a monument to the memory of the Andrews' raiders, which consists of a large granite block capped by a bronze locomotive, which is an exact pattern of the "General" with which the celebrated locomotive race was made on the lines of the Western & Atlantic Railway.

POWER STATION.

Returning to the city, we visit the power station, from which the lines are operated, and which consists of a brick building located near the corner of Broad and Seventh Streets, directly opposite the Richardson Block, in which the officers of the operating company are located. On the Broad Street side there is an L, which is employed as a car barn, which is provided with pits and a shop for car repairs. The iron repair shop is located upon the second floor of the station, and here also is a store room for supplies, which is fenced off by a wire screen.

The power equipment consists of four tubular boilers, two of which were made by the Taylor Manufacturing Company, of Carbondale, Pa., and two by Casey & Hedges, of Chattanooga. Run-of-mine coal is employed as fuel and costs delivered about $1.65 per ton, being hauled by wagons about three-quarters of a mile. It requires about eight tons a day to operate the twenty cars, which is the average number employed at this season. There are four high speed engines, which are belted direct to five Edison generators. One of the engines is of the Armington & Sims make, and is of 250 H. P. and is run at 240 revolutions. The other three are of the Beck type, manufactured by the Taylor Manufacturing Company; one is of 150 H. P. capacity and the other two, 125 H. P. each. The two iron smokestacks lead through the second story, and are enclosed between the floors in a casing of wood, part of which is iron lined. The object of the casing is to protect the machine shops from the radiated heat. It would seem, however, to be a good arrangement for starting a first class fire. The engine room is kept in an exceptionally neat condition, reflecting favorably on the engineer in charge.

The cars are of the Brill and Stephenson make, and some of them were purchased from the Fourth Avenue (New York) line, where they were employed in the storage battery experiments that were made some years since. Some of the long cars have been made by splicing together two of the old horse car bodies. The motor equipment consists of Thomson-Houston, Detroit and Edison machines.

TRACK CONSTRUCTION.

In the paved streets a girder rail is employed which is supported on chairs, but in the suburbs the lines are built with light T rails spiked directly to the ties, while a good portion of the roadbed is ballasted with broken stones. The principal streets of the city are paved, and the material employed consists of granite blocks, asphalt and vitrified brick. Upon Market Street, which is the principal business thoroughfare, the pavement is of asphalt, with granite blocks between the rails and tracks, this construction being employed to give more ready access to the track foundations for repairs.

The rate of fare is five cents, with twenty two tickets for $1, except on the line to Mission Ridge, upon which a second fare is collected, except from residents along the line.

The Chattanooga Electric Railway Company has been lately re-organized with a change of management: W. T. Adams is president; E. Watkins, vice-president. Chas. G. Gostafson, superintendent; Wm. S. McCall, auditor, and Wm. H. Roots, secretary. Mr. McCall has been in the employ of the company in various capacities since its organization.

The Chattanooga & North Side Street Railway Company.

This company operates nine miles of track, including three owned by the North Chattanooga Street Car Company, from which it is leased. The president of the company is S. R. Reid, who is also proprietor of the Reid House, the principal hotel of the city, and W. C. Teas is the acting superintendent, who also has charge of the hotel lighting plant. Both lines are owned by real estate syndicates, and were built to develop suburban property. The stockholders of the latter company are mostly English people.



FIG 8—LOOKOUT INN—CHATTANOOGA, TENN.

The cars of both lines run over the same tracks in the city, and start from Ninth Street on Broad, turning east, and then north past the Court House, and continue due north over the Tennessee River, which is crossed with a fine steel truss bridge, supported on granite piers. The bridge is half a mile in length, and the floor is 107 ft. above the water. After crossing the bridge the lines divide, and one route continues northeast and circles around the woody hills and numerous pretty homes which already line the route, and again approaches the river and terminates at River View, a most delightful location, where is located a dancing pavilion and other buildings for the accommodation of picnic parties.

The line of the operating company continues near due north from the bridge for about two miles, passing through Hill City, where the car station is located, and beyond which it continues in a southerly direction through the woods just under the heights upon which Fort Wilder was located, and where the rifle pits are still visible. The extension beyond the power house is operated only in summer.

The station is a small wooden structure quite removed from any other building, and in a wild, romantic spot.

The equipment consists of two Armington & Sims 150 H. P. engines and two Thomson-Houston D. 62 generators. The engines, although they have been running nearly three years, have had no outlay for repairs, except the replacing of a broken valve. In the summer time both engines are required; at this season only one is run at a time, the change being made from one to the other each day.

There are two tubular boilers of 150 H. P. each, manufactured by Walsh & Weidner, of Chattanooga. Steam lump coal, $1.75 per ton, is employed for fuel. This is hauled from a landing on the river, where it is delivered in barges. It requires, on an average, three and a half tons a day for the four cars that are being run.

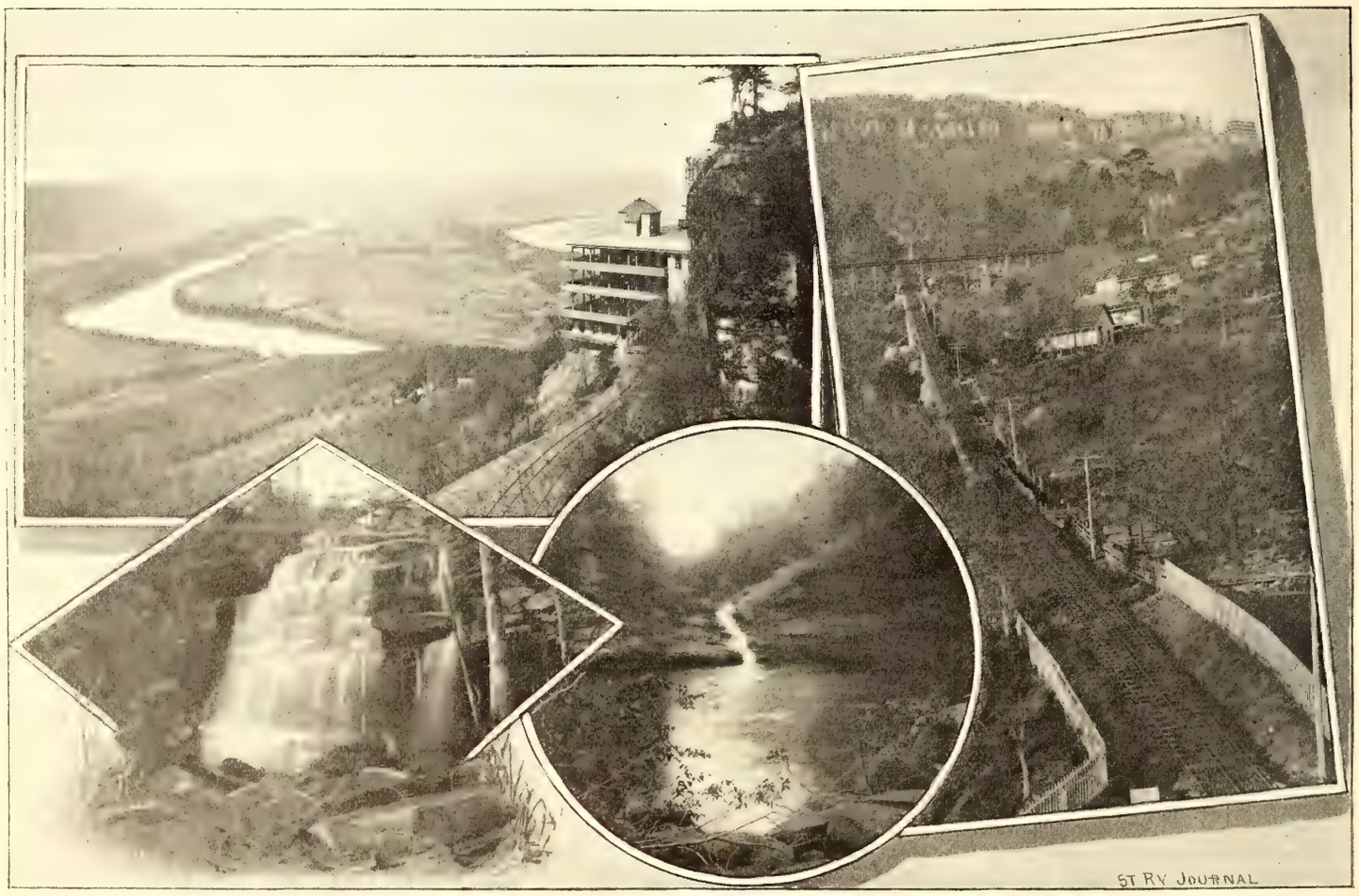


FIG. 9.—VIEWS ABOUT LOOKOUT MOUNTAIN—CHATTANOOGA, TENN.

In summer a larger number are employed. The cars and trucks are all of Stephenson make, and are equipped with Thomson-Houston S. R. G. and Edison No 6 motors. This is the only line in the city on which the cars are heated, and for this both the Standard and Lewis & Fowler stoves are employed. One conductor collects the fare upon two cars, changing as the cars pass each other on the bridge. Inspectors are employed in the city, and in case of heavy travel, they act as conductors. The wages of motormen are thirteen and a half cents per hour; some of the men long in service receive fifteen cents an hour.

Conductors receive from twelve and a half cents to thirteen and a half cents an hour. Should the district through which the cars run build up as is anticipated, a prosperous future awaits the enterprise. The same is true of the other city lines and the lines upon Lookout Mountain.

We think, however, that it would be for the interest of the latter lines to provide more tasteful and inviting cars, as tourists will doubtless come in greater numbers each year, and will form more favorable impressions of the locality if the car equipment is in keeping with the hotel and other accommodations.

Atlanta, Ga.—Part II.

It is hard to realize that this city, now so large, so beautiful and so prosperous, has entirely grown up within the last twenty-nine years, or since November, 1865, when General Sherman's army left it, a scene of charred and desolate ruin, to begin the memorable march to the sea. No city during the war was so nearly annihilated, for what was not consumed by fire was blown up or torn down, or otherwise destroyed; besides, all its white citizens had been ordered away following its surrender in September. In 1861 the population was about 13,000, but the city having afterwards been made a military headquarters and supply depot for the Confederate Government, the population was swelled to a much higher figure by the influx of soldiers, and laborers in the arms and ordnance factories, and by the disabled in the hospitals, all of whom were afterwards expelled from their homes by the order noted above.

Time, however, has wrought a marvelous change, and here the Blue and the Gray, with their sentiments modified by generous and kindly memories, have together restored the city to all that warfare wasted, and tenfold more than was consumed, and established upon the very scene of conflict a monument of enduring peace to be far more renowned than one of war. The Atlanta of to-day was briefly described in our last issue, so it only remains to note a few of its salient features and complete the description of its street railway system. The elevation on which the city is located is higher, with one exception, than any other thickly settled portion of the country east of the Rocky Mountains, the height being 1,050 ft. above ocean level, the exception being Denver, which is about one mile above. Geograpically it is situated near the center of the great Southern quadrilateral, which embraces ten states with unsurpassed natural resources, with every part of which it is in direct communication with its eleven railway lines.

Its elevation makes it absolutely exempt from malarial influences and epidemics, so that it has become a veritable "city of refuge" for the people of the coast cities during yellow fever epidemics. Here infectious diseases find nothing to feed upon, and infected patients brought here fail to produce a second case.

Chiefly on account of its healthfulness the region was selected for the location of Fort McPherson, the second finest army post in the United States. The camp is situated west of the city limits and five miles from the center of the city, and contains 236 acres, being a level and well shaded tract. The barracks and officers' quarters are of brick, the latter being large and tasty in design and finish. At present the garrison consists of five companies of artillery and one of infantry, the latter being composed of Indians; in all about 350 men. In summer the number is largely increased by the transfer of many of the artillery companies from the coast defences to the reservation in order to avoid exposure to yellow fever and cholera.

The camp is a popular resort for Atlanta's citizens, who visit it in large numbers on pleasant evenings to witness the dress parades and listen to the music which is provided by a brass band attached to the post. The camp, or barracks, as it is locally known, is reached by steam cars, which run trains every hour, and by the main line of the Atlanta Traction Company's system.

WATER WORKS.

The water works system of Atlanta, which has recently been completed at a cost of $750,000 is said not to be surpassed by that of any city in the country. The Holley system is employed, and consists of two pumping stations, a storage reservoir, filters, and the necessary mains and hydrants. The first station is a fine brick building of ample dimensions located beneath a high bluff near the bank of the Chattahoochee River, about seven miles from the city, and which is protected from high water by a semi-circular embankment about twenty feet high. A forty-eight inch supply pipe extends for some distance along the bank and to the middle of the river through which the water flows into a deep oval well near the station from which it is pumped and forced a distance of four miles to the reservoir, which has an elevation of 250 ft. above the river, and a storage capacity of 198,000,000 gals. The equipment of the river station consists of two Holley duplex, compound engines with Gaskill pumps, each having a capacity of 10,000,000 gals. per day (twenty-four hours). The two high pressure cylinders of each pump are thirty inches in diameter, and the low pressure fifty inches, with a forty-two inch stroke, the high pressure cylinders being directly above the low pressure. The four pistons are connected with a short walking beam which actuates a large flywheel placed between the pumps and cylinders, while the pistons of the pumps are extensions of the low pressure pistons. A pair of air chambers completes the equipment. The combination forms one of the most massive and interesting machines to be found in any similar station. The steam is generated in nine 100 H. P., tubular boilers manufactured at the Atlanta Machine Works. A high brick smokestack completes the principal equipment.



JOEL HURT,

PRESIDENT ATLANTA CONSOLIDATED STREET RAILWAY.

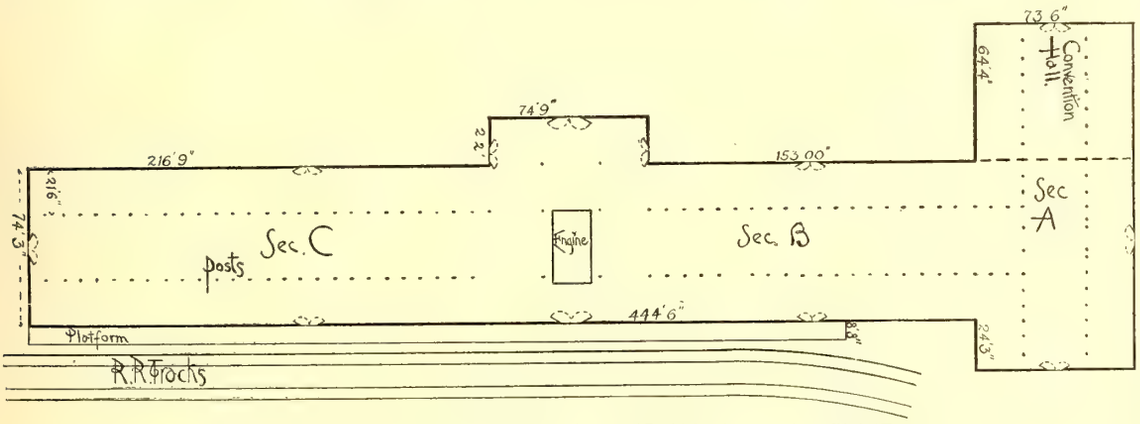


FIG. 10.—PLAN OF MACHINERY HALL—PIEDMONT PARK, ATLANTA.



FIG. 11.—MACHINERY HALL—PIEDMONT PARK, ATLANTA, WHERE THE NEXT CONVENTION WILL BE HELD.

Station No. 2 is a similar building and is located at Hemphill on the northern boundary of the city, near the reservoir and about three miles from the center of the city, both stations being reached from the city, over a wide boulevard recently constructed by the county. Station No. 2 is equipped similar to the river station, except that the pumps have a capacity of 12,000,000 gals. per day and are run continuously, keeping a sufficient pressure upon the mains for ordinary purposes, but which, in case of a fire alarm, can be greatly increased with sufficient force to throw the water over the highest buildings.

The river water, being very muddy, is filtered at the reservoirs before it is delivered to the mains; it is, however, considered very pure and heathful. The city has also a very excellent sewer system.

HOMES AND PARK SOCIETIES.

Peachtree is the finest residence street and is bordered by as many and as fine homes as can be found in a single street of most any other city in the country, while there are many elegant residences located in other sections. On a pleasant afternoon there may be seen on the streets a large number of fine turnouts, and many other evidences of wealth and prosperity. The public parks embrace about 1,500 acres, the principal one of which is Grant Park situated on the southeastern boundary of the city and contains 140 acres. The tract is well shaded and has been well improved, making it a most attractive resort. The city has recently purchased the celebrated painting of the Battle of Atlanta, and placed it in a commodious building in the park. There is also a well assorted "Zoo."



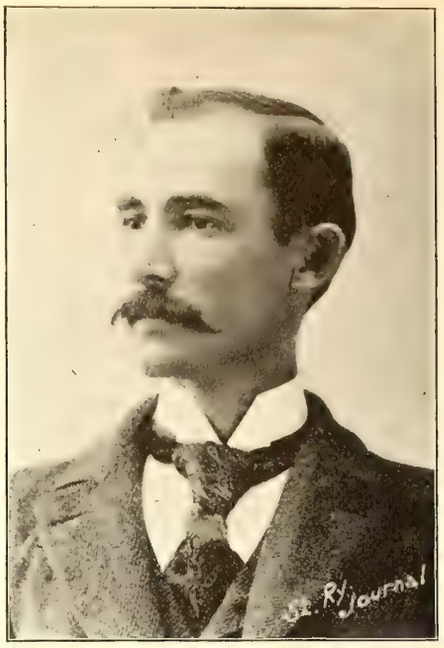
FIG. 12.—ENTRANCE TO PIEDMONT PARK, WHERE THE NEXT CONVENTION IS TO BE HELD.

There are sixty-six churches and missions, and a number of fine school buildings.

There are two social clubs—one known as the Capitol City Club, and the other the Commercial Club. The former has a large membership and occupies a very elegant and handsomely furnished house on the corner of Peachtree and Ellis Streets, which is illustrated in Fig. 13, this view being taken on the line of the Atlanta Consolidated Street Railway, and near where the lines of the Traction Company cross.

The city supports two daily papers, the principal one being the *Atlanta Constitution*, which was made famous by the labors of the late Henry W. Grady, whose monument was illustrated in our last issue. The paper now occupies a large, elegant building on Alabama and Forsyth Streets.

The Atlanta *Journal*, known as the greatest afternoon paper in the South, issues four editions daily, except Sundays, and has every evidence of prosperity. There is also a publishing company which prints patent outsides for about 400 country papers.



H. N. HURT,
SUPERINTENDENT ATLANTA CONSOLIDATED STREET RAILWAY COMPANY.

STATE CAPITOL.

The edifice is one of the most imposing in the city, the material being limestone, Georgia granite and marble. The east and west face is 325 ft.; the north and south 172 ft., and the height to the top of the figure of Liberty is 257 ft. It is worthy of record that it was built within the appropriation of $1,000,000.

The Union Passenger Depot is located in the immediate center of the city, and is easy of access from all parts of the city by the street cars. It is proposed, however, to move it away, on account of the confusion and annoyance caused to the near residents. The principal business streets are south of the depot, but the hotels and best residence portion are north and northeast, as is also the Exposition ground, where the meetings of the Association are to be held.

HOTELS.

These were quite fully described in our last issue, but the illustration of the Kimball House is given on the next page. This is a fine fireproof building, and is noted for its grand dimensions, and for the central arcade which is 60 × 100 ft., open to the skylight, with wide balconies upon each floor.

MANUFACTORIES.

Atlanta is an important manufacturing city, there being, it is claimed, 300 manufacturing concerns in its near vicinity, and embracing nearly every important commodity. There are three large cotton factories; extensive manufactories of agricultural instruments; cottonseed oil machinery and cotton gins; also cottonseed oil mills, and establishments for the manufacture of chemicals employed in making commercial fertilizers. There is also an extensive manufactory of leather belting styled the Southern Belting Company. Added to these are the granite industries described in our last issue. The city being the trade center of the

South Atlantic States, here are located the headquarters and agencies of numerous Northern manufacturing concerns. These include the principal Southern depot of supplies of the General Electric Company, which occupies a large four-story brick building at the corner of Marietta Street and Jones Avenue, while the offices for the Southern territory are in the Equitable Building. The present office force is as follows: A. F. Giles, resident manager, who has been recently appointed to succeed H. E. W. Palmer, resigned. D. R. Bullen is chief of the supply department. S. W. Trawick and F. W. Wilcox are traveling salesmen; Frank Lederle is engineer; F. A. Hills has charge of the railway department, and G. L. Thompson, the isolated lighting and motor departments.

The headquarters of the Johnson Company, of Johnstown, Pa., manufacturers of the Johnson girder rail are also in the Equitable Building, Wm. W. Kingston being the principal representative, with L. R. Shellenberger as engineer.

The Carnegie Steel Company is represented by Walter M. Kelley, with headquarters in the Gould Building.

C. H. Willcox represents the Lane & Bodley Engine Works, of Cincinnati, and the Harrison Safety Boiler Works, of Philadelphia.

The Siemens & Halske Company, of America, also has a branch office in the Equitable Building, and is represented by H. I. Bettis.

The Stilwell-Bierce & Smith-Vaile Company, manufacturers of Victor turbines, is represented in Atlanta by J. W. Taylor.

The following are also local manufacturers, or deal in street railway supplies to a considerable extent: Brown & King Supply Company; Chas. A. Conklin Manufacturing Company, and the Standard Oil Company.

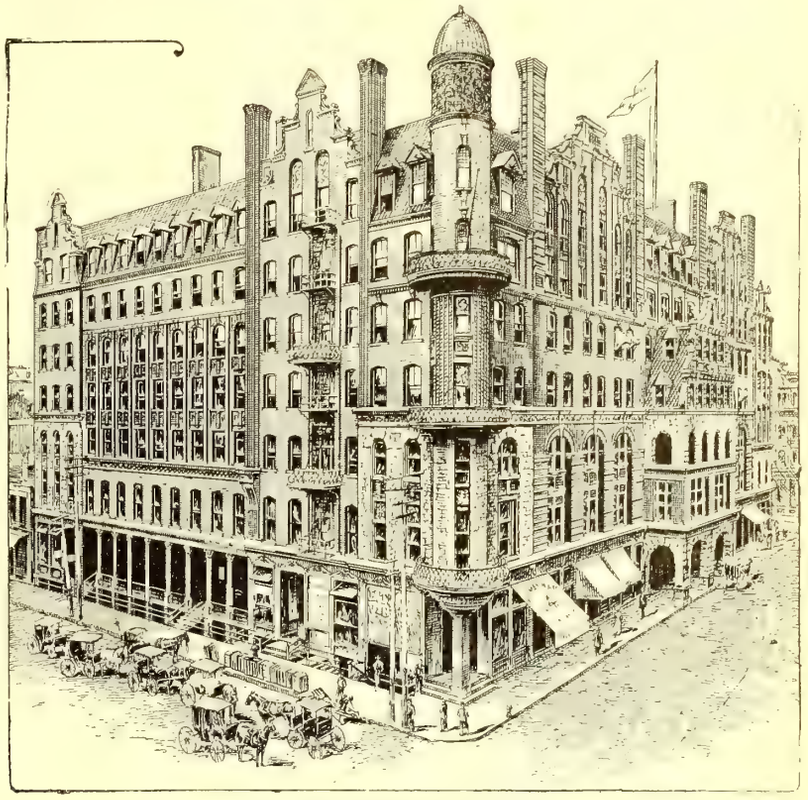


FIG. 12.—KIMBALL HOUSE.

STREET RAILWAYS.

The financial affairs of the Atlanta Consolidated Street Railway Company have recently been satisfactorily adjusted, following the refusal of Judge Pardee to appoint a receiver for the line, application for which by one of the bondholders, was mentioned in our last issue. The station and rolling stock will now be largely increased, a shorter headway adopted, and the service generally improved.

It was noted last month in connection with the operating affairs of this company that it was manufacturing its own car wheels at a cost of about $3.00 each. This should be qualified by the statement that the scrap employed in the manufacture of wheels was not charged up in the estimate. It should also be remembered that coke and pig iron are remarkably cheap in this locality, the former costing only about $3.40 a ton and the latter about $17.00. It is not possible, in our opinion, for street railway companies, as a general thing, to make wheels that



FIG. 13.—PEACHTREE STREET, LOOKING NORTH FROM ELLIS STREET—ATLANTA, GA.

are as durable or as cheap as those bought from the wheel manufacturers.

The company now proposes to try the experiment of making its own cars, the wood work for which will be procured ready for setting up from the local planing mills, and will be put together in the company's shops. It is proposed to build a number of open cars entirely of Georgia pine lumber.

In connection with street construction, it is interesting to note that no grade crossings of steam lines are allowed in the city. The lines of the Consolidated Company cross the steam lines on seven bridges and pass under at two points.



FIG. 14.—OLD CAPITOL BUILDING—ATLANTA, GA.

Atlanta Traction Company.

This company was formed last year by the consolidation of two systems, one having the same name and the other known as the Atlanta Street Railway.

The present officers are: T. B. Felder, president; E. T. Shubrick, vice-president; J. T. Voss, superintendent.

The system embraces about twenty miles of track, and the principal line extends from Camp McPherson, five miles southwest of the city, through the center of the city, passing the postoffice, and within one block of the corner at which all the lines of the Atlanta Consolidated Company meet; thence out to Decatur, a flourishing town to the east. There are also branches to East Lake and Grant's Park. Already the road has developed the territory through which it passes, new houses having gone up all the way from Atlanta to the terminals. The line passes over an undulating surface, and some of the grades are quite steep. From a hill upon the line, near the East Tennessee shops, a commanding view is had of the city and surrounding country, and this is said to be the best point from which to overlook the situation. The track is composed mostly of a forty pound T rail, and is a single track line, with switchback turnouts, and the system is operated from two power stations, one located in the southwestern part of the city, between it and Camp McPherson, and the other on Irwin Street, on the Decatur branch. The boiler equipment of the first station consists of three 125 H. P., drop tubular or vertical boilers, manufactured by McGlaughlin of Boston, in which slack coal, costing $1.90 a ton, is employed as fuel. There are two Russell high speed, automatic engines of 260 and 125 H. P. respectively. The engines are belted direct to the generators, which consist of one Edison of 100 K. W. capacity, and two M. P. Eddy generators of the same capacity. The M. P. generators have recently been

substituted in place of two Eddy bipolar machines. Adjoining the power station are the car barns, the pits, the machine shops and armature winding room. A stationary motor provides power for repair shop machinery.

The rolling stock consists of cars manufactured by J. G. Brill and the American Car Company, which are mounted on Brill, McGuire and Robinson (Altoona) trucks, and are equipped with Detroit, Westinghouse and Edison motors, there being eight of the Detroit type. The cars are at present run under a twenty minutes headway, and the average number a day operated is fourteen. The fare is five cents each way from the center of the city.



FIG. 15.—UNION DEPOT—ATLANTA, GA.

The terminal points are popular as places of residence or resort, and with a new equipment of rolling stock and motors, which is proposed, no doubt in time the line will do a thriving business. One branch of the system has been running since March, 1891.

Collins Park & Belt Railroad Company.

This line was originally planned for the development of property lying west of the city, along the banks of the Chattahoochee River. It is a single track with switchback turnouts, and starts from the center of the city, near the post office, and as originally built, extends fifteen miles, but owing to the expense of tunneling and embankments for passing under the Western & Atlantic Railway, it has not been opened further than this point, and now terminates at Bolton, about nine miles from the city, the remainder of the line being idle. The laws of the state, relating to grade crossings have recently been modified, and permission has been secured to cross the steam line near the depot, in the town of Bolton, when the entire line will be operated. The line is constructed with a fifty-six pound T rail, which was formerly employed on a steam line. This is spiked directly to sawn ties, placed two feet apart, making a very substantial roadbed. The rail joints are bonded and the bonds connected with a very large galvanized return wire. The line is suffering considerably from a collapse of the real estate boom, as first inaugurated, but is still in operation, and with the return of prosperous times will yet, no doubt, meet the anticipations of its projectors. It is at present in the hands of a receiver, J. W. Darr, who is superintendent and manager, and to whom the creditors are greatly indebted for the skill and economy with which the affairs are being managed and the fact that the line has been kept in operation.

A portion of the route is through a woody, wild, romantic region, with many curves and street grades, but which is rapidly building up with new homes. The cars leave the city terminal every half hour and run to the limits six miles distant, but from this point out, trips are made only once an hour.



FIG. 16.—POWER HOUSE OF THE COLLINS PARK & BELT LINE RAILROAD CO.—ATLANTA, GA.

The car station is a stone building, located about six miles from the city and stands alone in the woody tract. The equipment consists of two Reynolds-Corliss 180 H. P. engines, each of which drives direct by a twenty-four inch belt a Short generator, one of which is a thirty-six inch, 150 K. W. machine and the other a 225 K. W. The belts were furnished by the Southern Belting Company, of Atlanta. The steam is generated in three tubular boilers of 200 H. P. each, manufactured by E. H. Jones, of Cleveland, O. The station is kept in an exceptionally fine condition.

The fuel consists of Little Warrior coal from Hewitt, Ala., which costs, delivered, $1.90 per ton, being hauled by the company three-quarters of a mile over its own tracks, a siding being provided which leads out to the side of a steam line. Water is obtained from a neighboring stream, which is brought from a considerable distance in an open trough, the trough having been substituted for a two inch iron pipe formerly employed, as the latter was liable to be choked with sand, or to freeze up in cold weather. There is no barn for the storage of the cars, and the outside repairs are done under an open shed.

The rolling stock consists of four sixteen foot, closed cars, and seven eight seat, open cars, all of which are of Brill manufacture. Two of the closed cars were recently purchased from the Atlanta Consolidated Company, and electrically equipped by the superintendent. The cars are mounted on Dorner & Dutton trucks, and are all equipped with twenty horse power, S. R. G. Short motors. The motor equipment was formerly employed on the line at Wilkesbarre, Pa.

The line does a considerable freight business, including the hauling of wood, brick, sand, etc. A funeral car is also operated when occasion requires, as the line passes Hollow Wood Cemetery, a new burying ground located at some distance from the city. The number of employes is twenty-one, and the pay of motormen and conductors is $1.50 for thirteen hours' work. There is no extra list, as the crews are required to lay off one day in each week. Colored trackmen are employed who receive $1 per day.

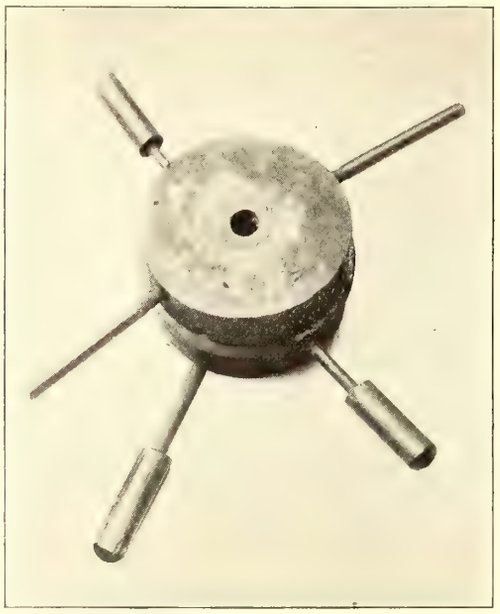


FIG. 18.—TROLLEY MOULD CLOSED.

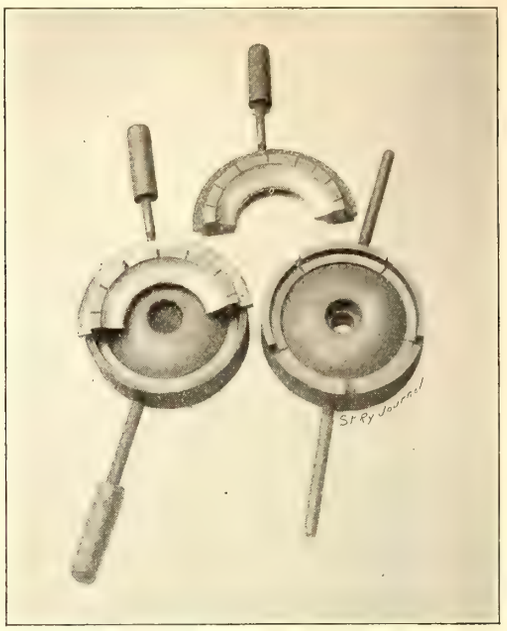


FIG. 19.—TROLLEY MOULD OPEN.

Only a short night run is made, as the last car leaves the city at eight o'clock.

Wanting a machine shop, the ingenuity of the superintendent is greatly taxed for making repairs. If seriously damaged, the motors and armatures are sent to the Steel Motor Company, of Cleveland, O., for repairs, but slight damages are repaired at the station. For turning down commutators, a lathe has been devised, which consists of a frame made from ties, with wood journal caps. The armature is turned by hand power by a crank which is provided with a clamp to embrace the armature shaft. A metal tool rest completes the equipment.

Considerable trouble is experienced in this locality from lightning. To guard against danger from this source, a lightning arrester is provided, which consists of a double set of serrated plates, connected with a switch, can be thrown as soon as the fuses of one set burn out. This is supplemented by a home made arrester consisting of two parallel bars of copper, one above the other, and placed about one foot apart, one of which is connected to the line, the other to the ground. These are joined by a number of small copper wires which are hooked over the upper bar and rest against the side of the lower bar, the wires being covered with a thin coat of shellac to prevent contact, but which is readily pierced by the static discharge. Additional wires are kept at hand to replace the others as fast as they burn out. However, the superintendent prefers to shut down the plant during a storm rather than risk the danger of a burnout.



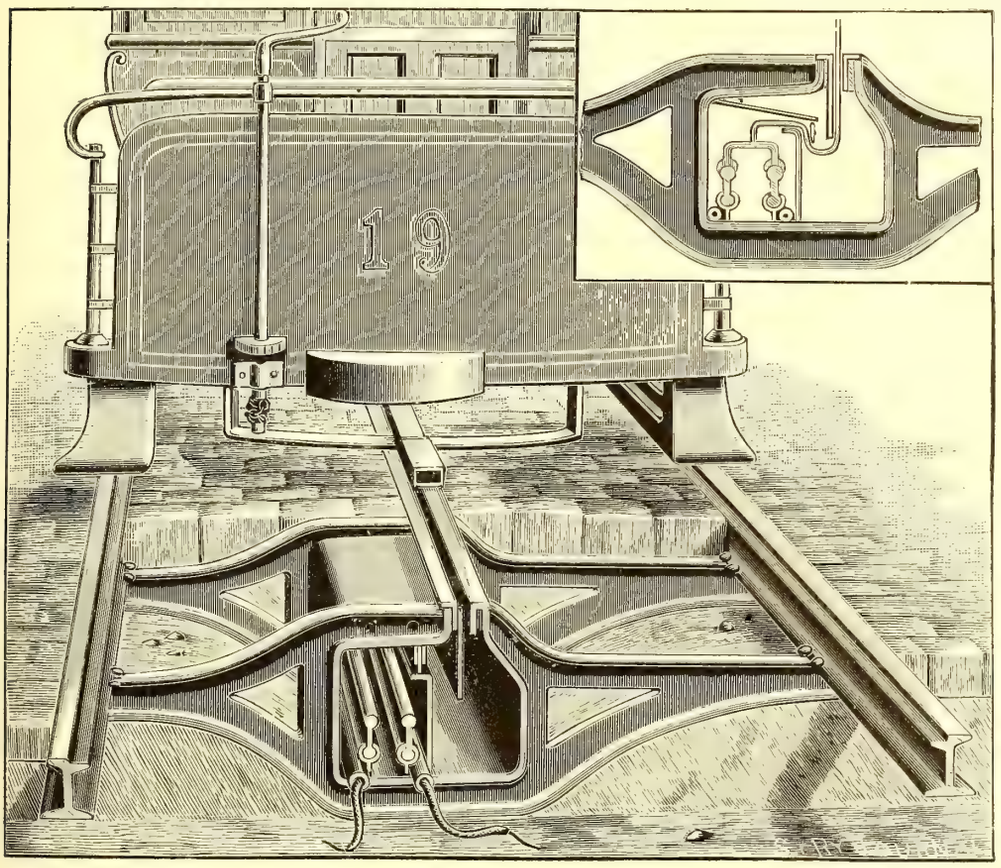
FIG. 17.—NEAR ARROWOOD—COLLINS PARK & BELT RAILROAD, ATLANTA, GA.

PROJECTED LINE.

The Lithia Springs Railway Company, of which Harry Camp is president; B. F. Curtis, vice-president, and Thomas Camp, secretary, has recently begun the construction of a new line, which is intended eventually to extend from near the post office in Atlanta, twenty-two miles, to Lithia Springs, a popular resort west of the Chattanooga River, capital for which is being furnished by Minneapolis parties. The first six miles, which are now building, will extend only to the river, and which it

is expected will be in operation in the early summer. The river will then be bridged and the line extended. A portion of the city section will run for a short distance along the same streets upon which the tracks of the Atlanta Consolidated Company are now laid.

The line is projected for the development of suburban property and for establishing a park at the river, where it is proposed to provide a fleet of electric launches for the accommodation of pleasure seekers. The effort is being made to purchase some of the same boats that were employed upon the Lagoon at the World's Fair. The batteries for operating the launches will be charged from the railway line. The current of the river, for a considerable distance in the neighborhood of the proposed park being comparatively slow, it will make a safe and pleasant sailing course. As this is the only available water of any extent in the neighborhood of Atlanta, it is expected that it will develop into a popular resort. The track is being constructed mostly with T rail, manufactured by the Illinois Steel Company, but in the paved streets of the city a rail of the Johnson girder type will be employed. The type of motor and power equipment are not yet determined upon.



NEW CONDUIT SYSTEM FOR STREET RAILWAYS.

TROLLEY MOULD.

The trolley mould used in the manufacture of trolley wheels by the Atlanta Consolidated Street Railway Company and described in our last issue, is shown on the opposite page. This mould is of iron and in three parts, each of which is provided with handles. The use of iron for moulds has given better results, it is claimed, than sand, as the iron chills the metal somewhat. C. B. F.

A DISASTROUS fire occurred February 2, in Cincinnati, at the Avondale Street Railway car houses.

THE Lake Street Elevated Railway Company, of Chicago, intends to build, before long, a three mile extension to the northwest.

THE Third Avenue Railway Company, of New York, has petitioned for rights on a number of streets in the northwestern part of that city, with privilege to employ electric power.

A Double Compartment Conduit System.

A conduit system for electric railways, which differs radically from any of the many devices for putting the contact wire under the surface of the street, has been invented by H. Petersen, proprietor of the Petersen Electric Works of Milwaukee, Wis. The system has attracted a great deal of attention among expert electricians and street railway men who have examined it, and many favorable opinions have been expressed about it. The inventor intends to install a section of road before long, when the merits of the device can be thoroughly tested and demonstrated. The principal object of the invention has been to make suitable provision for guarding against an accumulation of dirt and moisture within the conduit. The general arrangement of the invention is shown in the accompanying engraving.

As will be seen, the principal feature of the conduit lies in the fact that it is constructed with two longitudinal compartments, one of which is arranged to contain the electrical conductors, and the other to carry off the water that might find its way to the inside of the conduit, this latter compartment being connected at intervals with the sewers. A steel broom attached to the cars is arranged to sweep along any accumulation of dirt in this compartment and deposit it in the sewer.

The second compartment is placed out of the line of the slot. In the upper part of the wall between these two compartments is an opening provided with a device by which it is kept closed when the car is not passing, but so arranged as to be automatically opened by the trolley arm. In the conduit shown in the large engraving the device consists of vertical strips of metal of considerable length jointed and adapted to be raised between guides. By this means no moisture is permitted to get into the compartment containing the conductors, and the slot rail is extended down far enough to prevent any water getting on the closing device. As the conductor compartment is thus to all practical purposes entirely shut off from the interior compartment, and as, consequently, its temperature is the same as the temperature of the wall of the conduit, it is thought no condensation will take place in this compartment. In a very wet climate, if found necessary, a circulation of air may be supplied to this compartment by means of a fan, but there seems to be hardly any reason why this should be required, especially as the passage of the car will provide a considerable current of air. In the upper right hand corner of the cut on this page is shown a slightly different method of keeping the compartments separate. This consists of a flexible cover or flap, which normally rests on the division wall, but is raised on a roller carried on the trolley arm to permit the passage of the latter.

Instead of using wires for conductors, it has been considered more reliable to employ iron or steel contact rails, as shown in the cut. These are divided into sections of about 100 ft. or any other convenient length. Such section is tapped on the two main feeders and provided with switch and safety cutouts placed in manholes, so that if any trouble should occur, one section can be switched off without delaying the traffic on the whole line. These contact rails can be held in position in various ways. The cut shows two brackets supported on two yokes, and held in position by insulating material. The whole compart-

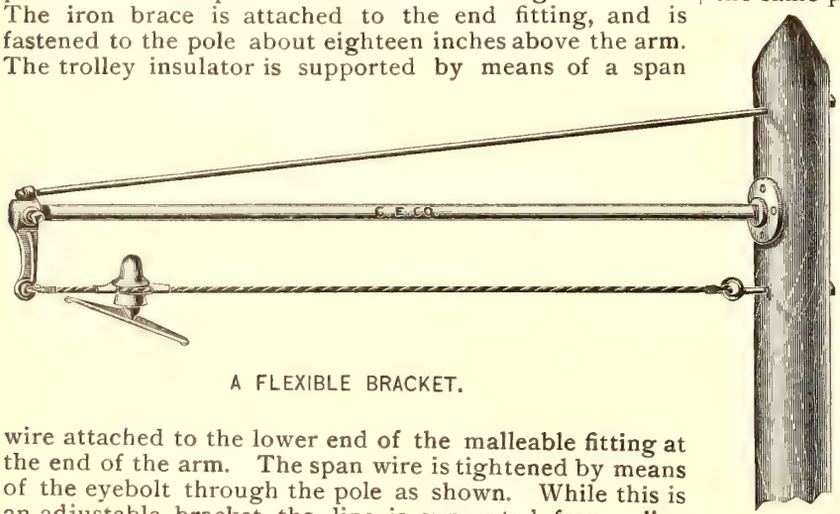
ment is finally coated with waterproof insulating paint. The main feeders are laid in pipes. The depth of the conduit is considerably less than that required for a cable conduit.

The shape of the trolley arm is shown in the small engraving. This arm is provided with two contact shoes, which nearly surround the upper part of the contact rail, so that they cannot jump the conductor. The contact shoes are provided with a swivel arrangement so as to take up any unevenness of the track, and by means of springs keep in proper contact with the conductors. From each contact shoe, wire is laid through the hollow arm and extended up to the motor, and at each end the arm is hermetically sealed. The contact carrier is so arranged that the motorman can from his platform, by moving a lever, lift the contact carrier out of the conduit at the manhole, without delaying the car for more than a minute.

A Flexible Pole Bracket.

The new pole bracket shown herewith is manufactured by the Creaghead Engineering Company, of Cincinnati, and is offered as a device of special merit. It is adjustable, and is a flexible support for the trolley wire.

The horizontal arm is one and a half inch pipe provided with a special malleable iron fitting at the end. The iron brace is attached to the end fitting, and is fastened to the pole about eighteen inches above the arm. The trolley insulator is supported by means of a span wire attached to the lower end of the malleable fitting at the end of the arm. The span wire is tightened by means of the eyebolt through the pole as shown. While this is an adjustable bracket, the line is supported from a line insulator on a flexible span wire. This flexible support eliminates all the troubles peculiar to "stiff bracket" construction.



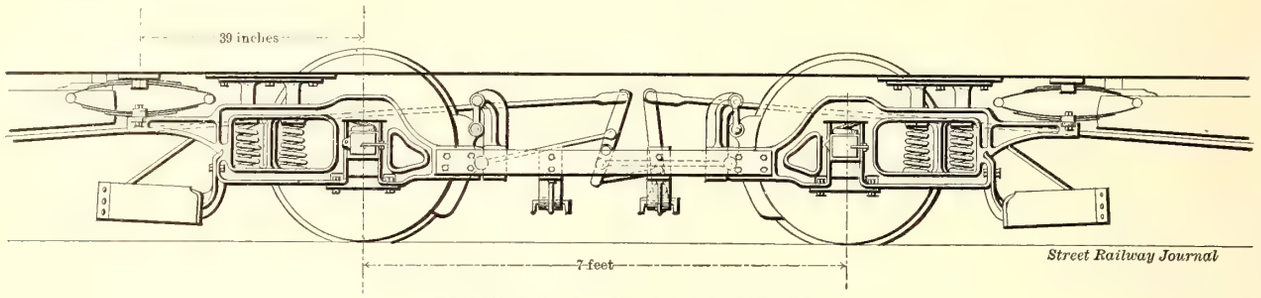
A FLEXIBLE BRACKET.

On high speed suburban roads it is often difficult to get satisfactory results from the ordinary forms of rigid bracket construction. With this flexible support, there is less strain on the insulators, less noise, less "arcing" and less "jumping" of the trolley. This bracket in the form illustrated is made in lengths up to eight and a half feet, and in a modified form up to fifteen feet.

The Liverpool Overhead Railway Company reports for the half-year ending December 31, 1893, as follows: Passengers carried, 2,475,639; number of trains run, 46,429; train mileage, 243,539. They also show a balance available for dividends of over $27,000 on the half-year's business.

St. Louis Car Company's Truck No. 8.

The accompanying cut shows an elevation of the St. Louis Car Company's steel truck, No. 8, which is an improvement on a previous truck somewhat similar in design, placed on the market a little over a year ago, and illustrated and described on page 697 in the November, 1892, issue of the Street Railway Journal. The spring base of the latter, though of the extended type, was not found long enough, and in the new truck the four large steel castings, one at each corner, have been modified so as to give room at each for an elliptic spring. In the old truck the concussion spring over each oil box brought back the disadvantage of oscillation of the car body, to eliminate which the truck was designed, and in truck No. 8 it has been found that the lengthening of the wheel base has done away with this, although the concussion springs are retained. In the old truck the spring base was ten feet nine inches, while in truck No. 8 it is thirteen feet eight inches. The four castings of the truck are riveted together with distance pieces in order to make any desired wheel base. This is a new and advantageous feature which no other truck possesses.



TRUCK NO. 8.—ST. LOUIS CAR CO.

The brake mechanism is very powerful, and as it will be seen, there is direct leverage on the brake shoes. The engraving shows inside brakes, but outside brakes may also be applied. The mechanism of the latter works on the same principle as that of the old truck. The brake hangers are very stout, and are joined to the distance pieces. There are no brake beams, but the brake levers apply the shoes to the wheels through a steel bar running across the truck, to which are joined the small levers. With the outside brake arrangement the brake beams are retained.

The motor hangers are of cast steel, and hung to the distance pieces. It will be noticed that the cast pieces holding the life fenders to the truck are simply bolted to the truck frame. This is a new and excellent departure, for when fenders or the pieces attaching them to the truck are broken, the latter is not disabled entirely or rendered useless, the pieces not forming an integral part of same. It is only necessary to substitute new cast pieces. In the engraving it will be noticed that each of the fenders is further strengthened by a steel rod joining the latter at the apex of the angle and each of the end distance pieces.

The truck is equipped with dustproof and automatic felt oiler journal boxes, which need oiling but once in three months. In order to raise the truck from the wheels, it is necessary only to unscrew the four bolts under the axle boxes, which release small retaining plates. The company expects truck No. 8 to meet with a large and ready sale, on account of the great success had with the truck of which No. 8 is the improved type. Over 500 of the old style trucks have been sold to various street railway companies throughout the United States. A large number is in use in St. Louis alone.

Bristol, England, is about to introduce the overhead system on one of its principal tramway lines. The necessary permission and consents have been secured for the equipment of the line between Old Meeting Street and Kingwood Hill.

A New Fender in St. Louis.

One of the latest fenders to be used in St. Louis is shown herewith. It has been employed on the cars of the Lindell Railway of that city with excellent results. It is adapted to run along the rails on small flangeless wheels,



A NEW FENDER IN ST. LOUIS.

and will thus pick up an individual and carry him along, there being no chance whatever of the fender passing over him. When not in use the fender is carried about ten inches from the ground and easily passes over any ordinary street obstructions. In time of necessity it is lowered by a small hand lever. This lever, however, will be done away with in the future, and a foot button substituted, because it is thought that in time of danger the motorman will find his hands fully occupied in manipulating the brake and power controlling handles.

The fender has on a number of occasions proved its value in saving life. It is the joint invention of Geo. W. Baumhoff and Gus. Hegemann, respectively general manager and master mechanic of the Lindell Railway Company.

AT a meeting of the stockholders of the Lancaster (O.) Street Railroad Company, held at Lancaster last month, it was decided to make an assessment on the stock to discharge the old debt of the company and equip with electric power. The track is already bonded and laid with fifty-two pound girder rails on chairs. All the streets are paved with brick. The officers elected were: Wm. Duffy, president; Dr. G. Mussee, vice-president; C. F. Nestor, secretary, and A. Bauman, treasurer and manager.

THE City Council, of Baltimore, Md., recently passed an ordinance requiring all street railways operating in that city to equip their cars with a proper guard or fender, to prevent, as far as possible, injuries to persons or animals.

THE New Haven (Conn.) Street Railway Company will commence operations, electrically, March 1.

The Ball Engine Company's Direct Connected Engine.

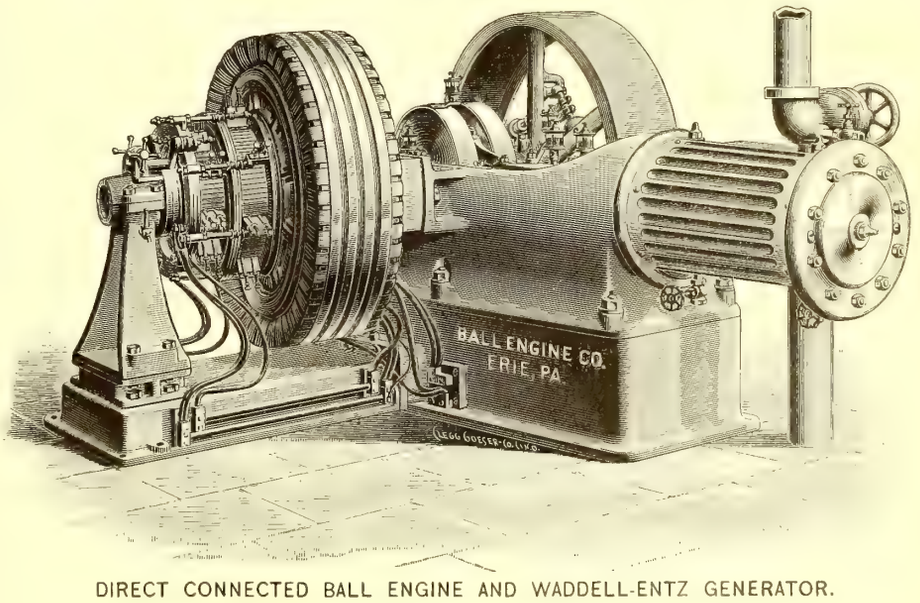
The direct connection of engines and generators has many advocates, and the call for direct connected couples has induced many engine builders to devote their attention to this practice.

This arrangement of engine and dynamo has a twofold advantage. The first of these is the small floor space occupied. This is an important consideration for central stations, hotels and office buildings in large cities where there is a steadily increasing demand for economy in this direction. Another advantage is in the elimination of waste of energy by transmission through belts and countershafting. With the direct connected engine the frictional losses due to outside causes entirely disappear, leaving nothing but the internal friction of the engine to be accounted for.

The Ball Engine Company, of Erie, Pa., has made a number of installations in connection with its various types of dynamos; among late ones, two 200 H. P., cross compound engines, directly connected to Siemens & Halske dynamos in the Lumber Exchange Building, Minneapolis, Minn.; one 125 H. P., simple engine, in connection with a Waddell-Entz dynamo, in the store building of Willoughby, Hill & Company, of Chicago; one eighty horse power engine in connection with the Waddell-Entz dynamo, in the building of Cumner, Craig & Company, of Boston, Mass. The accompanying illustration represents an eighty horse power Ball engine directly connected to a Waddell-Entz dynamo. It shows the armature mounted on the engine crankshaft, which is supported on the end by an outboard bearing resting on an extended sub-base. This is a remarkably compact, durable and efficient arrangement, and has given the greatest satisfaction in practice.

The distinctive features of this well known engine are beauty of design, simplicity and compactness, solidity and strength of frame, large bearings and wearing surfaces, excellence of material and workmanship.

The engine, therefore, is economical and durable, and being well balanced, will run quietly and smoothly under the heaviest and widest varying loads. The regulation is so perfect that, it is said, the engine will not vary more than 1 per cent. in speed.



DIRECT CONNECTED BALL ENGINE AND WADDELL-ENTZ GENERATOR.

THE latest projected electric railway of considerable length is one to connect the city of Washington with Richmond, Va. A bill has been presented to the Virginia legislature to incorporate the Southern Railway & Electric Company which has this in view. Among the incorporators are: A. Pizzini, Jr., T. N. Kendler, G. D. Patch and Hill Montague, all of Richmond.

Practical Notes on Rope Driving.

By M. E.

Introductory.—While economy in the generation and transmission of power is a more or less important factor in nearly all manufacturing concerns, it is doubtful if its influence has ever a more direct bearing on the profit and loss account than in the case of electric light and power plant. In the saw mill, or the flour mill, the cotton or the woolen mill, the cost of generating and transmitting power is of valuable import, but it represents in each case practically a fixed proportion of the cost of the finished product. But in the central station plant, and in one or two other similarly circumstanced concerns—where "force transformation" may be said to represent the "product"—any increase of efficiency in power generation or transmission becomes of supreme importance, affecting, as it does, the profitable operation of the concern nearly in direct proportion. Though of somewhat lesser moment, other points, as first cost, and maintenance, durability, and more frequently the space occupied by the installation, call for thoughtful consideration.

The necessity which so often obtains of restricting within the smallest possible limits the space occupied by the installation, has undoubtedly exercised a very marked influence upon the development of power generating plant in both its electrical and mechanical aspects. Directly connected engines and dynamos have now become common, but beyond the reduction of space and of first cost thus secured, it may reasonably be doubted if any other very material advantages can be claimed for this method of driving. Dispensing with intermediary gearing is not, in electrical work, the unmixed blessing that ardent advocates of direct connection would have us believe—a fact which a severe short circuit not infrequently demonstrates in a very unmistakable manner. Moreover, the interposition of an elastic connection between the engine and the dynamo cannot fail to act beneficially, for other well understood reasons, while the arrangement has the further advantage of allowing the engines and machines to be readily combined in various ways, as repairs or alterations may render necessary. These advantageous features, in conjunction with those of economy of fuel and greater durability of the lower speeded engines, appear to point conclusively to the fact that where the cost of space is not prohibitive, economy in working, durability, and general convenience in operation, call for dynamos indirectly coupled to engines of the most efficient type available.

Upon this assumption the method of driving to be adopted calls for careful consideration, in order that the power transmission may be most efficiently effected. Toothed gearing being obviously inadmissible, there remains available only belt and rope gear, and of this the former was until recently almost exclusively adopted in this country. During the last few years, however, attention has been directed to the method of transmitting power by fibrous ropes, a system largely adopted in England, and to a lesser extent in Europe generally. Concomitantly with this, there has been increasing attention given to the so-called American system of rope power transmission.

In quite a number of central stations in England, rope transmission has been adopted, and although in one or two instances, owing to bad arrangement, only indifferent success has been obtained, the majority of installations have given every satisfaction, the results showing that properly designed rope gear is quite as efficient, mechanically, as belting, while possessing several material advantages over the other method of driving.

Advantages of Rope Driving.—Among the special advantages claimed for ropes over belting for dynamo driving, the following call for special mention:

(1.) The first cost of the ropes is considerably less than that of the equivalent belting.*

(2.) Rope gear is a more nearly positive system of power transmission than belting, and allowance need not therefore be made for slip.

(3.) Rope gear is much more compact than belting at equal power, and consequently narrower (though not necessarily *lighter*) pulleys are required. The latter is often an important consideration in the transmission of large powers, as it reduces the width between the crankshaft bearings, which with very wide band wheels, frequently becomes a serious inconvenience. Further, with the continuous system of rope driving, the driving and driven shafts may be much closer together than with belting.

(4.) Rope transmission is practically noiseless at all speeds, and the connection being more elastic than with belting, the power is conveyed in a more smooth and equable manner. Contrasted with the noisily flapping and swaying belts sometimes met with, this feature is recognized as a real, though a minor, advantage of the rope driving system.

(5.) The flexibility of this gear renders exact alignment of the connected shafts unnecessary, and thus it is not affected by any slight settling of buildings or foundations.

(6.) The cost of maintenance is, generally speaking, less than that of belting, this being a point, however, largely determined by the care bestowed upon the planning of the installation in the first place.

(7.) The separate rope driving system possesses the very material advantage of securing complete immunity from breakdown, as individual ropes may be readily renewed or old ones taken off, respliced and replaced, without necessitating the shutting down of the entire plant.

(8.) It is claimed that ropes occasion less drag on the shaft necks, and, consequently, entail less frictional loss than belts. This, however, cannot be said to have been conclusively proved.

Among other advantageous features which may be briefly referred to as being of more general interest are: Ropes enable power to be economically distributed to various parts of a building, corners being turned, and shafts at any angle being driven with facility, this being an especial advantage of the continuous system. Vertical drives—practically impossible with belts—can be almost as satisfactorily arranged as ordinary drives, while power can be efficiently transmitted to much greater distances by ropes than by belts.

Historical.—There can be very little doubt that the system of transmitting power by ropes owes its origin to the method adopted by the early inventors of cotton spinning machinery, for driving spindles, "rims," etc. Rope makers, were, however, among some of the earliest users of rope driving. As instancing this, it may be said that at a rope factory at Great Grimsby, Lincolnshire, England, ropes were used from 1830 to 1837 for conveying the power from the engine to the first motion shaft. Some flax spinning mills at the same place were also driven by rope gear about this time. In the rope factory about 100 H. P. was transmitted, and very satisfactory results obtained.* In this case hemp ropes and semi-circular grooves were employed. The wire rope transmission, introduced by the brothers Hirn, at Logelbach, in 1850, again attracted attention to the possibility of transmitting power by ropes, but it was not until about 1858-1860 that James Coombe & Company, of Belfast, Ireland, introduced rope driving for large powers. For some years the system made but little progress, but about 1865, Pearce Brothers, of Dundee, Scotland, took the matter up, and after several mills had been equipped with the new system of power distribution, it found its way to the large textile manufacturing districts of Lancashire and Yorkshire, where it is now almost exclusively adopted. In this country the system has, during the last decade, attracted considerable notice, but it has not been so largely adopted as might have been anticipated.

Materials.—The earliest forms of driving rope consisted of specially prepared leather thongs, twisted together, but these were found liable to untwist and cause

*This is in part due to the fact that while the strength of a leather belt is very greatly diminished at the joint, that of properly spliced rope is not more than 15 per cent. less than the specific strength of the material.

*Proceedings Inst. Mechanical Engineers (Eng.), 1876.

trouble, while their cost also militated against their more extended adoption. It is not surprising to find, therefore, that this material was soon abandoned in favor of hemp, and ropes of this material were afterwards largely employed. A few years later a variety of hemp, known as manilla, was tried with much success, and this material is at the present time used largely in this country. In France and Germany, but more especially in Great Britain, however, manilla is not by any means so generally used, probably owing to the relative poorness of the fibre as compared with that used in this country. The choice of material is, however, largely influenced by the products of the locality. Thus, good hemp and manilla being available in the Dundee and Belfast districts of Great Britain, ropes of these materials are there more generally used, while in the cotton spinning districts of Lancanshire, cotton ropes are almost universally employed. In England generally, however, during the last ten or fifteen years, and in this country for a shorter time, the use of cotton ropes has rapidly extended, and although more costly in the first instance, they have proved to be much better adapted to the purpose. Cotton possesses the marked advantages of strength and durability, while it is more elastic and pliable than hemp or manilla. Moreover, the internal friction caused by the fibres rubbing over each other in bending around pulleys is much less than with hemp or manilla. Ropes made of the latter materials cannot be so tightly twisted as those of cotton, and as the fibres are of a harsh, wiry, unyielding nature, the rope is only brought into a compact form by the partial chafing away of the fibres composing it. To obviate the internal wear of the fibrous ropes, it is now customary to "lay" them in some lubricant which, by reducing the friction, increases the pliability, lessening, therefore, the loss of power due to bending around pulleys, while greatly prolonging the life of the rope. Some makers use plumbago only; others, a mixture of plumbago and tallow, while others, again, prefer to employ only a little wax or French chalk. Some makers of cotton rope coat only the exterior of the strands with lubricant, contending that treating the yarns also, only adds weight to the rope without increasing its effectiveness or prolonging its life.

It should here be remarked that much of the driving rope now sold is largely adulterated with weighting material, white lead being often employed for this purpose. This, as will be readily imagined, soon hardens and stiffens the rope considerably, while it has the double disadvantage of reducing the stress-resisting sectional area of the fibres and of increasing the centrifugal tension, both causes reducing the available strength of the rope.

In the manufacture of hemp and manilla ropes, the fibre, after it has been prepared, is spun into yarn, the direction of twist being in a right hand direction. A number of these yarns, depending on the size of the rope, are then twisted, but in an opposite direction, to form strands. Finally, three or four strands are twisted together in a right hand direction to form the rope. In this way the tendencies of the composite parts of the rope to untwist are to mutually counteract each other.

The manufacture of cotton ropes is a somewhat similar, but rather more complicated, process. Some difference of opinion exists as to the relative value of Egyptian and American cotton, many claiming for the former variety superior strength of fibre. Some makers prefer one, and some the other, but in the writer's opinion there is little to chose between the two. For the best make of rope, the size of yarn technically known as 32's twist is very generally used, but a cheaper variety, made from weft yarn, is also sold, but this is found not to compare favorably with the former as regards durability.

As to the relative merits of manilla and cotton rope for power transmission, much may be said. As previously remarked, hemp or manilla rope is not so extensively used in Europe, but as the manilla obtained in this country is of a much finer description, it is likely that it will continue to be largely used for the purpose. For the particular purpose of dynamo driving, however, the greater pliability of cotton rope would appear to recommend its adoption, more especially as much smaller pulleys may then be used on the dynamos than with manilla. There is no doubt that manilla ropes—especially when new—absorb more power than those of cotton, and this again ought to give the latter the preference for central station work, where efficient power transmission is such a great desideratum. Raw hide rope has much to recommend its use, but its cost appears prohibitive. Composite ropes of iron or steel and fibrous material, in various forms, have also been tried. In one form a series of leather disks were threaded upon a core formed of iron wire rope. This made a very flexible rope, and one which had a good grip in the semi-circular groove in which it was used, but the cost and the difficulty of splicing formed serious objections to the use of this rope. In another case, a core of cotton was used, upon which steel wire covered with flax was woven; but this has not given satisfactory results.

Make of Rope.—While manilla rope is usually of three or four strands, the forms of cotton ropes are various. Three and four strand ropes are very largely employed, but seven strand ropes are also used, while others again use a three, four or seven strand rope, upon which is wrapped or coiled a layer of cord about a quarter of an inch in diameter. The latter forms are not to be recommended for dynamo driving as the outer protecting coil greatly increases the resistance to bending, in addition to complicating the splicing of the rope. The question therefore resolves itself into three *versus* four strand ropes.

The *three strand* rope has the advantage of simplicity of construction, which renders it easier to splice than any other form. Moreover, the strands lie very close together, and the small aperture in the center is completely filled up by the mutual compression of the strands. The three strand rope does not conform so nearly to a circle as does the four strand, and the outer fibres are subjected to greater bearing pressure, while not offering so great a resistance to slippage in the groove as the four strand.

The *four strand* rope, approximating more nearly to a circle than the three strand, and, for a given diameter, containing more fibres, it is clear that it is the stronger rope of the two. On the other hand, to evenly twist four strands into a rope, it becomes necessary to use a central core, which while adding to the weight and cost of the rope, does not bear any portion of the stress. Further, the core detracts from the flexibility of the rope, as the strands on bending around a pulley, slide not only over each other, but also upon the central core. It appears reasonable to suppose, moreover, that the core piece, being straight, must stretch very considerably or break, as the spirally twisted strands outside it will much more easily yield under the load. In spite of these seeming objections, however, excellent results are obtained with well made four strand ropes. In working they soon become quite circular in section and afterwards the wear is inappreciable.

The amount of "twist" put into a rope is not without its influence. A "hard-twisted" rope is materially stronger than a "soft" or "light twisted" rope, but its flexibility is also much less. It may frequently be noticed that some of the intermediate sizes of rope, which are not in general request, are more hardly twisted than others. This appears to be the result of the practice of some makers, who by "hard-twisting" the next larger size of rope, are enabled to produce a diameter somewhat approximating to that required. It would be unfair to say that this practice is generally followed, but it has been done in several instances, and in some cases of dynamo driving, with somewhat smaller pulleys than should have been used, the results have been far from satisfactory.

(*To be continued.*)

THE Tarentum Traction Passenger Railway Company, of Tarentum, Pa., is to install a suburban line six miles in length. J. B. Crawford is secretary of the company.

S. A. DARRACH, a Newark inventor, has brought out a new fender.

Notes from England.

(*From our London Correspondent.*)

In the last installment of these notes it was mentioned that in the three cases where the local authorities had decided on buying up tramways, the arbiters who fixed the price to be paid to the companies decided that structural, not rental, value was the sum payable, and the further statement was made that the companies intended to appeal against this decision to the law courts. The first of these appeals has been brought, and was decided towards the end of January. The case was that of the London Street Tramways Company. The twenty-one years from the time of construction of four and a quarter miles of the company's lines having expired, the London County Council was entitled to buy up the undertaking. The Council decided to do this, and the arbiter, Sir F. Bramwell held (and this also was the contention of the County Council) that under the Tramways Act, all the company was entitled to was a sum for which the tramways in question could be established, minus an allowance for depreciation. The sum he fixed was £64,540. The company maintained that it was entitled, as in the case of any other hereditament, to get the rental value capitalized, and in its case, the company claimed, this should be at twenty years' purchase. The company considered that the fair rent of the tramway, as worked with adjoining lines, was £10,625 per annum, and its claim thus stood at £212,500, and it moved the courts to set aside the arbiter's award.

Mr. Justice Mathew and Mr. Justice Collins, before whom the case came in London, thought that the section of the Tramways Act covering this point was very difficult to construe, but they could not come to the conclusion that Parliament, when the Act was passed, meant that such consequences should follow to the company as were insisted on by the Council. The right to use the undertaking was sold, as well as the undertaking itself. They sent the question back to the arbiter to determine the valuation, but they left it to him to say what was the rental figure, and at how many years' purchase it should be capitalized. It was learned on inquiry that in view of the extreme importance of the question it will be carried to the supreme tribunal, the House of Lords, for decision. If the decision of the court is upheld on appeal, there is little doubt that we shall hear very little more of local authorities purchasing tramway undertakings.

In Leeds it is still doubtful whether the Town Council will work the newly acquired tramways itself or lease them to a company. No decision has been reached, either, upon the question whether cable or electric power shall be used. The people like the Thomson-Houston electric line to Roundhay Park for its speed and comfort, but they do not like the poles and wires. From Leeds, as from other towns—notably Bristol, where an electric line is in contemplation—deputations have visited Wallsall, in Staffordshire, and seem to have been very favorably impressed with the overhead wire system in use there. As many readers are no doubt aware, the trolley wire is in this case carried along the side of the road, and the trolley pole, which has a lateral as well as a vertical play, reaches out sideways and upwards to the wire.

The cable tramway in Brixton, London, which has been open for a year, is now working with the utmost regularity and smoothness. The chairman of the company at the recent meeting of shareholders, was able to announce that the number of accidents per car on the horse lines of the city were three times as numerous as on the cable road. No separate accounts of the operating expenses have yet been published, but I learn from private sources that these will probably soon be obtainable, and that they will reveal an almost incredible economy as compared with the cost of horse traction. In regard to the extension of the cable line, to which reference was made in the last installment of these notes, I find I was in error as to the length of the new road. It is to be three miles reckoned by single track, not by double track, so that the street length will be one and a half miles. This will make the total street length of double track cable road four and one fourth miles.

The significant announcement was made in the beginning of the year that so well pleased was the Liverpool Elevated Electric Railway Company with the working of the line that it released the Electric Construction Company of its contract to work it for two years at a guaranteed traction cost of eight cents per train mile. This shows the great confidence which the railway company already has in the system.

The tramways of Douglas, Isle of Man, will, it is expected, soon be equipped either electrically or with the cable. Probably the former would be preferable, looking to local circumstances.

New England Notes.

The regular monthly meeting of the Massachusetts Street Railway Association, which was held at Young's Hotel, Boston, during last month, proved to be of great interest. The members dined together and subsequently listened to a paper on various types of steel rails, which was read by G. S. Clark, of the Pennsylvania Steel Works, who exhibited samples of many different kinds of rail manufactured by this company. The paper gave rise to an interesting discusson. This was followed by an address from Mr. Hooper, electrical engineer of the Lynn & Boston Railroad, on the subject of "Bonding Rails." The address was replete with valuable information bearing on the subject, the speaker giving at length his experience in the use of various types of bonding rails with copper wire, pointing out the advantages and the disadvantages of each. A very animated discussion followed, some useful hints being given by the various speakers. Other addresses bearing on the same topic were announced, but the speakers were absent. It was decided that at the next meeting the subject of "Mutual Insurance" and "Brake Shoes and Car Wheels" shall be introduced for debate.

The troubles into which the Interstate Railway has got are by no means straightened out as yet. It was decided a few weeks ago that a receiver should be appointed to take care of the stockholders' interests, but owing to the divided and conflicting interests, no receiver has yet been appointed. Application was made last month to the United States Circuit Court, by counsel representing both individual stockholders and many creditors. No less than three different men were suggested as being suitable for the office, but not one of them was appointed. There are points of law involved in the matter, and Judge Colt has permitted counsel to file briefs on the questions argued.

The subject of removing overhead wires from the streets of Boston, is attracting much attention. The State Legislature and the City Council have undertaken to deal with the matter simultaneously, if not conjointly, and with a determination which forshadows success to to the movement. Representative Hoar has a bill before the Legislature, which is supplemented by an order passed in the Council, the effect of which, if the end sought is accomplished, will be to remove from the streets of Boston all electric wires except the trolley wires and the wires necessary for supporting them. A further order was also submitted, with this provision: "That the Board of Fire Commissioners be requested to have an electrical expert located in each of the fire districts." This order was referred to the committee on fire department, but really has an important bearing on the street railways.

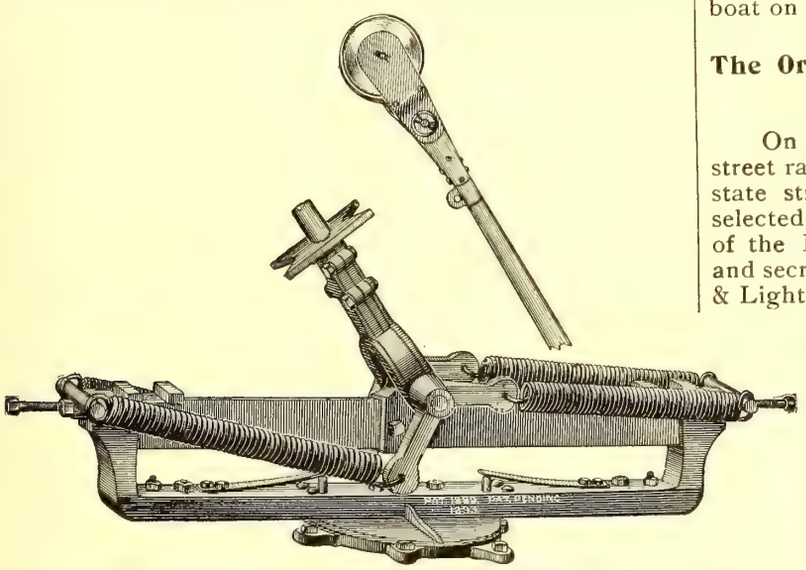
The committee on transit and street railways of the Massachusetts Legislature has made a trip to Bellport, on the Long Island Railroad, fifty-eight miles from New York, to inspect the Boynton Bicycle Railway in operation there. Hon. E. P. Shaw, of Newburyport and Colonel Cunningham, of Chelsea, accompanied the party.

The tramway company of Aix-la-Chapelle, Germany, will install electric power.

A New Trolley.

The accompanying engraving shows a new type of trolley pole put upon the market by the Duplex Trolley Company, of New York, of which C. E. Chinnock is president. The base of the pole, as shown, is supported on a vertical strip of steel which will always keep the flanges of the trolley wheel parallel to the overhead wire, so that there is no tendency to ride over the wire. This gives the pole great lateral range of movement, enabling it to follow closely the variations of the trolley wire, and at the same time insures passing over frogs without danger of jumping the wire.

The pole is jointed just below the fork, and complete vertical flexibility is permitted by the four coil springs shown, which have the usual methods for regulating tension, and the upper part is held in position by flat springs, permitting a slight vertical movement which gives a spring touch on the wire. The wheel itself is composed of four parts; the two flanges, the hub and the tire, the



DUPLEX TROLLEY.

latter being renewable, so that it is only necessary to replace this portion, which can be done at a small expense. This construction also makes the wheel much lighter than with a solid construction, reducing, it is claimed, the wear on the trolley wire.

The lightness of the trolley wheel, and the "duplex" feature of the pole allow the wheel to follow the wire closely, eliminate arcing and noise, and reduce wear and tear on the wire and appliances. The trolley wheels cost 50 per cent. less in consequence for renewals, and will last 50 per cent. longer, making a saving of 75 per cent., claimed, in the life of the trolley wheels.

Mr. Chinnock, who is the inventor of the trolley, has had over twenty years of practical experience in the electrical field, from electrician of the Metropolitan Telephone & Telegraph Company to vice-president and general manager of the Edison United Manufacturing Company, and superintendent of the Edison Electric Illuminating Company, of New York. His long experience in this line has enabled him to bring out a device which meets the difficulties encountered with trolleys.

A Peculiar Accident.

A peculiar accident happened recently on the so-called aerial railway at Knoxville, Tenn. At this point the bank of the Tennessee River is some twenty feet above the water on the Knoxville side, while it reaches a height of nearly 350 ft. on the other side. This suspended railway furnishes access to a park situated on the top of the bluff, directly across from a point about one mile below the city. The car travels on two one and three-eighths inch cables, having a rise of 350 ft., and a span of 1,060 ft, making the incline a little over one in three. These cables are anchored strongly in the ground at the lower end, and to the rock at the top. The car is propelled by an endless, one-half inch cable operated by two twenty horse power engines. The line at its highest point is 350 ft. above the water. The up trip is made by power, and takes three and one-half minutes. The descent is made in one-half minute by gravity. The car is equipped with automatic brakes which will hold it at any point on the line.

On the afternoon of February 18, while making the up trip, with six persons in the car, the hauling cable broke when the car was within a few feet of the top. The brakes stopped the car within forty feet of the bluff, but the small cable commenced to overhaul with great rapidity, until the broken end struck the car, and wrapping round it, caused it to tilt to an angle of 45 degs., and made it impossible to move the car either way on the cables. The passengers were taken out, after considerable difficulty, by means of a rope sling slipped down over the cables from above, and lowered one by one to a boat on the river 350 ft. beneath.

The Organization of the Texas Street Railway Association.

On December 5, 1893, several representatives of Texas street railways met at Waco for the purpose of forming a state street railway association. The following were selected as temporary officers: Chairman, A. Zintgraff, of the Dennison Street & Belt Line Railway Company, and secretary, J. A. Hobson, of the Waco Electric Railway & Light Company. A meeting was called for January 24, 1894, at Austin, to effect the permanent organization.

In accordance with the above action, the First Annual Meeting of the Texas Street Railway Association was held at Austin, January 24, with a representative attendance. The following officers were elected: President, W. H. Sinclair, of the Galveston City Railway; vice-president, J. K. Urie, of the Austin Rapid Transit Railway Company; secretary-treasurer, J. A. Hobson, of the Waco Electric Railway & Light Company. Directors: W. H. Weiss, of the San Antonio Street Railway Company; A. W. Childress, of the Queen City Railway, Dallas; W. H. Sinclair and J. K. Urie. Committee on membership: Carl Drake, of the Laredo Electric Railway Company; J. K. Urie, A. W. Childress and C. A. McKinney, of the Houston City Railway Company. A constitution was adopted, and the Second Annual Meeting set for the Third Wednesday in January, 1895, at Dallas. The delegates were entertained by Mr. Urie, of Austin, and Mr. Drake, of Laredo, and the meeting was closed by a banquet at the Driskill Hotel.

Contracts Let for the Baltimore & Washington Railway.

The projected electric railway between Washington and Baltimore, to which frequent reference has been made in past issues, now seems to be near completion. The president of the road is reported as saying that everything connected with the route has been settled, except the entrance to Baltimore. We understand that the contracts have been let, and it is hoped that the road will be built and in operation by September, 1894. The length of the line will be about twenty-eight miles, and the schedule running time, as estimated, will be one hour.

The same company controls the Eckington & Soldiers' Home and the Belt Railway systems in Washington, and entrance to the latter city will be had over these lines. The gauge of the track will be four feet eight and a half inches, the same as the lines in Washington mentioned. As the gauge of the Baltimore Street Railway Company's lines is five feet four inches, special tracks will have to be laid in the latter city.

Gold's Storage Street Car Heating System.



EDW E. GOLD.

The problem of thoroughly heating street cars has engaged the attention of the Gold Car Heating Company during the past few years, and its efforts in this direction have met with every success.

The following illustrations show the Gold storage heater, the chief factor of this system. The entire apparatus is extremely simple, and and the results which have been obtained from tests during the most severe weather of the past winter have been very satisfactory.

A very thorough test of this system was recently made by the Third Avenue Cable Railroad Company, and for two weeks, during which the thermometer registered below 25 degs., the car in which this heater has been installed was heated to the expressed satisfaction of both the railroad officials and the traveling public. The temperature was maintained at over 70 degs. under all conditions. The following copy of one of a number of tests made on that road shows the heater's capabilities and the economy of fuel obtained by its use. This test was made Tuesday, February 13, 1894, on car No. 424, of the Third Avenue Railroad Company, running between Fort George and the East River at 125th Street:

Time.	Temperature Inside the Car.	Temperature Outside the Car.
2.00	70	13
3.00	72	13
4.00	70	12
5.00	70	12
6.00	70	11
7 00	70	11
8.00	70	10
9.00	70	9
10.00	70	9
11.00	70	8

The fire in the stove was started at 12.40, the temperature inside the car being 18 degs., while the temperature outside before starting was 14 degs.

Thirty-nine pounds of coal was used in the stove. The cost was about 7.8 cents for heating the car for thirteen hours, and there was sufficient coal left in the stove when the test was completed to last for two more trips which in time would be equal to nearly three hours.

One of the very essential features, and that which is in most cases considered the one on which the adoption or rejection of a heating system hinges, is the cost of maintenance of heat per day, which, with the Gold system, is reduced to a minimum.

As shown in our illustrations, a storage heater of sufficient length is placed longitudinally under the seats of the car. This storage heater consists of a length of five inch boiler tube, enclosed in which is a cylinder four inches in diameter, filled seven-eighths full with a strong solution of non-freezing liquid, and sealed at both ends. When steam is turned on, it passes between the outer tube and the interior cylinder, and consequently the warming of the car and the storage of heat commence simultaneously. To obviate the necessity of charging the heater with steam at intervals, a stove, enclosed in which is a coil, is placed underneath the platform of the car, and this enclosed coil is connected with the steam chamber of the heater. When the steam with which the heater has been charged condenses, the condensation flows into the coil by gravity and is again made into steam and returned to the steam chamber of the heater. In this manner the car can be heated for an indefinite period. Should the fire in the stove, through some unforeseen cause, become extinguished, there is at all times sufficient heat retained by the storage heater to keep the car warm for five to seven hours. It is a perfectly simple matter to equip any construction of horse, cable or electric cars with these heaters. As they take up no valuable space in the cars, the cost of the apparatus is saved in a very short time by the seating capacity gained, which in other cases is taken up by the car stove or the fuel necessary to feed the same. A pleasant hot water heat is radiated uniformly through the car, and in damp and wet weather the floor is always kept perfectly dry.

In Figs. 1, 3 and 4, B is the coil stove, C steel floor plate, D door to supply the stove with coal, E supply pipe, F return pipe, H under pipe, M air cock, P safety valve. In Fig, 2 A is outside tube, B inside tube, C strap bolted to heater stand D, F support for inside tube, G steam space on passage, H extension space.

All the fittings and parts of the apparatus are double extra heavy, and will therefore last as long as the car remains intact. That no repairs are needed for this heater is proved by the fact that over 15,000 of these heaters have been in use on the largest railroads of this country and Europe from two to ten years, and yet not one of them has required any repairs whatever.

Comparing this Gold system with that used at the present time, we find that two stoves are used in each car by the Third Avenue Railroad Company, but as is well known, the heat given by them is of little account, and furthermore, they cost at least four times as much for maintenance as does the Gold system.

The name of Edward E. Gold, the inventor of this apparatus, has been a familiar one to the public for the past twenty years, as the patentee of many ingenious appliances. He is a direct descendent of Major Nathan Gold, one of the petitioners (nineteen in number) named in the charter of Connecticut, granted in the reign of Charles II., which petition "was signed by no gentleman unless he had sustained a high reputation in England before he came to New England." Mr. Gold has devoted a great deal of his time during the past twenty years to the science of steam heat, and his heating systems and other railway appliances are well known in the railway world. His patents in the line of car heating are handled exclusively by the Gold Car Heating Company, of which he has always been president.

Mr. Gold's heaters have demonstrated their superiority to all others in the minds of a large number of steam railway managers, and are in use on a large number of the most prominent lines in the country.

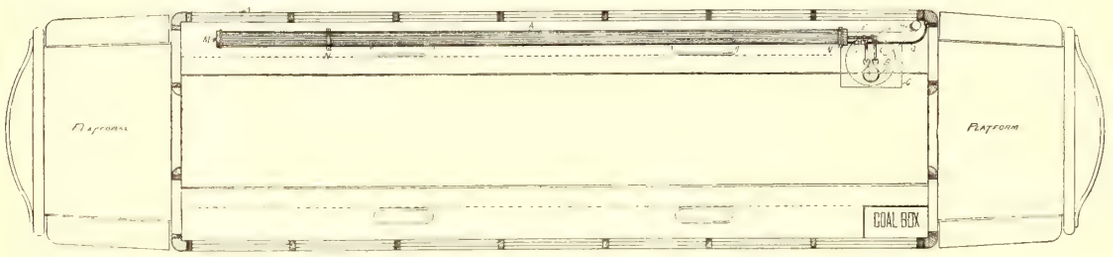


FIG. 1.—PLAN OF CAR EQUIPPED WITH GOLD'S HEATER.

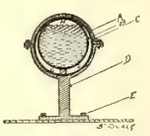
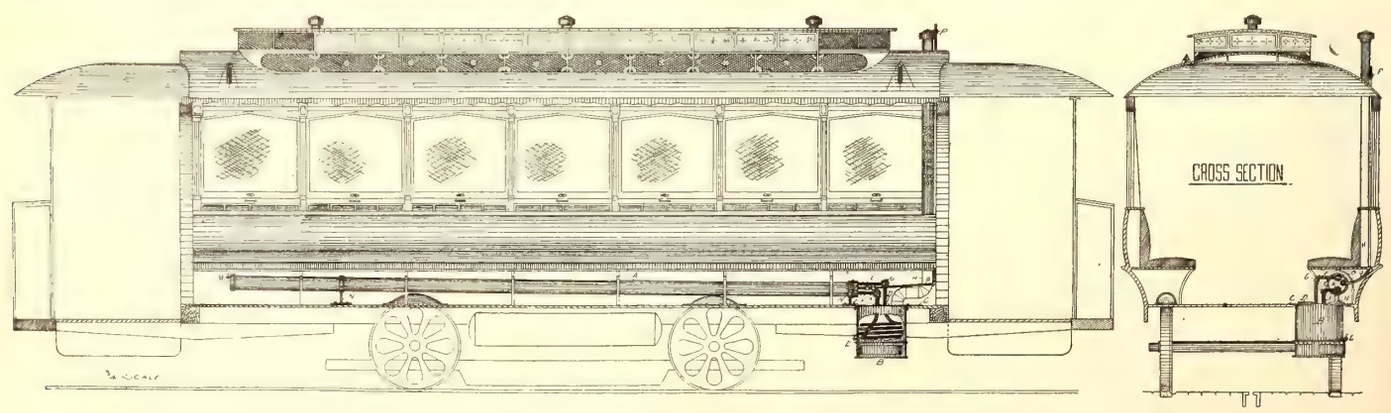


FIG. 2.
SECTION OF STORAGE HEATER.



FIGS. 3 AND 4.—SIDE ELEVATION AND CROSS SECTION OF CAR EQUIPPED WITH GOLD'S HEATER.

The Morrin Climax Steam Generator.

The increasing demand in stations where the ground space is necessarily limited, for boilers that will develop a maximum amount of power and at the same time take up very little room, has led to the use of water tube boilers to a considerable extent. This form of boiler has the advantage of occupying the smallest possible space, and besides its safety from explosion has great durability, and may be repaired when necessary with a minimum loss of time by stoppage. Our illustrations show two views of the Morrin generator as manufactured by the Clonbrock Steam Boiler Works, of Brooklyn, N. Y.

The heating surface of this generator is made up of loops of steel tubes, T, which are expanded into the cylindrical shell, A. Within the shell, A, is a second cylinder, B, which is not necessarily steam and water tight, and is bolted together in short sections for convenience of removal in case of repairs being required. The cylinder, B, is closed at the bottom and a point at the top, which is a little below the water level. The lower end of each of the tubes, T, is connected to the inner cylinder, B, by means of the short tubes, C. These short tubes are not expanded, as it is not necessary that they be kept tight. The purpose of this arrangement is to secure a constant, rapid circulation within the main tubes, which result it accomplishes perfectly. The firebox, V, surrounds the cylinder, A, and the products of combustion impinge upon all of the tubes in succession. The grate may be either stationary, in which case more than one fire door is required, or rotary, when one fire door is sufficient. With a mechanically driven, rotary grate an automatic feed mechanism may be successfully used.

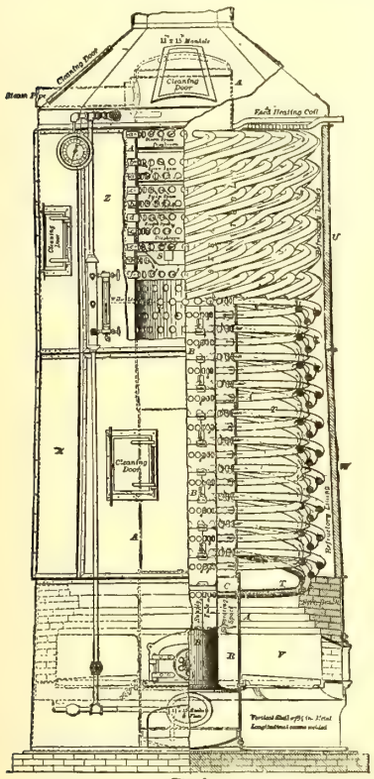


Fig. 1.

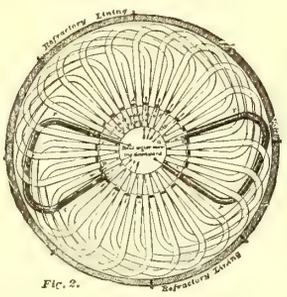


Fig. 2.

VERTICAL AND CROSS SECTION OF MORRIN CLIMAX STEAM GENERATOR.

The builders claim for this generator very high efficiency, as shown by numerous tests, and also the ability to run economically up to 30 and 40 per cent. beyond its rated capacity. The outer casting, U W, is constructed in sections, and may be easily removed to get at the tubes. This generator is made in sizes of from 100 to 1,000 H. P., and has given satisfaction to a large number of users and under widely varying conditions of service. Its satisfactory qualities are well evidenced by successive orders from a number of large electrical and manufacturing companies. The builders also claim great durability, quick repair, the absence of all the complicated joints that are so fruitful a source of leakage in many other water tube boilers.

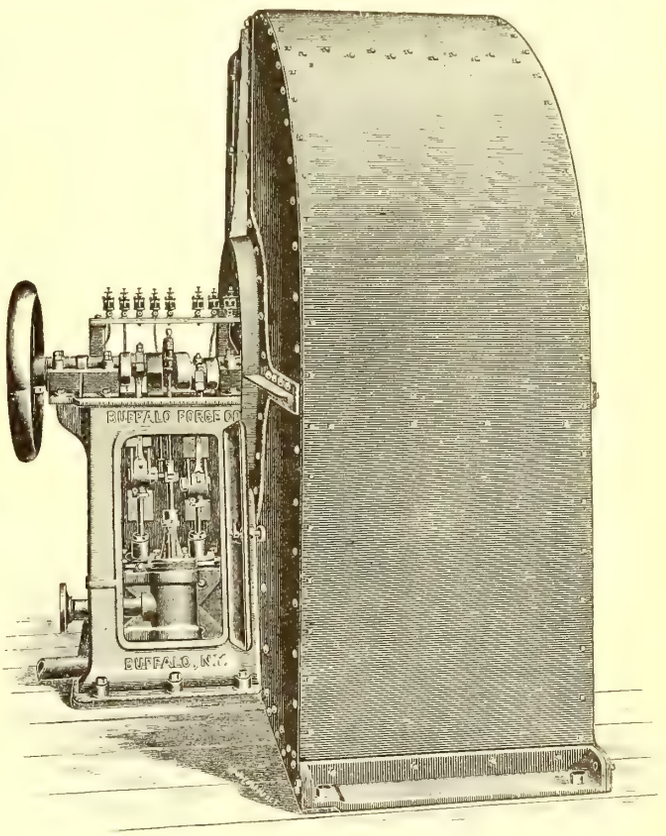
Special Steel Plate Steam Fan With Double Upright Enclosed Engine.

The practice of applying fans to batteries of boilers is not a new one. It is not generally known that by the use of a fan especially constructed for the work, hard coal screenings and slack may be burned, and with great economy. In street railway power houses, and other locations where great quantities of fuel are consumed, this is a great item.

In producing this design the aim has been to secure a type of engine which would develop a large amount of power at high rotative but moderate piston speed. The work required of steam fans for forced draft duty under boilers demands the above, and the illustration presented herewith clearly portrays the construction of the double upright, enclosed engine, built by the Buffalo Forge Company, of Buffalo, N. Y., and employed with its steel plate blowers for such service. Where this engine is to be used in dusty situations, it is built with the working parts entirely enclosed.

The frame is rectangular, and wider at the base than at the bearings. In the larger sizes the cylinders are bolted to the base, which forms a part of the housing, and they can be so arranged that the piston can be readily removed by withdrawing the bolts of the cylinder head and the lower end of the connecting rod, whereby the crosshead, cylinder head and piston can be lifted out without removing any other part. The steam chest is bolted to the cylinder, so that it may be readily removed when desired. The crosshead slides are so jointed to the frame as to enable adjustment for wear. The crossheads have Magnolia metal gibs to prevent cutting of the slides, and have clamp joints for the piston rod. The pistons are of the snap ring pattern, the rings being made of a special metal (some having been used for a long time without internal lubrication). The valve is of the piston type, steam being admitted at the center instead of at the ends. The rods have large wearing surfaces. The crank end is lined with Magnolia metal, and the wrist end has phosphor bronze boxes with wedge adjustment. The crank end adjustment is similar to that of marine engines.

The shaft is of crucible steel, the cranks being opposite each other,



BUFFALO SPECIAL STEAM FAN FOR BURNING SCREENINGS AND SLACK IN BOILER FIRES.

and the eccentric is cast centrally between. By specially arranged jigs, these cranks and eccentrics are so turned that their relative positions are such as to give the proper position to the valve at the various points of the stroke. The eccentric strap is lined with genuine babbitt. The bearings, which in their ratio are large, are bolted to the main housing, and lined with a special brand of babbitt metal, and also fitted with an improved oiling ring. While every portion is made as compact as possible, yet the arrangement is such as to give ready access to all parts of the engine without disturbing others. The stuffing boxes are provided with nuts which screw on to the glands, and while standard packing is used, if desired, approved metallic packing may be substituted. To prevent corrosion, brass glands are used for the rods. The valve rod is of steel fitted with hardened pin and clamp joint. The steam chest has a phosphor bronze bushing to form a guide for the valve rod. The eccentric rod has means for adjustment of the valve without removing the cover. No rocker or its substitute is used, the object being to reduce the engine details to the lowest possible number —a great desideratum in all high speed engines. A hand wheel on the shaft, that the engine may be thrown off the center, is provided.

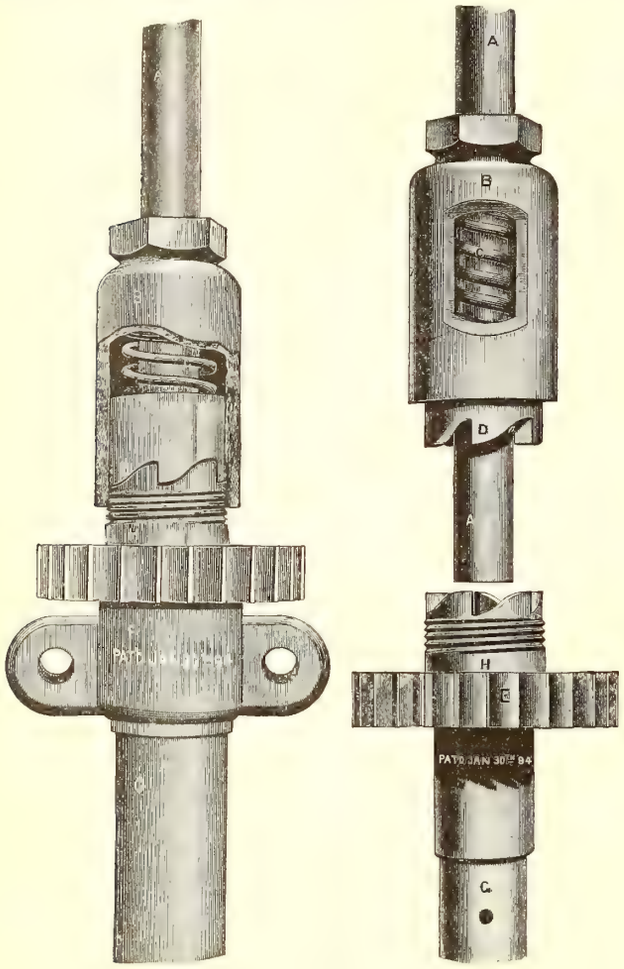
These machines have also been introduced extensively into ocean steamships and are usually so arranged as to serve two purposes, viz., of inducing perfect combustion of fuel, and obtaining the greatest steaming capacity of boilers, at the same time of ventilating the hold and other portions of the ship. The full effectiveness of steamboat boilers is always insured, and is entirely independent of the direction or force of the wind.

Technical Society of the Pacific Coast.

The Technical Society of the Pacific Coast, of San Francisco, Cal., elected the following officers for 1894, on January 19, 1894: President, C. E. Grunsky; vice-president, Geo. W. Dickie; secretary, Otto Von Geldern; treasurer, W. C. Ralston. Board of directors: Frank Soulé, W. F. C. Hasson, Geo. E. Dow, Henry S. Wood, J. Ch. H. Stut.

An Improved Clutch Brake.

The increasing weight of both cars and motors now operated in electric railway service, and the necessity of making the same number of quick stops, makes the call for brake power one of great importance, and naturally draws the attention of managers to the best form of brake attachment. Having this in view and knowing well the defects of the ordinary form of ratchet brake handle, The Safety Clutch Brake Company, of Philadelphia, has brought out a new form of coupled



IMPROVED CLUTCH BRAKE.

clutch brake that seems to possess many features of excellence. This brake is especially adapted for use on electric cars, as this form of service naturally calls for stronger braking power. Our illustrations show two views of this brake. As may be seen from these views, the brake shaft, A, extends down through the hub of the sprocket wheel, E, and operates the same by the clutch, D. This clutch is kept in position by the spiral spring, C, within the casing, B. The clutch, D, which operates the sprocket wheel, E, and the brake chain shaft, G, is situated, as may be seen, close to the bearing, F, which is strongly bolted to the front timber of the platform. The operation of the clutch is therefore much more effective than the ordinary ratchet brake handle, both on account of its increased surface, having five or more points of bearing with an area of at least one and a half square inches, and on account of its nearness to the fixed bearing, F. The brake chain shaft, G, is supported by a brace at its lower end to prevent springing and bending. This brake may be operated either by a wheel or the usual handle.

The makers claim that this is the best brake made, as well as the best made brake, and that 80 per cent. more power can be secured than with the usual form. They also guarantee the brake to last as long as the front end of the car. They have received a number of testimonials from prominent street railways that have used their brake, speaking of it in the highest terms. The officers of this company are: L. Bachenheimer, president; C. E. Baird, vice-president and general manager, and E. M. Fields, secretary and treasurer, all of Philadelphia. The New York agent for this brake is F. C. Fries, No. 83 Tenth Avenue.

The Pittsburgh, (Pa.) Glenwood & Homestead Passenger Railway Company has filed papers for an extension of its route with the Secretary of State.

The Ames Register; A Portable and Stationary Register Combined.

The accompanying engravings show a new departure in car fare registers. The Ames Register Company, of Boston, Mass., has perfected a register that has all the commendable features of a breast register, bell punch register and stationary register combined, furnishing the conductor with a register for his entire day's work, no matter how often he changes cars during that day. When changing from one car to another he also changes the portable register which is made interchangeable, and fits any stationary or car register. After a little study of the illustrations herewith shown, railroad companies will readily understand the manifold advantages possessed by this register. Fig. 1 shows the register ready for operation. Fig. 2 shows the portable register projected and partially in place. Fig. 3 shows the portable register.



FIG 1.—REGISTER READY FOR OPERATION.

The method of manipulating the portable portion of this register is as follows: At the beginning of the conductor's day's work he is furnished with the portable register which he inserts into the stationary or car register. Before operating the register, he records upon his day card the figures that appear on the portable register. At the close of his day's work he turns in the portable register with his money and day card. In computing the conductor's work, the manager simply refers to the portable register to ascertain the number of fares taken during the day.

By the use of this register it is unnecessary to assign an employe to the duty of recording the state of the register, either before the register starts on its day's work or after, for the simple reason that the portable register performs that function. The elimination of this very serious objection will be readily appreciated by railroad managers.

The stationary, or car register, cannot be operated unless the portable register is in place. It is so arranged that the conductor, if so desired by the company, can turn back to zero the stationary, or car register, at the terminus of each half, or at the terminus of each full trip, without removing the portable register or affecting the figures thereon. The portable register is a continuous one, operating to

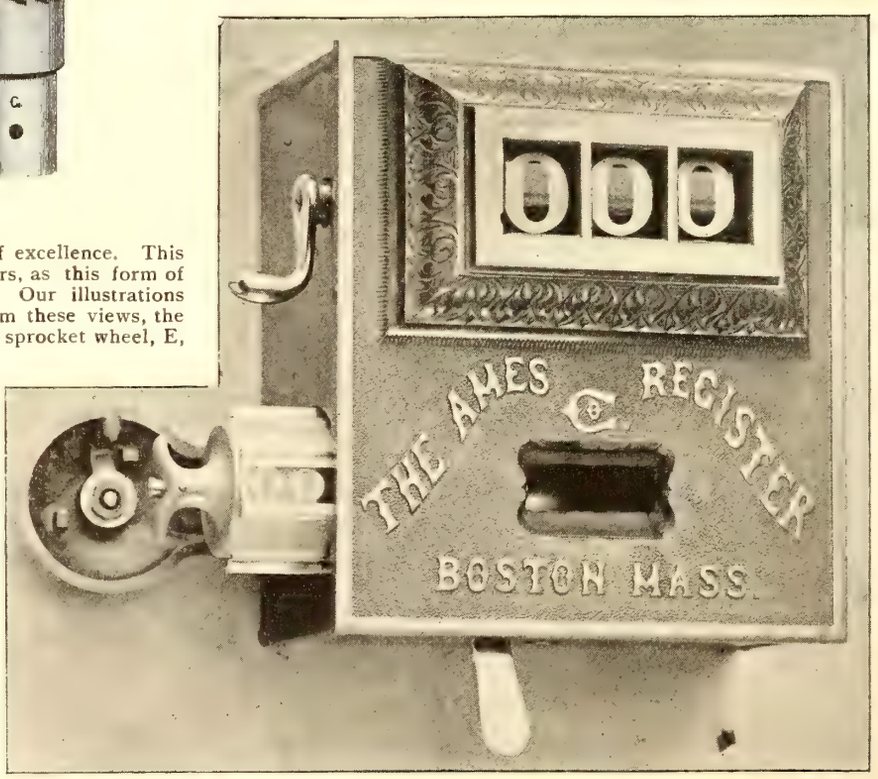


FIG. 2.—PORTABLE REGISTER PROJECTING AND PARTIALLY IN PLACE.

1,000,000, and starting again at zero, making it a perpetual device. The construction is such that tampering with the device is an impossibility. Two distinct reports are given. The construction is such that the mechanism is inaccessible to any official or employe of the railroad, thus making a positive check on those who handle the money or its equivalent. The device is simple, durable and is made of the best quality of material. The entire mechanism is operated by one lever.

The Ames register is claimed to be the only reliable, all around register, and is the only one of its kind manufactured. These registers are in use in Lawrence, Haverhill, Brockton and Allentown. The general manager of the Ames Register Company is Louis Pfingst, 753 State Street, Boston, the well known street railway engineer and inventor.

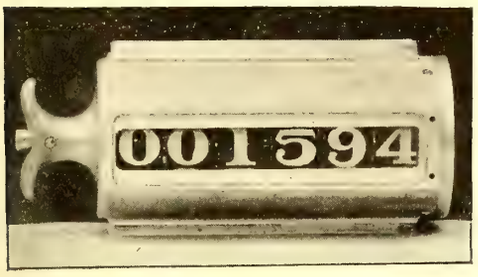


FIG 3.—PORTABLE REGISTER.



SIX INCH WATER MAIN CORRODED BY ACTION OF RAILWAY CURRENT.

The Importance of Complete Metallic Circuit for Electric Railways.

BY J. H. VAIL.*

In the early days of electric railway construction two distinctly different systems were devised and competed for public favor. The one being the overhead double trolley system, affording a complete metallic circuit for the outgoing and return of all the electric current required to move the motor cars, and the other being the single trolley system, using the track and earth as a common conductor for one side of the circuit, and the trolley wire and parallel mains for the opposite side. The double trolley system was found impracticable of operation in many of its details, and the single trolley, because of its simplicity and convenience, has made rapid advances in public favor. The single trolley system has depended largely upon the earth and buried pipe systems for completing the circuit.

Many devices for making the track and earth combined, a more complete and low resistance circuit have been resorted to, such as burying copper or iron plates, old rails or old car wheels, and connecting same to the track; or, at frequent intervals, driving iron rods down in the earth and connecting by wires to track; or by making actual connection with wires from tracks to gas and water pipe systems. Also, for *supposed* reinforcement of the track, we have used a bare wire of iron or copper, buried in the earth, laid parallel to the track, and connected at frequent intervals; also the *supposed* electrical connection of rails at joints, by bond wires of iron or copper, only having a small fractional part of the capacity of the rail as a conductor.

In the early days of electric railway construction it was assumed by experts that the earth and the buried pipe systems would, when combined, form an ample return for the electric current. At that age of the art, experts did not fully appreciate the immense quantities of current that would require to be carried, and, therefore, did not foresee that these currents when disseminated would produce the serious results that have been caused by electrolytic action on systems of pipes buried in the earth and owned by other companies. Frequent tests prove that the earth itself cannot afford the free path for the current that was anticipated. Earth conductivity has been overestimated. Iron and lead pipes, being better conductors than earth, must of necessity carry the current, if no superior path is offered by the method of construction. The natural moisture of the earth hastens the destructive electrolytic action of the current on these pipes. In some soils electrolysis is more rapid than in others. The rapidity of action depends upon the chemical constituents of the soil. It has been found that illuminating gas leakage held in such soils as underlie the cities of New York, Brooklyn, Boston, Philadelphia and elsewhere, hasten electrolytic action.

To prove that the methods of work mentioned are still in vogue, I quote the following section from specifications recently sent out from the office of a prominent electric railway company:

"Each rail shall be connected together by two bonds, made of No. 4 galvanized iron wire (Roebling gauge), to each end of which shall be brazed two nine-sixteenths inch Norway iron rivets. Both of the bonds shall be separately connected with a No. 0 galvanized iron, supplementary wire, by means of No. 4 galvanized iron wire connections, which shall receive at least four turns around both the bonds and supplementary wire and be thoroughly soldered to the same. Ground plates shall be placed about 1,000 ft. apart. They shall be buried not less than eight feet in the ground, preferably in the damp places, and two No. 0 galvanized iron wires shall be brazed to the ground plate and connected one to each supplementary wire in each track, by thorough wrapping and soldering. The ground plates shall be of galvanized sheet iron, two feet square and one-eighth inch thick, bent around in the form of a spiral."

It is evident that electricians had then perfect faith in the earth as a conducting medium. Evidence had not been produced that Mother Earth was incapable of carrying the enormous quantities of current required; neither had an opportunity been afforded to demonstrate her capacity. That some *still* have faith in the earth's ability in this direction is attested by above specifications and other constructions being executed at this date.

Having briefly reviewed the practice for the past few years, let us now have a look at the resultant effects. In cities provided with electric railways destructive electrolytic corrosion is now acting upon gas and water pipes, and will inevitably produce serious impairment of all such underground pipe systems within a brief period, unless prompt measures are taken to prevent further damage. Within the past year strong evidence of damaging electrolytic action has been produced.

Simply for the sake of fixing the evidence on your memory, I will mention only seven instances of electrolytic action of railway currents on gas and waste pipes, in different cities.

1st. A section of iron water pipes shows complete perforation, caused in four weeks' time. The lead covering of telephone cables also show serious damage. A large number of additional items will be found in the report to Board of Electric Subways for 1893.

2d. A plumber in a city in Pennsylvania was repairing a water pipe in a house, and on breaking joint, an electric arc formed across the separating ends of the pipe. This house was not in the direct path of the railway circuit. Investigation followed, proving beyond question the insufficient electric conductivity of the track system; also that the earth did not afford a good return, though the tracks were well grounded. It was found that the railway current was traveling all pipe systems in its effort to complete the circuit to the dynamos in the power station. Actual tests were here made by an expert using standard instruments. From 135 readings of ampere meter it was found that the feed water pipes leading in the station carried an average current of ninety-three amperes. Further careful test proved that with twenty-three cars in operation on the system, 40 per cent. of the total current was carried on the underground pipe systems.

3d. December 15, 1893, a fire occurred in the basement of James Sutherland's house. After being extinguished, investigation showed that the current of the electric railway system had been carried along the iron water pipe, and that probably by vibration causing the pipe to come in contact an arc was formed between the water pipe and gas pipe, burning a hole through the gas pipe, and thus set fire to the gas. The house was saved by prompt action.

4th. Tests show the electric railway current present on the water pipes. In the generating station the fireman gets a shock when he opens the furnace doors of his boiler with the bare hand.

5th. A test recently made by an expert engineer developed the fact of a loss of 24 per cent. on the system, and a difference of twenty-five volts potential between parallel tracks opposite the power station.

6th. Professor Barrett, in an exhaustive report to the Mayor of Chicago, states that "this destructive action is not alone confined to the lead covering of telephone cables, but is acting on gas and water pipes and almost all buried metal work," and that it can only be a question of time when more disastrous results will manifest themselves.

As further and substantial evidence, a cut is here shown, taken from a photograph, of a section of six inch water main from city No. 7. This pipe has been entirely corroded through by the action of the electric current of the street railway system which was constructed under my direction about four years ago.

This effect was produced in about two and one-half years.

Abundance of additional and substantial evidence can be produced. These serve to prove the case which cannot longer be denied nor assigned to other causes. It has been stated that in an electric railway system where a connection has been made to water pipes, the pipes have carried as much as 28 per cent. of the total current. Instances are known where as much as 40 per cent. is carried on the pipe systems. It is the opinion of the writer that any gas or water pipe system used as a carrier of electric currents will not only be corroded through the body of the pipes, but will surely in due time show defects at the joints, as here will occur higher resistance than in any other portions of the pipe system. It has been proven by test that the electrolytic action of even five amperes of current on an iron pipe is considerable, and that much damage will result in one year. The rapidity of action depends upon character of soil, amount of moisture and quantity of current; the destructive action is constant and sure.

I do not wish to create unnecesssary alarm, but there can be no

*Read before the National Electric Light Association at its seventeenth convention held at Washington, D. C., February 27, 28 and March 1, 1894.

question that a grave danger confronts us, and must be surmounted. Instances are numerous proving that the electric railway current is present on the gas and water pipes in buildings contiguous to electric railway lines. Even those of us who are familiar with handling the electric current hesitate to draw a combination of electricity with our gas and water. We know that the gas and water pipes entering our houses may be charged with such a current, and that it only remains for the circuit to be completed by a possible accident through our bodies, or the occurrence of a fire by automatic action between vibrating pipes. City engineers, water companies and gas companies are placing the responsibility upon the railway companies for the damage caused on pipes by electrolysis. Any system using ground plates, ground rods or substitutes therefor, or bare return track wire buried in the earth, is constructed primarily to utilize the earth as return circuit; when the earth does not afford good return the current is sure to follow the water pipes, gas pipes or other buried conductors offering the path of least resistance. We now see that these prove to have been only makeshift methods to reduce the cost of construction. We find that the evidence thus produced, and the troubles constantly occurring in existing street railway systems are sufficient to show that all methods of grounding the track circuit or connecting to pipe systems should be entirely discontinued; it therefore becomes of vital importance to so construct the electrical railway system as to avoid all electrolytic action on buried systems of metal work that are the property of other concerns.

Having produced the evidence and established the case, let us briefly analyze the matter and ascertain the reason for these results. The whole case may be stated in the single sentence, that *the electric current must under natural laws follow the path of least resistance.* What was intended to be good has proved to be defective electrical work executed in connection with track systems, has not given to that side of the system a perfect path for the travel of the current; the conductivity of the rail circuit being impaired to such an extent that the electric current must force itself through the earth or through metal pipe lines buried therein. We must here diverge for a moment to show how the incandescent electric light system operated in multiple arc compares with the railway system. An electric railway system may in some degree be compared with a system of electrical distribution for incandescent lighting, the groups of lamps in buildings connected in multiple arc, comparing with each car and its motors demanding current. The systems otherwise differ in important particulars; the load on the electric light system is not subject to such violent fluctuations as on the electric railway, where the instantaneous demands for current, and its equally prompt release must be controlled. The current required for the car is a moving load as the car progresses on its route; this and all other differences of conditions must be duly considered when laying out the system of distribution. With the electric lighting system, the current for consumption is derived from the mains, the equalization of pressure is maintained through the feeders, the mains are of equal capacity on either side of the system.

With the electric railway the track forms one side of the consumption circuit, and must be so treated in regard to distribution of current as to utilize its carrying capacity equally with the other side, and thus equalize the delivery of current. The electric conductors composing a system of distribution for electric railways should be so well proportioned as to show the minimum variation of pressure throughout the system, even when the entire number of cars are in operation. This equality of pressure is an important requisite for the economical working of the motors. The writer has tested electric railway systems operating with a station pressure of from 500 to 550 volts, and showing only 300 to 325 volts on various divisions of the system. Here is a direct loss between dynamos and motor car of over 40 per cent. Is it, therefore, any wonder that some roads report extraordinary coal consumption? Such loss in pressure indicates radical faults in the original planning of the system and the distribution of copper. When operating under low voltage, the motors demand an increased quantity of current above what should be the normal supply, thus augmenting the heating effect in the armatures and fields, the efficacy of the motors being reduced in corresponding ratio.

A further examination into other features of construction requires some consideration of the bonding of rail joints. The existing method of utilizing railway tracks for conducting large quantities of current are faulty in at least three particulars: First. Restricted conductivity at joint, due to insufficiency of the rail bonds. Second. Neglecting to properly utilize the track as a conducting medium. Third. Failure to provide a complete circuit of low resistance. For electrical purposes we cannot regard the joint plates and bolts as of any permanent value; the contact is electrically imperfect, the metal surfaces oxydized and under constant movement, due to passing cars pounding the rail joints. The rail sections are in many systems of ample conductivity to carry more than the requisite current, provided that they are perfectly bonded and properly connected by feeders with the dynamos. We must, therefore, bond the rail joint in such a *mechanical* manner as to maintain perfect *electrical* contact, and with sufficient metal to restore at the joint nearly the full conductivity as of the rail itself, and at the same time to give the existing joint plates their present freedom of motion. It has been found that a system of track with faulty rail bonds will give a shock to animals, and, possibly, to human beings, should the same be brought into actual contact in such a manner as to complete through them the broken circuit.

It will be readily understood how difficult it is to maintain proper inspection of the electric bonding where the bonds are covered up by the street pavement. Under such conditions the ground circuit and the bonding escape inspection until excessive coal consumption, loss of current and other troubles force themselves upon the attention of the street railway management. Observation proves that a faulty rail bond will show its location in winter by heating, due to high resistance, and if snow be present on the ground around the joints the snow is partially melted, thus indicating location of the fault. Let us turn our attention for a few moments to the question of the conductivity of the rails. For the purpose of comparison we will assume that iron has six times the resistance of copper. (The actual proportion being 1 to 5.63).

	56 POUND RAIL.		70 POUND RAIL.	
	One Rail.	Single Track of Two Rails.	One Rail.	Single Track of Two Rails.
Area in sq. inches	5.4874	10.9748	6.8593	13.7186
Equal in area to circle whose diameter is in inches	2.642	3.735	2.95	5 90
Equivalent in cir. mils. to	6,980.000	13,960,000	8,702.500	17,405,000
Resistance per foot B. A. units	.00000845	.00000422	.00000679	.00000339
Equivalent to copper resistance in cir. mils	1,175,000	2,350,000	1,463,000	2,926,000
Equivalent to copper rod whose diameter is	1.13	1.533	1.21	1.71
Safe carrying capacity of iron reckoned at ⅓ that of copper in amperes	390	780	488	976

Table prepared by G. F. Sandt, E. E.

NOTE.—In the above statement the areas of rails have been determined by use of the planimeter. The ampere capacity of iron has been based upon the most reliable data obtainable. The author believes that the figures submitted are sufficient for comparisons, but cannot guarantee their absolute accuracy.

The following table gives the current strength that can be carried by iron wire, within doors, in still air, and without becoming unbearably warm to the hand; that is, not to exceed a temperature of 50 degs. Centigrade:

B. & S. GAUGE.	AMPERES.
10	16
9	19
8	21
7	25
6	28
5	32
4	37
3	43
2	50
1	58
0	67
00	77
000	90
0000	105
½″	117
¾″	203
1″	302

Data furnished by A. E. Kennelly, February 12, 1894.

These figures serve to show how utterly absurd it is to bond a track of seventy-pound T rails with iron rail bonds No. 4 or No. 0 in size, and to pretend to reinforce their conductivity with a No. 0 iron or even a No. 0 copper wire. It is like laying a twelve inch water main and then putting a half inch pipe alongside to help it out. The No. 0 B. W. G. copper wire has a resistance of over twenty times the single track of fifty-six pound T rails per foot and the No. 0 B. W. G. iron wire over 112 times the resistance per foot of the same track. How, then, can either of these be of any adequate assistance for conducting current. The writer knows personally of several instances where the copper supplementary wire has absolutely disappeared. The writer believes that 99 per cent. of the money expended for so-called supplementary wire is absolutely thrown away. The same money expended in other directions will give more adequate return.

Does not this show conclusively that we should give our attention to the more perfect bonding of the rail joints, and also to apply track feeders in such a manner as to utilize the conductivity of the track and thereby make it fulfill the service of which it is capable when properly treated? We are in error when the track system is named as a return circuit. The track system of all electric railways should really be the positive side or outgoing circuit. The writer fully explained this in a brief article in the Street Railway Journal about a year ago. It will be readily understood that as the current travels from positive to negative, therefore any arc which occurs between the trolley wheel and the trolley wire will carry metal from the trolley wheel and deposit the same on the trolley wire. If the reverse method of connection is made, the trolley wire will lose the metal, the same being deposited on the trolley wheel, and in time the strength and conductivity of the wire must be seriously impaired, eventually resulting in breakages. It is also important that existing systems of operating electric railways should be promptly taken in hand and the proper remedies intelligently applied.

The three-wire system has been mentioned by some engineers as a possible solution. I will here diverge for a minute to state that a trial was made four years ago under favorable conditions—not to avoid electrolysis, but to save copper. We developed physical difficulties of operation which warned us to avoid the three-wire system in future electric railway work. I believe I am safe in stating that 90 per cent. of the electric railways have their systems so constructed as to largely restrict the conductivity of the rail circuit. A one-sided system is fundamentally wrong. The quantity of current to be controlled is so enormous that ordinary makeshift methods will not answer.

Having carefully analyzed the whole matter, I feel justified in recommending that we must adopt the complete metallic circuit as the standard for the best electric railway practice. This can best be obtained by the following method: First. By so bonding the track as to render the *rail joints* of as low resistance and nearly equal conductivity to the rails, and to execute this work so as to maintain this improved

condition; and second, the track system must be supplied with insulated feeders leading direct from the bus bars in the station to predetermined points of the track system, and thus offer a perfect low resistance path for this side of the electric circuit, the same as is obtained with the trolley line and the overhead system. All of these features and improved methods have been put in practice by the writer. The only proper system is one that affords a well insulated and complete metallic circuit of low resistance, that will give an ample path for the complete unrestricted circulation of the entire current from pole to pole of the dynamo, thus offering no inducement for the current to follow such conductors as gas or water pipes, but, as it were, actually robbing the earth of any desire to carry the current. I am not recommending extravagant methods, but only such as are deemed essential for economy, and of a practical nature for reducing expenses and augmenting dividends. The item of cost cannot properly be urged as an objection, because where the whole construction requires a large investment, *every detail* of the work should be so executed as to be *permanent* and *enduring*. If the details are carefully analyzed it will be found that the cost of frequent reconstruction, maintenance and renewals of rail bonds and bare wire amount to an excessive rate of interest on original investment, and would soon pay the small additional cost to build a complete metallic circuit. The superior service obtained from a complete metallic system of low resistance with the proper application of insulated track feeders will, within a brief period, more than refund a reasonable interest on the investment through the saving of fuel alone, not counting other economies in renewals and maintenance. The track feeder system will be far less costly than the double trolley system.

Whether track feeders should be laid underground or erected overhead is a question largely controlled by local conditions and capital available. I express a *preference* for *underground* work as being more permanent and subject to the least cost for repairs. The original construction is certainly more costly for underground. The actual cost of copper is the same in either. The necessity of constant repairs, under existing methods, and the damage to water and gas pipes by electrolytic action, simply proves that it is but a question of time as to how long before electric railway companies will be forced to adopt the complete metallic circuit. Where experience and practical knowledge are applied, the cost will not be excessive. It is not difficult to arrive at an exact method of doing the work and an accurate estimate of its cost.

The writer has observed on some roads that large quantities of copper for return circuits have been placed at great expense, apparently without a proper conception of how to obtain the best results. Frequently, a far less amount of copper judiciously applied for improved distribution by the feeder system, would give superior equalization of pressure at reduced cost. If for the movement of cars, singly or in quantities, at a high rate of speed, the electric current is to be distributed uniformly over an electric railway system, the subject must be handled with as much scientific accuracy as is always used for a perfect system of incandescent lighting, in order to obtain equal distribution and free flow of current in both sides of the system. The writer has fully and completely provided for all contingencies in the following manner: First. By a careful study of the conditions under which a system will be operated; these important points being ascertained with reasonable accuracy, the requisite supply and distribution of current for the service is determined, and the system of conductors arranged to meet the requirements. For the proper supply of electric current, the important *underlying principles* of the feeder system must be *thoroughly* understood. Second. The conductivity and current carrying capacity of the track system is calculated, and a system of insulated track feeders is provided leading from the switchboard in station and connecting at predetermined points, and with a calculated fall of potential. Each feeder must be determined for its maximum current requirements at a stated drop in potential. The actual work required of the feeder and number of track feeders necessary is determined upon such factors as: The cars in service—their weight, speed and headway; the position of power station and the geographical lay of the railway system; the weight of rails, and whether double or single track, and the amount of load concentrated on sections of track between feeder junctions. The carrying capacity or conductivity of the sum total of all the feeders of the system will be found to give complete and ample circuit for the free flow of the entire current required, and to take care of extra heavy traffic and blockades at any point. The parallel track main is only applied in sections of systems extending over very large territories and long distances. The conductivity of the rails is calculated with as much care as the overhead system, and when the track needs reinforcing, the purpose is accomplished by laying a thoroughly insulated main line (not a bare line) and making frequent sub-feeder connections bonded to the track. If used at all, this main will be of large size. Such a system, accurately worked out, will show by actual test with instruments on the cars a surprising equality of electro-motive force throughout a large territory.

A very careful test has been made with instruments on moving cars, throughout a system covering forty miles of streets, with double tracks, equal to eighty miles of single track. The readings showed Maximum volts, 512; minimum volts, 420. Average of electro-motive force over entire system, 460 volts, the electro-motive force in station, at bus bars, being 520 volts. The feeders were calculated for 10 per cent. drop. The actual average drop from dynamo to motor does not exceed 12 per cent. This will be found to result in *reduced* fuel consumption, *better* working of the motors, a most satisfactory *reduction* in repair accounts and an improved *general economy* of the entire system. In the system of distribution secured by the above method, the use of ground plates, rods or other insufficient methods is needless; the current travels only over the paths provided for it, and electrolysis of gas and water mains is entirely obviated,

Annual Report of the Massachusetts State Board of Railroad Commissioners.

The annual report of the Massachusetts State Board of Railroad Commissioners was presented to the legislature February 7. An abstract of the portion of the report relating to street railways will be found below.

The commission reports that returns have been received from sixty companies, one less than in 1892. Of this number, forty-three were engaged in operating railways, eleven had leased their roads, two had been consolidated with other companies, three companies had not completed their lines, and the railway of one company was not in operation.

The total length of street railway September 30, 1893, including double track, but not sidings, was 874.14 miles—an increase of 119.29 miles over the preceding year. Of this total, 711.08 miles were operated in whole or in part by electric power, and 163.06 wholly by horse power. This shows, as compared with the previous year, an increase of 214 78 miles equipped with electric power, and a decrease of 95.49 miles equipped for horse power only. The aggregate capital stock of the sixty companies, September 30, 1893, was $25,883,575, an increase of $2,293,039.

The whole amount of cash dividends paid the last year was $1,716,-637.50—an average of 6.63 per cent. on the total amount of capital stock outstanding at the end of the year, as against 6.71 per cent. in 1892. Computed (as it should be) on the mean amount of capital stock outstanding at the beginning and end of the year, the average dividend the last year was 6.94 per cent., as against 7.34 per cent. in 1892. Thirty-five companies paid no dividends. The average rate on the capital stock of the twenty-five companies which paid dividends was 8.22 per cent.

The gross assets of the companies, September 30, 1893, were $50,-130,273.20; gross liabilities, $49,589,687.91. The funded debt of the companies amounted to $14,109,000—an increase of $4,138,850 over the previous year.

During the last ten years it is noted that there has been a steady and rapid decrease in the surplus of the companies. In 1884 the surplus was $1,039,360, or 13.44 per cent. of the capital stock; in 1889 the amount was $726,740, or 5.91 per cent. of the capital stock, and in 1893 the surplus was $540,585, or 2. 09 per cent. of the capital stock.

The total number of passengers carried by all the companies making returns to the board, was 213,552,009—an increase of 19,380,067. The number of passengers carried on the street railways exceeded the annual number carriedon all the railroads in the state, by 93,772,062. The total number of miles run by street cars was 34,507,282—an increase of 4,829,246 miles. The total number of round trips run was 4,481,171—an increase of 312,713. The average number of passengers carried per round trip was 48—one more than in 1892.

Comparing the figures for 1893 with those for 1883, there has been an increase in the last decade of 142 per cent. in the number of passengers carried, of 125 per cent. in the number of miles run, and of 96 per cent. in the number of round trips annually.

The total income of the companies from all sources, for the year ending September 30, 1893, was $10,894,704.11, and the total expenditures were $10,617,641.99, leaving a net balance of income for the year of only $276,762.12 to carry to surplus account.

The percentages of operating expenses to gross income from operation, for the last decade are as follows: 1884, 78,37; 1885, 80.02; 1886, 80.04; 1887, 82.81; 1888, 81.07; 1889, 78.80; 1890, 74.80; 1891, 76.13; 1892, 71.74; 1893, 69.26.

The ratio of operating expenses to gross income from operation has fallen in the last five years from 81.07 to 69.26 per cent.—a marked decrease. The percentage for the last year was, in fact, a little lower than that for the railroad corporations of the state, which was 69.79 per cent. The net earnings from operation have increased, on the average, from $2,420 to $3,810 per mile of railway owned, and from 5.56 to 9.65 cts. per car mile run during the last five years.

There has been in the last five years an increase from 40 to 74 cents in the average net earnings per round trip run, and from .96 to 1.56 cents per passenger carried.

The average cost of the street railways of the state per track mile (including the cost, but not including the length of sidings) was $26,792 for construction, $15,455.06 for equipment, and $11,738.03 for land, buildings and other permanent property, making a total average cost of $53,985.69 for each mile of main railway track, including double track.

The figures are of value as showing just how heavily the street railways, as a whole, are capitalized, or, in other words, the average amount per mile on which dividends and interest are, if possible, to be earned. The cost, as returned by the several companies, ranges from $13,745 to $98,907 per mile.

The report says: "It is too early as yet to draw exact and final conclusions with regard to the financial economy of electric power, as compared with horse power, in street railway operations. It is desirable, however, both for the investor and the public, that current opinion on this point should conform as nearly as may be to the truth, and that false or exaggerated ideas, if such have gained a footing, should be set right.

"The question here is not whether electricity is a success as a motive power, or whether, taking into account the convenience, comfort and dispatch of street car travel on the one hand and the obstruction and danger to ordinary travel on the other, the electric system is, on the whole, preferable to the horse system. The present question is whether the electric system promises a larger return on the capital invested, and thereby a possible future reduction of the charges for transportation; so that the new system may be fairly expected in the long

run to prove not only more remunerative to the stockholder, but cheaper for the public."

A comparison of the railway year just closed with that ending in 1888, the last in which the railways were operated wholly by horse power, will evidently afford the fairest and most satisfactory test of the financial results of the two systems thus far.

Earnings and cost.	In 1888, cents.	In 1893, cents.	Per cent. of Increase.
Net earnings per passenger carried	0.96	1.56	62.50
Net earnings per car mile run.....	5.56	9.65	73.56
Net earnings per round trip.....	40.00	74.00	85.00
Net earnings per mile of railway..	$ 2,420.00	$ 3,810.00	57.44
Cost of railway per mile.....	33,985.00	53,986.00	60.22
Capitalization per mile.....	32,304.09	53,307.09	65.20

"The most direct and conclusive test of the net earning capacity of the two systems is a comparison of the increase in the net earnings per mile of railway with the increase in the cost of railway per mile. Applying this test, it will be seen that, while the net earnings per mile are 57 per cent. greater, the cost and capitalization per mile are respectively 60 and 65 per cent. greater in 1893 than in 1888—the odds being clearly in favor of the horse system.

"As in the case of a newly built and furnished house, the necessary repairs and renewals for the first few years are comparatively slight. For this reason the cost of the maintenance of the new system, which is chargeable to operating expense, has thus far been abnormally small, and the consequent showing of net earnings from operation has been abnormally large. The extraordinary reduction of the last two or three years in the ratio of operating expenses to gross income from operation is largely, if not wholly, to be explained in this way.

"The returns show that the railway companies as a whole have been running closer and closer to the wind during the electric period, and have substracted from the old surplus much faster than they have added to the new divisible income. We must conclude, then, taking everything into the account, that there has been thus far no demonstration of the superior net earning capacity of the electric as compared with the horse system, but rather the reverse.

"It can and should be said without hesitation or qualification that the electric system has not shown or indicated any such margin of profit as to justify the expectation of more than ordinary returns on money legitimately invested in it. The idea, which seems to have obtained some currency, that the electric railway system is a bonanza of rare and inexhaustible wealth is clearly a delusion, and has doubtless proved to some a snare.

"Instead of inflating the liabilities and straining the earnings and surplus for the division of ostensible profit, the manifestly safe and imperative policy for the electric companies—and that without special regard to the present unusual stringency of the times—is to keep the capitalization and charges upon income within the narrowest possible limits, and to set apart year by year some substantial portion of the earnings as a fund for future contingencies, and for the increasing burdens of expense which are sure to come, and whose weight is now only partially felt or known. The recent action of the directors of the West End Company, much the largest and one of the most ably and successfully managed of the street railway companies, in voluntarily reducing the rate of dividend on its common stock, was eminently wise and commendable in every point of view. Such action ought to enhance, and doubtless has enhanced, the value of the stock in the estimation of every well informed stockholder and sagacious investor."

The total number of persons injured in connection with street railway operation, as reported by the companies for the year ending September 30, 1893, was 585, of whom forty-five received fatal injuries. The number of passengers injured was 311, of whom only two were injured fatally. Most of the accidents to passengers occurred as they were getting on or off cars. The injuries to employes were forty-eight in all, of which five were fatal. The number of injuries to travelers and others on the street was 226, of which thirty-eight were fatal.

One in 686,662 of the passengers carried was injured, and only one in 106,776,004 was killed; street cars were run on the average 152,686 miles without injuring, and 908,089 miles without killing any traveler or other person on the street, and on the average 7,659 round trips were run without injuring, and 99,579 round trips without killing any passenger, employe or traveler, or any other person.

Five-eighths of all the passengers on the street railways of the state were carried the last year by the West End Company, and considerably more than one-half of all the car miles and round trips run were run on its lines. In view of its metropolitan location, and the comparatively thronged and congested condition of the streets through which the bulk of its traffic passes, it will be interesting to compare the casualties on this railway with those occurring on all the other railways taken as a group.

Reducing the ratios to percentages, it appears that the casualties to passengers carried were 39 per cent. less on the West End than on the other railways, while the casualties to persons on the street were 26 per cent. less per car mile run, and the casualties to passengers and all other persons were 22 per cent. less per round trip on the other railways than on the West End.

It also appears that on the West End the casualties to passengers and all other persons were 44 per cent. greater in the electric than in the horse car service per car mile run.

The whole number of grade crossings of railroads by street railroads, on the 30th of September last, as reported in reply to a circular issued to the railroad companies, was 133—the total number of such crossings has grown in the last two years from 116 to 133. The most noticeable change, however, is in the increase from 26 to 100 in the number of electric railway crossings, while the horse railway crossings have dropped from ninety to thirty-three, and bid fair to give way altogether to the new system of motive power.

If the construction of 100 grade crossings of railroads by electric railways were to be brought forward as a direct and original proposition it would be received with the serious apprehension which it deserves, and would be permitted, if at all, only under careful restrictions and regulations similar to those which sixty years' experience has proved to be necessary in regard to the crossings of railroads on the same level. It is not to be believed that the allowance of 100 such crossings outside of the public highways would for a moment be thought of. Of all the perils which attend travel on railroads and railways in this commonwealth, there is no one which, in the apprehension of the board, is so serious, both in its character and extent, as that here pointed out.

The report repeats last year's suggestion of the expediency of limiting the issue of bonds of street railway companies to the amount of the paid up capital stock.

During the last year, taking the street railway companies, as a whole, they issued $4,138,850 of additional bonds, while the addition to paid capital stock was only $2,293,039, or about half as much. Seven companies had, September 30, 1893, bonds outstanding in excess of paid capital stock. The capital stock was $2,575,000 and the bonds $5,115,500, the excess of bonds being $2,540,509.

It should be stated in justice to the other companies that their paid capital stock at the same date amounted to $23,308,575, while their aggregate bonded indebtedness was only $8,993,500; so that the other companies, as a whole, were far within the limit above recommended. Railroad corporations have been for many years subject to such limitation by the general law of the state.

In ten years the number of street railway employes has grown from 3,846 to 8,070; cars from 1,926 to 4,040; horses have diminished from 8,996 to 3,531.

On the question of consolidations and the attendant increase of capital stock, the report says:

"Without going into details, it may be stated that five purchases and consolidations have taken place during the last year. The seven companies concerned—the two purchasing and the five purchased companies—had on September 30, 1892, before consolidation, according to their annual reports to the board, a total capitalization (capital stock and net debt) of $3,857,140. The two purchasing companies, after absorbing the other five, had on September 30, 1893, according to their annual reports to the board, a total capitalization of $8,580,077 —an increase of $4,722,937, or about 125 per cent. These figures do not include the $4,000,000 of bonds issued by the Lynn & Boston, nor the excess of those bonds over the unfunded debt.

"The seven companies reported in 1892 a total of 142.80 miles of railway track owned, and the two consolidated companies reported in 1893 a total of 159.93 miles—an increase of 17.13 miles, or about 12 per cent. It is gathered from a comparison of the two sets of reports that, in the intervening year, some 46.61 miles of original horse railway line were also equipped for electric motive power. Making a liberal allowance for the cost of this new construction and re-equipment, there still seems to be left a very large fraction of the $4,722,937 of increased capitalization unaccounted for; at least the board is unable to account for it."

Changes in the Brooklyn City Railroad Company.

Daniel F. Lewis has resigned the presidency of the Brooklyn City Railroad Company, and has been elected to succeed Felix Campbell as president of the Long Island Traction Company, the lessee of the lines controlled by the former corporation and run by it. The Board of Trustees of the Traction Company, which was organized under the the laws of Virginia, and has a capital of $30,000,000, has been changed by increasing the number of directors from five to thirteen. The executive committee is comprised of Daniel F. Lewis, E. W. Bliss, Felix Campbell, Crowell Hadden, S. L. Keeney and Martin Joost. Among the new directors are Abraham Abraham, of Abraham & Strauss; W. S. Sloan, of the Delaware, Lackawanna & Western Railroad Company, and James Timpson, of the Mutual Life Insurance Company. The other officers, besides President Lewis, are E. W. Bliss, vice-president; W. A. H, Bogardus, general manager, and Cyrus P. Smith, secretary and treasurer. The same officers have been chosen for the Brooklyn Heights Railroad Company. The offices held by Mr. Lewis as president, and Mr. Bogardus as secretary and treasurer of the Brooklyn City Company, have not yet been filled, but these new directors have been chosen: Richard L. Edwards, Edward B. Bartlett, Frederick A. Van Iderstine, Samuel W. Browne and Edward Merritt. They succeed Messrs. Bliss, Lewis, Keeney, Polhemus and Lyman, who have resigned.

Performance of Storage Battery Cars in Snowy Weather.

The Waddell-Entz storage battery cars in use upon the Second Avenue line in this city received a rather severe test during the recent heavy snow storms. On January 27 the cars ran all day and performed their schedule trips, although the horse cars on the same line were running on half time with four horses. On February 14 and 15 the conditions were also very severe, particularly on the morning of the 15th, a foot of snow having fallen during the night. On both days the cars had no difficulty in keeping up to their schedule. Several of the daily papers commented favorably at the time on the satisfactory performance of the storage battery cars.

Personal.

Mr. L. H. McIntire, electrical engineer of the People's Traction Company, of Philadelphia, was a visitor in New York last month.

Mr. F. B. Brownell, president of the Brownell Car Company, of St. Louis, spent a considerable portion of last month in New York.

Mr. John A. Brill, of Philadelphia, was in this city recently. He considers that the prospects for business during the coming year are excellent.

Mr. Harold B. Thorne, formerly of the General Electric Company, is now representing the Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y.

Mr. E. F. Seixas, formerly of the *Street Railway Gazette*, has connected himself with the Walker Manufacturing Company, and will be located with Western Manager Barclay, in the Monadnock Building Chicago.

Prof. Sydney H. Short, of Cleveland, has decided to engage again in the manufacture of electric railway apparatus, and has been appointed superintendent of the new electrical work of the Walker Manufacturing Company.

Mr. Edward I. Robinson, general manager of the Laclede Car Company, of St. Louis, Mo., has been in the East during the past month, engaged in closing up some important contracts for the company which he represents.

Mr. Joseph McNaugher, Jr., superintendent and treasurer of the Pittsburgh Steel Hollow Ware Company, of Pittsburgh, Pa., has been making an extended trip in the interest of his firm. He reports a bright business outlook for 1894.

Mr. W. J. Cook, vice-president of the McGuire Manufacturing Company of Chicago, Ill., made a trip through the East last month. He spent some time in New York, and reported the truck business as excellent, and a large demand for McGuire trucks.

Mr. F. X. Cicott, late manager of the *Railway World* of London, Eng., and well known among the electrical fraternity in this country has formed a business connection with the Pettingell-Andrews Company, of Boston, manufacturers of electrical appliances.

Mr. G. J. Melms, general manager of the Milwaukee Electric Railway Company up to the consolidation of that line with that of the Milwaukee Street Railway Company, has returned from a European trip, and passed through this city last month on his return to Milwaukee.

Mr. Geo. W. Myers, the popular secretary of the Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., was a recent visitor at our office. Mr. Myers reported the various departments of the Lewis & Fowler Company as busily engaged in manufacturing, and anticipates an excellent demand for supplies during the coming year.

Mr. H. Ward Leonard read an interesting paper last month before the American Institute of Electrical Engineers upon "How to Operate an Electric Railway, 100 Miles From the Power Station." Mr. Leonard's plan involves the ingenious application of an alternating current using step-up and step-down transformers with his motor generator system for cars.

Mr. G. E. Pratt, well known and popular in the street railway fraternity during his long connection with the Lamokin Car Works, has severed his connection with that company and has accepted a position with the Jackson & Sharp Company, of Wilmington, Del. This latter company is to be congratulated for having secured the services of so capable a representative for introducing its cars to street railway managers. We extend to both Mr. Pratt and the company with which he is connected our best wishes for future success.

Mr. T. J. Durnin, who has for many years been manager and secretary of the West Side Railway Company, of Milwaukee, and who has retired owing to the transfer of that company's line to the Milwaukee Street Railway Company, was last month presented a handsome gold watch, chain and charm by the employes of the West Side line. The charm was an electric car worked in gold, with seven diamonds to represent the windows, and with an emerald to represent the headlight. Archibald McNaughton, the retiring superintendent of the line, was presented with a gold headed cane.

Mr. C. Densmore Wyman, of New York City, who was president last year of the New York State Street Railway Association and was for a long time general manager of the Central Park, North & East River Railroad Company of that city, has resigned his position with the General Electric Launch Company and accepted the position of general manager of the Milwaukee Street Railway Company, of Milwaukee, Wis. Mr. Payne, formerly general manager and vice-president of that company, will retain the latter position, but has been obliged to resign that of general manager on account of the pressure of duties, in connection with his work as one of the receivers of the Northern Pacific Railroad Company. We extend our hearty congratulations to both the Milwaukee Street Railway Company and Mr. Wyman.

Obituary.

MRS. JOSEPHINE D. SMITH, who has for several years past carried on the business of the late Willard H. Smith as a manufacturer of railroad center lamps and reflectors, died at her residence, 83 Halsey Street, Brooklyn, February, 23. Her death was the result of severe burns sustained by falling into a gas log fire while suffering from an attack of vertigo on the evening of February 5. The manufacture of car lamps, as carried on for many years by W. H. Smith, under the name of "Smith of New York," and Smith lamps attained a wide reputation, which has been retained and increased under Mrs. Smith. The manufacture and sale of lamps will be continued by her son, C. E. Smith, who has long taken an active part in the management of the business.

Severe Tests of a New Fender.

The Leonhardt automatic safety car fender has lately been given a series of severe tests on the street lines in Pittsburgh, Baltimore and Washington. The Pittsburgh daily papers make the following comments on the tests made in that city:

The *Pittsburgh Press* says, in speaking of this fender: "'Hey, there—look out—What's that blamed fool trying to do?' was the simple observation of the cornerman at Fifth and Wood, shortly after 11 A.M., as a pedestrian seemingly threw himself in front of car No. 20, of the Fifth Avenue line. The officer rushed up to the car and found the suspected suicide calmly enjoying a ride in the pneumatic safety car fender, which was being tested for the first time on this line. With a look of intense disgust the officer retired, saying: 'I thought the fellow was drunk and casting swine before perils.' The experiment was repeated, and was eminently successful in each case, between Wood and Market Streets, as well as at other prominent points along the line. The pneumatic fender bagged its game every time with such apparent ease and safety that it might be used with profit in recruiting Col. Geo. W. Elkins' Sunday School, for it would surely fetch the boys. The Leonhardt fender is a combination of pneumatic rubber tube two and a half inches in diameter, and a rope netting which can be detached and changed to either end of the car in a moment's time. The fender when struck will lower automatically and is also under full control of the motorman. In view of the number of accidents occasioned by rapid transit, this fender would be an economical addition to the stock of a street railroad."

The *Pittsburgh Dispatch* comments as follows: "A new guard for street railways invented by a Baltimorean was given a practical test by the Fifth Avenue line yesterday. A man stationed himself on the track below Wood Street, and was knocked down by a car running at full speed. He fell on the guard and was carried twenty feet before the car was stopped. He was uninjured. The dangerous test attracted a great deal of attention from pedestrians, who feared the man was intending to commit suicide."

Another prominent Pittsburgh paper says: "A new safety fender was tried on one of the Pittsburgh Traction cars and worked very successfully. A man stood on the track in front of the car on Fifth Avenue and was picked up without injury. He repeated the performance successfully. A policeman who saw the act thought the man was attempting suicide, and at first wanted to arrest him."

The "Pitt" Patent Folding Gates.

Folding iron gates have, of late years, come in for a great variety of uses in situations where sliding or swing screens were considered necessary. The "Pitt" patent folding gates manufactured by the William R. Pitt Composite Iron Works, New York, are among the best devices in the market for this purpose. They are simple in construction, and answer equally well for closing or protecting a small doorway or an opening fifty feet or more in width. These gates are constructed on the well known lazy tongs principle, and fold compactly and turn out of the way, thereby occupying very little space. The principal feature of the "Pitt" patent is the use of channel bars placed back to back, thereby giving great strength and stiffness with minimum weight. These gates are familiar to the general public, as they are used in a great number of situations where the hardest service is required, such as on ferry boats, elevator doors, and in various situations as safety devices, on elevated and other steam roads. These gates have also had a large use on surface roads, as safety guards on the off side of platforms and between motor cars and trailers. This company also manufactures a great number of different styles of fixed screens, grills and railings, as well as the familiar form of fixed platform guard, largely used on cable and other lines.

Some New Philadelphia Corporations.

THE West Side Traction Company is a new company which is the lessee of three railroad companies controlling about twenty-seven miles of streets in West Philadelphia. The capital stock authorized is $10,000; and the officers are: Clifford Pemberton, Jr., president; Frank Mauran, Jr., treasurer; Francis E. Bond, secretary.

THE Cherry Street Passenger Railway Company was incorporated February 12, 1894, with a capital stock of $12,000, for the purpose of constructing and operating an electric railway. The president of this company is Henry C. Moore, of 624 Tioga Street, Philadelphia. Others interested are, David C. Golden, McClellan Hersh and Joseph A. Lugar, all of Philadelphia.

THE Huntingdon Street & Connecting Street Passenger Railway Company was incorporated on February 15, with a capital stock of $6,000, for the purpose of constructing and operating an electric railway. The president of the company is Geo. D. Widener, of 1202 North Broad Street, Philadelphia. Others interested are: P. A. B. Widener, W. L. Elkins and David H. Lane, all of Philadelphia.

Equipment Notes.

James, F. Kelly, of New York, has been appointed general Eastern agent of the National Electric Manufacturing Company, of Eau Claire, Wis , with headquarters at Room 906 Temple Court, New York.

The Goubert Manufacturing Company, of New York, has opened a branch office at 403 Lewis Building, Pittsburgh, Pa., which will be in charge of J. H. Harrison. A full line of the Goubert feedwater heaters and Stratton steam separators, of which this company is the sole manufacturer, will be kept constantly on hand.

The Robins Life Guard & Manufacturing Company, of Philadelphia, Pa., manufacturers of the Robins life guard, is equipping the cars of the Suburban Traction Company, of Orange, N. J., and also those of the Norristown Passenger Railway Company, of Norristown, Pa., with its safety device.

Robert Poole & Son Company, of Baltimore, Md., the well known manufacturers of cable machinery has sent us a large drawing, handsomely framed, of the plant installed by it for the Baltimore Traction Company, on Gilmor Street. The picture shows a portion of the power station broken away, with the machinery, sheaves, etc., in position.

The W. S. Hill Electric Company, of Boston, Mass., is meeting with marked success in its efforts to gain the appreciation of street railway managers. This company manufactures an excellent line of switches particularly adapted for this special class of work. Among its customers are included the largest street railway corporations in America.

The Worcester Construction Company, of Worcester, Mass., has sent us a most convenient pocket reference book, containing useful data for street railway builders. The book is pocket size, and is handsomely and durably bound. It also contains testimonials of different street railway companies to the excellent work performed by this construction company.

William Hazelton, 3d, of New York, American representative of the Arbel establishments, France, has presented us with a large photograph, handsomely framed, of the Arbel Works, at Rive-de-Gier (Loire), France. The wheels of this company have an international reputation, and the extent of the company's works can be seen at a glance from the photograph.

The Waddell-Entz Company, of Bridgeport, Conn., owing to the present financial stringency, has been forced to apply for a receiver. The officers of the company state, however, that its affairs are in a hopeful condition, and owing to the valuable nature of the different patents and processes under its control it is expected that a reorganization and resumption may soon be effected.

The Campbell & Zell Company, of Baltimore, Md., wrote us the end of last month that it was in the market for a number of new or second hand boilers and machine tools. These include double and single head planer, screw cutting lathes of different sizes, radial and column drills, belt cutting machine, vertical boring mill, horizontal flange punch, plate bending roll, plate planer and suspension drills.

The Berlin Iron Bridge Company, of East Berlin Conn., is building for the Grosvenor-Dale Company, at Grosvenor-Dale, Conn., its new coal sheds of iron. These are arranged that the coal can be unloaded direct from the cars into the pockets without handling. The Grosvener-Dale Company expects to save a large amount of money each year by saving the expense of handing its coal the second time.

The Pittsburgh Steel Hollow Ware Company, of Allegheny, Pa., reports that its well known and popular steel ware is meeting with unqualified success. The gongs manufactured by this company seem to fill a long felt want, and to be extremely popular with street railway companies. The sound of the gongs is clear and pleasant to the ear; at the same time the bells are extremely strong and durable.

The Wakefield Electrical Engineering Company, of No. 731 Reading Terminal, Philadelphia, Pa., has secured a contract for a seven mile extension of the Lehigh Traction Company, at Hazleton, Pa. The road is to be built in a very substantial manner, and graded according to the best steam road practice, and will also include several large trestles. The work will be in charge of A. W. Gilbert, constructing engineer of the Wakefield Electrical Engineering Company.

Ralston & Company, successors to Ralston & Henry, of Philadelphia, write us that the firm of Ralston & Henry has been dissolved by mutual consent, W. B. Henry retiring. F. W. Ralston, Jr., will carry on the business of the old firm under the name of Ralston & Company, and respectfully solicits a continuance of patronage from former customers. He guarantees prompt execution of orders and care in the filling same, and also very low figures on the line of goods handled by him.

Sheaff & Jaastad, of Boston, is the title of a new firm of electrical, designing and constrncting engineers which has entered the field with good prospects of suceess. The principals are W. N. Sheaff, E. E., and A. U. Jaastad M. E., both of whom have had a long and varied experience in electrical and engineering work. Their offices are in the Cushing Building, Water Street, Boston, where they are preparing plans and specifications for a 5,000 H. P., lighting and power plant in the West, together with several others of a smaller capacity.

H. McL. Harding, of New York, who has charge, in the East, of the sale of the Walker Manufacturing Company's electric railway and power transmission machinery, will soon open an office in the handsome Postal Telegraph Building, corner of Broadway and Murray Street, New York. Mr. Harding is most enthusiastic over the outlook for the Walker Manufacturing Company in its new departure. Mr. Harding has had long experience in the sale of electric railway appliances, and is thoroughly posted on the needs of street railway companies in this line.

F. W. Friis, of Newark, manager of the National Railroad Detective Agency of that city, whose excellent detective work has given Mr. Friis a wide reputation for work of this character, has found the demands for experienced operators so large that the extension of his business has become necessary. Mr. Friis has, therefore, bought out the detective agency formerly managed by John S. Wood, at 176 Broadway, New York. Mr. Friis will run this agency in connection with his National Railroad Detective Agency, and will call it the New York branch of his Newark office.

Albert & J. M. Anderson, of Boston, Mass., have secured the contract from the People's Traction Company, of Philadelphia, to supply all the overhead insulators used on this road. When it is taken into consideration that every manufacturer of insulators in the United States has been bidding for this contract, it will be easily understood why Messrs. Anderson should feel proud of being the persons selected to supply these goods. It is universally admitted that this company manufactures a most perfect line of street railway insulators. The company also carries a full line of switches, etc.

The Consolidated Electric Storage Company, of New York, and the Brush Electric Company as co-complainants, have sued the Electric Storage Battery Company and W. W. Gibbs, president (manufacturers of the chloride accumulator), for infringement, in the United States Circuit Court for the District of New Jersey. The suit is brought on the Brush storage battery patents, recently sustained by the United States Circuit Court of Appeals; more especially patent No. 337,299. The motion for preliminary injunction was heard before Judge Green at Trenton, on February 20.

The Leonhardt Automatic Safety Car Fender Company, of Baltimore, Md., has been given a thorough and severe test on the street lines of Pittsburgh, Pa., as well as in Baltimore and Washington. In Pittsburgh, as in the other cities, very satisfactory results were obtained. The line upon which the test occurred was Fifth Avenue, and a number of men and boys were run down in various positions, and were picked up by the fender without injury. These tests attracted a good deal of attention from pedestrians, who feared that the persons upon whom the tests were made were intending to commit suicide.

W. B. Merrill & Company, of Boston, Mass., the sole manufacturers of Tripp metallic packing, report business as exceptionally good. The fact that the Broadway Cable Company has adopted this company's packing, after testing several other makes, is significant. Tripp packing is also in use at the Brooklyn Traction Company's plant, People's Traction Company, Philadelphia, and on the engines of the Montreal Street Railway Company. It has given excellent satisfaction wherever used, and the company has yet to hear of one single instance where the Tripp metallic packing has been taken out and replaced by other styles or make of packing.

Haight & Clark, of Albany, N. Y., manufacturers of the special trolley wheel illustrated in a recent issue, adapted to clean the trolley wires of ice and sleet coating in winter, report an increasing demand for this appliance. This firm writes us that it is now prepared to negotiate for the sale of its Canadian patent. Its sales in Canada, though no special efforts have been made to secure purchasers, have been most gratifying, while the call for the wheel in the United States has been far beyond the manufacturers' expectations. Haight & Clark are also iron and brass founders, and have special facilities for turning out iron, brass, composition, aluminum and aluminum bronze from patterns furnished them.

The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., has established a San Francisco agency in the Mills Building of that city. Here the company will carry a large stock of its standard supplies to satisfy immediate wants, and will be represented by H. A. Russell, assisted by R. B. Elder, both of whom are already well known in the electrical business on the Pacific Coast. The company's well known reputation will probably stimulate the work of electrical construction in this section of the country and will lead, it is thought, especially to the construction of a large number of long distance power transmission plants, in the installation of which the Westinghouse Electric & Manufacturing Company has been especially successful.

The Siemens & Halske Electric Company is rapidly covering the entire country with its representatives, and is opening offices here and there, placing in charge of the very best men to be had. An office in Boston has been opened, and R. C. Wiggin, late chief of the power and motor department of the General Electric Company, has been appointed agent. Mr. Wiggin has a wide and successful experience in the electrical business, and cannot fail to be of valuable service to the company he now represents. The wisdom and judgment displayed by the Siemens & Halske Company in securing competent and popular men in the electrical business as its representatives, augurs well for the future success of the company in this country.

The Sterling Supply & Manufacturing Company, of 47 Cedar Street, N. Y., is the title of a new corporation organized under the laws of that state. This company has purchased all the patterns, tools, etc., of Benton & Key, the manufacturers of the well known "Sterling" register, adopted by the Broadway cable road, also the "Monitor" type of register which has been in use by the Third Avenue Railroad for the past eighteen years. The new company is now manufacturing a large quantity of registers, and is well equipped in every way to furnish the registers in any quantity on short notice. The company

will also manufacture the "Sterling" sand box, which has been received with favor among street railway managers. The new company has ample capital, and no doubt will do a prosperous business.

The Joseph Dixon Crucible Company, of Jersey City, N. J., has recently added to its list of publications a most interesting treatise on the method of manufacturing lead pencils entitled "The History of a Lead Pencil;" by Walton Day. This pamphlet forms very interesting reading for all, and tells many facts that will be new to a large number of readers. The company has also recently issued a second and revised edition of its pamphlet entitled "Graphite as a Lubricant," which is especially interesting to engineers and others who have machinery under their care. The extent to which graphite is used for this purpose is an excellent indication of the satisfaction which it has given, but for the benefit of those who wish still further proof, the Dixon Company has included in this pamphlet testimonials from users in all sections of the country.

Chas. Ludlow Livingston, of Pittsburgh, Pa., electrical engineer and contractor, has removed his offices from the Fidelity Building to 713 Penn Avenue, where he will occupy an entire floor. Encouraged by his success during the nine months he has been in business, Mr. Livingston now proposes to give more attention to the construction of electric street railways. He will make a specialty of contracting for the complete equipment of roads, so that managers can, in giving him contracts, center the entire responsibility for the satisfactory operation of the construction upon one man. Judging from Mr. Livingston's already acquired reputation in the other branches of the electrical contracting business, he is fully competent to bear the responsibility. Mr. Livingston is assisted by an able force of engineers and superintendents who can be relied upon to sustain his reputation.

The Wainwright Manufacturing Company, of Massachusetts, manufacturers of corrugated copper tube, feed water heaters, surface condensers and expansion joints, etc., of Boston, writes us that it has transferred to the Taunton Locomotive Manufacturing Company, Taunton, Mass., the right to sell and manufacture the goods which it has supplied for several years past. For four years the Taunton Company has manufactured all of the Wainwright Companys' heaters, condensers, expansion joints, and corrugated gaskets, under a manufacturing contract, and is thus thoroughly acquainted with the various requirements of its customers, and with the technical and engineering features of the business. The long business experience of the Taunton Locomotive Manufacturing Company, and its high reputation are guarantees that the appliances which the company manufactures will be of the highest class.

The Philadelphia Engineering Company, of Philadelphia, has received an order for one of its Corliss winding engines from the Chamberlain Coal Company, of Pottsville, Pa., Francis A. Pocock, engineer. This winding engine has 34 in. steam cylinders, 60 in. stroke, to be operated by steam at 125 lbs. pressure per square inch, generated by a battery of Stirling boilers. The engines are provided with the Stevenson link reversed by steam gear, with an oil cataract. The engine is to be of the standard, Philadelphia-Corliss liberating valve gear, controlled by a sensitive governor of the Porter type. The hoisting drums are 10 ft. in diameter. 10 ft. long, with powerful hand and steam brakes. The adjustment of the lift is effected by a toothed gear clutch, thrown in and out with worm gearing. The main shaft bearings are 17 ins. in diameter by 30 ins. long, the body of the shaft between the bearings being 19 ins. in diameter, the central bearing being 19 × 30 ins. The engine is to lift an unbalanced load of 50,000 lbs. at the rate of 1,000 ft, per minute. The engine and drums will about 325,000 lbs.

The Buffalo Forge Company, of Buffalo, N. Y., manufacturers of power blowers and exhaust fans, whose apparatus is illustrated in this issue, has met with a remarkable call for large buildings. School trustees, especially, have learned the value of this company's system, and have from time to time recommended the purchase of Buffalo plants. We have seen copies of letters received by this company from trustees and principals of schools which speak in the highest terms of this apparatus. One letter from C. L. Plunkett, of Salt Lake City, Utah, described the use of the Buffalo Forge system in the Lincoln school of that city. Mr. Plunkett, among other remarks says: "Yesterday, with the temperature hovering close to zero, a test of all the school buildings in this city was made, and one of the Buffalo Forge Company's plants, that in the Lincoln School in the Sixth Ward, carried off all the laurels. The temperature in the nine rooms during the entire day varied only 2 degs. from the other, and to accomplish this result only 700 lbs. of slack were used, at a cost of less than a $1.00. All of the time in this building the apparatus is delivering thirty cubic feet of outside air for each of the 500 pupils domiciled there per minute. You will note that the above results are even better than in the Lehi plant last winter—which plant, by the way, is the pride of all the people of Lehi."

The Page Belting Company, of Concord, Mass., has sent us a very handsome calendar for 1894, giving a view of the seventy-two and seventy-one inch, three-ply World's Fair Crown tandem belts in use in Chicago, and in connection with the Allis engine, and described in the STREET RAILWAY JOURNAL. The photograph was taken by an exposure of twelve minutes, while the belt was running at 5,600 ft. per minute under a full load. The perfection of the running of the belts is shown by the absence of flap and vibration. A copy of the award given to the Page Belting Company, and of the medal awarded, is given on the calendar. Also given are a number of testimonials of the value of the Page belts. The company writes us that among other recent orders it has sold a large belting equipment to the Suburban Electric Railway Company, of Elizabeth, N. J. This contract, which is for fifty-two, forty-two and forty inch belts, was awarded the Page Company for Crown belting, among eleven competitors. The company has also received an order for a fifty-four inch belt from the Union Railway Company, of New York. During the last month the company has executed orders for 15,000 ft. and upwards of Crown and Eureka Dynamo belting for shipment to Japan.

Warren Webster & Company, with works at Camden, N. J., and Chicago office at No. 2 Canal Street, Chicago, Ill., reports among the many orders received for the Webster vacuum feed water heater and purifier, one from the Pullman Palace Car Company, Pullman, Ill. This is for three more Webster vacuum feed water heaters and purifiers, aggregating over 5,000 H. P., to equip this company's entire works, also one from the Williams vacuum system of steam heating, so as to utilize the waste exhaust steam without back pressure upon engines for heating purposes. Past orders received from the Pullman Company have amounted to 2,700 H. P., and were for apparatus installed in the Pullman plant at Pullman, Ill., during the past four years. These times of small margins are compelling a close scrutiny as to the methods in manufacturing, in order to secure greatest economy in the use of steam. Warren Webster & Company claim to have the best methods for correcting feed water for boilers, and for utilizing exhaust steam for heating purposes without back pressure upon engines, giving the best results upon all points of economy. They built their present new works at Camden, N. J., last year, and are now commencing an extension of 60×65 ft. in their wrought iron department. Examinations and estimates are made by them free of charge.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., finds business constantly increasing, and has been obliged to take another floor in the building which is occupied in Pittsburgh. The company is now employing about twenty-five men at its works exclusively in the manufacture of pick-up fenders and wheel guards. The safety devices of this company have been so often described in this publication that their particulars are familiar to our readers, and require no further description. The February contracts of this company called for 500 pick-ups and wheel guards. The high reputation of the device has spread to all sections of the country and even further, for among the requests for information and prices received by the company were some for fenders to be used in Australia and New Zealand. The company has also under contemplation the establishment of a Canadian agency. The company is building 150 wheel guards for the Philadelphia Traction Company, and has closed a large contract in New Orleans. Several other large contracts, it is expected, will be closed soon and these, when completed, will be announced in the STREET RAILWAY JOURNAL. In Williamsport, Pa., the fender is in use on the Passenger Railway Company, and Mr. Young, the superintendent of the road, writes that it recently saved a boy's life. The Central Traction Company, of Pittsburgh, also reports four lives being saved by the fender board.

The Robinson Electric Truck & Supply Company, of Boston, Mass., is building Robinson radial trucks as rapidly as possible on orders for immediate delivery. It expects to ship about forty radial trucks during the month of February. The Robinson Company has designed a new truck for four wheel cars, which is radically different in principles of construction, ftom any truck now in the market. It is extremely easy in riding, and, it is claimed, has less of the end teetering motion than any four wheeled truck yet brought out. This truck will be ready to put on the market this spring. Mr. Robinson's reputation as a truck designer and builder is too well and favorably known to need comment here. His production of the radial truck is sufficient proof of this. Mr. Robinson's promise therefore, to bring out a four wheel truck "differing in principles of construction from any truck now in the market," will arouse a great deal of interest, and the new truck will be watched for by railway men on the alert for something better than they now have. The Robinson radial is claimed to be the best truck known for cars having bodies eighteen feet and upwards in length. The new four wheel truck, however, is designed to meet the demands of those who use short or light cars. It is adapted, nevertheless, to carry as long and heavy a car as any four wheel truck in the market, and with greater steadiness. The new truck is known as the "Robinson Ajax Truck."

The Young Lock Nut Company, of New York, at this season of the year, when the construction of new street railways and the repairing or changing of old lines is engaging the attention of both the financial and engineering world, is the recipient of many inquiries in regard to its lock nut. This device, although opposed in its action to the spring washers so long in use, is not only theoretically correct in all the principles on which superiority is claimed for it, but three years' hard test have shown that these claims are well founded. To no more severe work could it be put than on the elevated railroad in this city, where a two years' test resulted in its adoption. Many other roads are using it with equal success. It is simple; its action is governed by a natural and never failing law; it is efficient, and above all in these days, it is a matter of economy which should not be overlooked by any railroad. Among the advantages claimed for it are that no one can be imposed on by the use of poor metal in its manufacture, as the quality of the meterial used does not enter into the question as with the spring washer, where it is the main, we might say, only, consideration. It can be reversed, and has not to be thrown into the scrap heap after one application. The following, lately received from D. S. Carll, chief engineer of the Washington & Georgetown Railroad, speaks for itself: "Replying to yours of the 14th inst., would state that the Young lock nut is giving us entire satisfaction where used. We are using these locks on the bolts that fasten our gripguards to their brackets around curves. We formerly had a jam nut on these bolts and they were continually getting loose; but since using the Young lock nut they have given us no trouble at all."

The Mather Electric Company, of Manchester, Conn., has been reorganized, and the management taken into the hands of a syndicate of Hartford capitalists. The old board of directors has resigned and the following officers have been chosen: President, Maro S. Chapman; vice-president, T. C. Perkins; secretary and treasurer, John L. Bunce. Directors: Charles E. Perkins, T. C. Perkins, M. S. Chapman, Henry A. Redfield, Charles M. Jarvis, John L. Bunce and Norman McD. Crawford. The new officers are all men prominent in electrical and mechanical circles, and intend to inaugurate an aggressive policy in the manufacturing field. The new superintendent of the electrical manufacturing departments is Theodore Gonet, formerly connected with the Westinghouse Electric & Manufacturing Company. He will have associated with him W. E. Powell, now of the Mather Company. Maro S. Chapman is largely interested in a number of paper mills in New England, is president of the Perkins Electric Lamp Company, and the Waring Electric Company, both of Manchester, and until the present time has been vice-president of the Mather Electric Company. Thomas C. Perkins, although a young man, is well known in the electrical fraternity, especially in the West, through his association until recently with W. B. Pearson, of Chicago, as Western representatives of the Ball & Wood Company, of New York City. John L. Bunce has been connected with the Perkins Switch Company and also with the Pope Manufacturing Company, of Hartford. Charles E. Perkins is a well known expert and patent lawyer, of Hartford. Henry A. Redfield is president of the Phœnix National Bank, of Hartford. Charles M. Jarvis, president of the very successful Berlin Iron Bridge Company, of East Berlin, Conn., is too well known to require introduction, as is also Norman McD. Crawford, of Philadelphia, an electrical railway engineer in connection with the Pennsylvania Railway Company, the Philadelphia Traction Company, etc., etc., etc. The company starts out under the reorganization free of all debt, with a paid up capital of $250,000. The company intends to make a specialty of large dynamos and generators. In anticipation of the heavy work in which the company expects to engage, it has recently erected a new shop, 200 × 50 ft., equipped with a twenty ton traveling crane.

WESTERN NOTES.

The Metropolitan Electric Company, of Chicago, Ill., is having large sales of its new "Metropolitan" lamp, which is giving good satisfaction. This company has moved into its new building 186—188 Fifth Avenue, Chicago, where it has ample store and office facilities, besides warerooms, and is putting in a large line of staple goods to take care of all orders without delay.

The Jones Bros. Electric Company, of Cincinnati, O., is about to put upon the market a new lightning arrester, which is claimed to be the simplest and most reliable manufactured. This arrester is manufactured in three designs, one for electric street car use, one for station work and the third for outside work. The company writes us that it will send a full description of this arrester upon application.

The Bass Foundry & Machine Works of Fort Wayne, Ind., the success of whose car wheels was mentioned in our last issue, turns out a wheel which is giving good satisfaction where used. The greatest care is taken in the manufacture of this wheel, and the agents of the company justly take pride in the high grade of article which the company manufactures. The list of users of this company's wheels is large and constantly increasing.

The Lunkenheimer Company, of Cincinnati, O., whose renewable seat gate valve has been illustrated and described in these columns, is having remarkable success in introducing the valve in street railway and electric light and power stations. The valve has a number of important features which recommend it for service, and the claims made for it are its simplicity, strength and compactness, and seem to be well substantiated by the service the valve is giving.

The Fulton Truck & Foundry Company, of Cleveland, O., as mentioned in our last issue, has established a general Eastern office in the Havemeyer Building, New York. Wm. Hazleton, 3d, who is well known to the street railway fraternity, is in charge, and has a handsomely furnished office on the thirteenth floor, where he will be ready at all times to explain the merits of the Fulton Truck & Foundry Company's steel truck, the "Imperial," and other appliances manufactured by it.

The American Car Company, of St. Louis, started up its works on full time in the middle of February, and is now working on a large number of orders received from various parts of the country. During the recent shutdown, the management has had the works made more perfect in its appointments than ever, placing them in an unrivalled position for turning out the largest amount of fine work. The company expects its paint shop, with a capacity of 160 cars at one time, to be filled in the future with new cars in fulfillment of orders now on its books.

The Fitzgerald-Van Dorn Company, of Lincoln, Neb., manufacturers of the well known Van Dorn drawbar for electric, cable and elevated railroads, writes us that business during 1893 was very satisfactory, considering the universal stagnation in trade, and that business had already opened for 1894 with a boom. This company's drawbar is now in operation on some forty lines of street railroads, including elevated, cable and electric. The company has recently added to its list of customers the Philadelphia Traction Company, the Electric Traction Company, of Philadelphia, and several other important companies. Several improvements, it is stated, have been added to the drawbar during the past few months, and its manufacturers claim now that it is without a peer in the market.

The Charles Munson Belting Company, of Chicago, has received an order for 141 ft. of sixty inch, three-ply, Eagle belt from the American Wire Company, of Cleveland, O. It was especially gratifying to this company to receive the order, as the circumstances under which it was awarded showed that merit was the quality considered. The Munson Company put in two forty-four inch, three-ply belts at the American Wire Works four years ago, which have given splendid satisfaction. They have never given the least trouble, and have transmitted full horse power ever since they were first placed on pulleys. These belts travel 7,000 ft. a minute, and are subject to very severe strain. They are still in excellent condition, and will last the Wire Company for a long time to come.

The Ohio Brass Company, of Mansfield, O., manufacturer of electric railway supplies, is putting a new track bonding device on the market. This is a steel cap which is made to fit snugly over the end of the bonding wire, and into the hole which is drilled in the rail. The mode of fastening is as follows: The end of the wire is pushed through the hole, and the cap is slipped over it and both are then inserted into the rail. A few blows of a hammer are sufficient to fasten it into place. The crimp in the cap extending its whole length allows it to shrink into the wire sufficiently tight to insure a perfect air and moisture proof joint. The facility and ease with which these are used, together with their low selling price will surely recommend them to every street railroad man. The Ohio Brass Company also advises us that its new catalogue is now ready for distribution.

The G. C. Kuhlman Company, of Cleveland, O., is evidently not troubled with the general depression in business which is prevalent in all sections of the country. This company seems to have no difficulty in obtaining orders at all times for its cars, and its works at present are extremely busy turning out rolling stock. Among the cars on which this company is now engaged are six for the Cleveland & Berea Railway Company and eighteen cars for the Cleveland Electric Railway Company. The work on these latter, especially, is to be the finest possible, and these cars when finished will be deservedly a source of pride both to the railway company and to the manufacturers. Mr. Kuhlman is expecting to close other contracts shortly with two large roads outside of Cleveland, which will compel the company to make large additions to its already extensive works, which are now being run to their full capacity.

H. F. J. Porter and Albert Fisher, of Chicago, have formed a partnership under the name of Fisher & Porter, and will carry on a contracting and engineering business, with offices at 1025 Monadnock Block. Their line will be the complete equipment of steam plants, giving special attention to large work. Mr. Porter was formerly first assistant mechanical engineer at the Exposition during its construction, and afterward assistant chief of the machinery department. Mr. Fisher has been well known as the Chicago representative of the Ball, Watertown and Green engine companies. Fisher & Porter have recently been made Western representatives of the Providence Steam Engine Company, builders of the improved Green engine, and of the Altoona Manufacturing Company, builders of the M. A. Green engine. They are also making arrangements with other Eastern manufacturers as agents, so as to be able to handle a great variety of business.

J. L. Barclay of Chicago, is now occupying his new business quarters on the sixteenth floor in the south end of the Monadnock Building, in Chicago. The suite of offices is admirably planned for handling Mr. Barclay's electrical interests, and was primarily selected by him for exploiting the sales of the Walker Manufacturing Company's electric railway and electric power transmitting machinery, the Central and Western selling departments of that company's business being under Mr. Barclay's immediate supervision. H. McL. Harding, who also represents the above company, has his headquarters for the Eastern department in New York. While the general electrical interests of the Walker Manufacturing Company will receive the combined attention of Messrs. Harding and Barclay, all selling business directly connected with the Western and Middle States will be exclusively transacted at the Chicago headquarters. District and sales agents are now being appointed in the various districts; among the latter are men who have the confidence of street railway managers, and thoroughly posted in the details of the business. Mr. Barclay feels very much encouraged at the business outlook notwithstanding the financial depression, inquiry for the heavy types of generators and motors, such as the Walker Company manufactures, being numerous. A description of these machines will be published in a later issue.

The St. Louis Car Company, of St. Louis, reports business as very brisk and the prospects for the future very encouraging. The company, as mentioned in the last issue, has recently received a contract from the People's Traction Company, of Philadelphia, Pa., for 400 electric motor cars. 250 of these are to be built immediately, and the remainder as the railway company demands. One-half will be closed cars with twenty foot bodies, and the remainder open cars with twenty-eight foot bodies. The latter will have coach seats, and will be very similar in design and arrangement to the standard long cars used in St. Louis, and built by the St. Louis Car Company. Both closed and open cars will each be mounted on two four wheel, maximum traction trucks, and equipped with two twenty-five horse power, General Electric single reduction motors. The car company reports a very large sale of its No. 8 truck, of the suspended spring base type. The general manager of the company, P. M. Kling, is perfecting a new four wheel truck to be used under long cars. Besides the Philadelphia order the company has also contracted to send 300 cars to various points throughout the country, such as Pottstown, Pa., St. Louis, Scranton, Pa., Topeka, Kan., which are among the largest buyers. The St. Louis contract is that of the Baden & St. Louis Railroad Company, which calls for ten twenty foot cars, with seven coach seats on each side, double doors, mounted on the St. Louis Car Company's improved No. 8 steel truck, and propelled by two twenty-five horse power, General Electric single reduction motors.

New Publications.

The Genett Air Brake for Cable and Electric Railways. Published by the Genett Air Brake Company, Chicago, Ill.

This is a handsomely gotten up and illustrated catalogue of the Genett air brake. The efficiency and practical operation of this system has been well shown by the numerous roads adopting it for their cars, and the results of tests published from time to time in the STREET RAILWAY JOURNAL. The catalogue treats of the description of the system, fully explaining its construction and operation, and also clearly illustrating all the different parts in detail, as well as the manner of adjusting, operating and maintaining these brakes. A large illustration is shown of the application of the Genett system to a typical motor car and trailer street railway train. The catalogue is handsomely printed and illustrated, and gives much valuable information regarding the system.

Dynamo and Motor Building for Amateurs, With Working Drawings. By Lieut. C. D. Parkhurst, New York. The W. J. Johnston Company, Limited. 163 pages, 71 illustrations. Price $1.00.

There is a fascination in the use of electrical machinery which appeals with great force to most people, and induces many to seek a more intimate acquaintance with the methods of generating and utilizing electrical power. The book mentioned above gives in clear and concise form instructions for building simple forms of motors and dynamos which will give fairly efficient results. These, if followed by the student, will not only give him apparatus which has a commercial value, but what is more important, will give him that practical knowledge of mechanical and electrical principles involved in the working of electrical machinery, which he can attain in no other way. The work is accompanied with working drawings and other aids for helping the reader in constructing motors and dynamos. An appendix is added in which is contained data of some of the high type dynamos and motors, which will be of assistance should the amateur wish to design any other types than those treated in the book.

After the Fair: The Twenty-fifth Anniversary Souvenir of the Page Belting Company. Published by the Page Belting Company, Concord, Mass.

The excellent exhibit which the Page Belting Company, of Concord, N. H., made at the World's Fair, Chicago, formed a striking feature of that exposition, and is familiar to our readers through illustrations given of the principal installations made, in our issues last year, during the continuance of the fair. The desire to provide a permanent record of the exhibits shown at Chicago, which the company could present to its friends and customers, has induced the Page Company to issue the handsome pamphlet whose title is given above. This pamphlet contains views, not only of the special exhibits made in the machinery and electrical buildings by the Page Company, but also of the exhibits made by the engine and electrical companies and other machine builders in which the Page belts were an essential and important factor in transmitting power. Views are also given of the Intramural power station, showing the installment of Crown belting, and of lighting plants in various parts of the grounds, in which Page belts were used. The testimonials of a large number of users of the belts at the fair are included in the pamphlet, together with views of the offices of the company and its works at Concord, N. H.

The Inventions, Researches and Writings of Nikola Tesla, by T. Commerford Martin, New York. Published by *The Electrical Engineer*. Cloth, 500 pages, 330 illustrations and new portrait. Price $4.

The extended investigations of Mr. Tesla in the electrical field have opened up to us an immense tract of hitherto unexplored territory, and have not only enlarged our conceptions of the properties of the mysterious force electricity, but indicate a direction in which still more wonderful discoveries will probably be made before many years. Too much credit can hardly be given to that class of inventors of which Mr. Tesla is a type, who, almost alone and unaided, have devoted their energies to increasing our knowledge of the operation of electrical force tn new fields. The practical value of many of Mr. Tesla's inventions and discoveries has already been demonstrated, and all have an important bearing on electrical development.

The first part of the book contains an account of Mr. Tesla's work in polyphase currents, some of which have proved of inestimable value in perfecting the plans of the Niagara Falls power transmission plant. The second section of the work treats of the electrical experiments performed by Mr. Tesla with currents of high potential and high frequency, and the third includes a variety of his inventions in other branches of electrical work, such as dynamos, motors, arc lamps, etc. In that section, some of the Tesla early "phase" motors are described.

The work contains Mr. Tesla's most important lectures and writings which, though previously published, have been so scattered as to be often inaccessible. The author, Mr. Martin, has used his usual careful judgment in compiling the work and has made even the most abstruse and technical of the investigations so attractive that even the non-technical reader will find it appealing irresistibly to his interest.

ARTICLES of incorporation were filed at Elizabeth, N. J., February 15 by the Suburban Railway & Electric Company, the incorporators of which are James B. McGiffert, of Roselle, W. B. Hosmer, of Boston, John S. Bartlett and Charles H. Fewhall, of Lynn, Mass. The capital stock of the company is $300,000.

List of Street Railway Patents.

U. S. STREET RAILWAY PATENTS ISSUED JANUARY 23, 1894, TO FEBRUARY 13, 1894, INCLUSIVE.

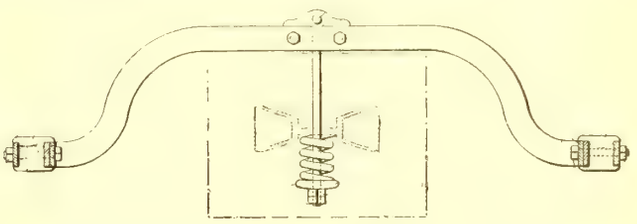
JANUARY 23.

TROLLEY WHEEL—George C. Bourdereaux, Peoria, Ill. No. 513,076.

A trolley for electric cars comprising two separable portions or halves fitted together to form the trolley wheel and a casing for the trolley bearings, a series of rollers inclosed by said casing and having enlarged bearing ends and a central bearing shaft constructed to engage the enlarged ends of said series of rollers.

MOTOR SUPPORT FOR MOTOR TRUCKS—Walter S. Adams, Philadelphia, Pa., assignor to J. A. Brill, same place. No. 513,226.

The first claim of this patent reads as follows: In combination, the side bars, a cross bar or bars, the web of which extends upwardly, having an outward bend or enlargement on the end or ends adjacent to the side bars, and a thimble having recesses within which both the side bars and the enlarged ends of the cross bar or bars lie, the metal of the thimble resisting downward stress of the cross bars independent of any other connection.



PAT. NO. 513,226.

CAR BRAKE—G. M. Brill, Philadelphia, Pa. No. 513,229.

In a car brake the combination of brake beams, brakes secured therein, equalizers secured to the beams and directly connected together. An upright lever included in the connecting mechanism and means connected with the car wheels for primarily operating the upright lever and drawing the ends of the equalizers each toward the opposite beam.

TRACK SWEEPER FOR RAILWAYS—G. M. Brill, Philadelphia, Pa. No. 512,230.

Sweeping brooms are supported at opposite ends of the car truck, in such a way that they may be revolved when desired. These brooms rest normally in contact with the rail. All brooms are operated from the same source of power, in such a way that they may be all simultaneously operated, or by disconnecting one or more, the others may be operated independently.

CAR BBAKE—George F. Brandau, Cohoes, N. Y. No. 513,298.

A swinging brake shoe normally held away from the track and having a cam portion and adapted, when released, to fall by gravity into contact with a car track. The cam portion engages with the brake block, in such a way as to force it into engagement with the car wheel.

ELECTRIC MOTOR FOR STREET CARS—Benjamin G. Lamme, Pittsburgh, Pa., assignor to the Westinghouse Electric & Manufacturing Company, same place. No. 513,401.

In a motor for electric cars, an armature mounted upon the axle of the car, and two field magnets independently sleeved upon the axle and suspended at their rear ends from the car body.

SPAN WIRE FOR OVERHEAD ELECTRIC RAILWAYS—Sidney H. Short, assignor to the Short Electric Railway Company. No. 513,426.

Covers the use of parallel overhead conductors with span wires composed of two or more sections, the sections being insulated from each other.

SAFETY BRAKE—Kitchell A. Maynard, Kansas City, Mo., assignor of one half to William M. and Geo. M. Randall. No. 513,432.

Consists of a brake pivotally carried by a cable car, and having its lower end passing into the grip slot, and friction rollers carried by said lever at the upper and lower sides of said grip slot, and adapted to bear upon the upper and lower sides of the slot rails.

JANUARY 30.

TROLLEY WIRE FINDER—Edward Gale, Peoria, Ill. No. 513,566.

A trolley pole and wheel, with a revoluble guard extending laterally beyond the vertical planes of the sides of the wheel.

DYNAMO BRUSH—W. H. Fleming, Bayonne, N. J. No. 513,611.

A brush consisting of successive layers of wire gauze put together under high pressure, and disposed diagonally to the length of the brush.

CAR BRAKE—Herbert E. Collett, Chelsea, Mass., assignor of three-fourths to Herbert E. Collett, Jr., Lynn, Mass., and Charles W. Armstrong and James Howard Bing, Philadelphia, Pa. No. 513,670.

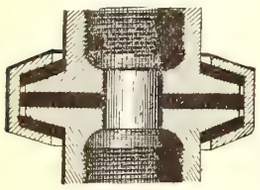
Covers a sectional rotary brake staff in combination with a ratchet fast to its lower section, and so arranged as to form a clutch. A companion clutch member is fast to the upper section, and a cap encloses the clutch mechanism and is attached to the ratchet.

Car Brake—Willard Curtiss, Grand Rapids, Mich., assignor of one half to Wm. T. Powers and Wm. H. Powers, same place. No. 513,672.

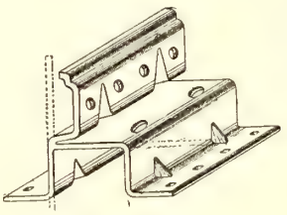
In connection with a cable car and slot rails, employs a laterally and vertically movable bar, having a brake shoe adapted to engage said slot rails, springs to maintain said bar in mid-position laterally, and means for vertically moving said bar.

Wheel Fender or Guard for Cars—Georg Blakistone, Baltimore, Md. No. 513,701.

Consists essentially of a sheet of flexible material, attached at its rear end to the car, and having a loose bar on its front end suspended by means of operating cords or chains from the car platform. The sheet is normally held up by the cords or chains, and lowered as occasion demands.



Pat. No. 513,670.



Pat. No. 513,711.

Wheel Fender for Cars—Georg Blakistone, Baltimore, Md. No. 513,702.

Embraces the sheet employed in No. 513,701, with the addition of supporting rods and springs to hold down the outer end of the sheet.

Safety Fender or Trap—Georg Blakistone, Baltimore, Md. No. 513,703.

Same as No. 513,702, with an automatic tripping device to release the fender.

Railroad Rail Joint—Arthur J. Moxham, Johnstown, Pa. No. 513,711.

A rail joint consisting of a base plate supported by two vertical sides provided with two angular feet, a brace on one side attached to the ends of abutting rails, and a separate splice bar acting as a washer for said bolts.

Combined Chair and Cross-Tie for Railroad Rails in Track—Arthur J. Moxham, Johnstown, Pa. No. 513,712.

A metallic cross-tie having a rail chair struck up therefrom, forming a rail seat, the metal of the tie being forced out laterally in the operation of striking up the chair.

Electric Connection for Railway Rails—Alfred Green, Rochester, N. Y., assignor of one-half to William Rosbrough, same place. No. 513,777.

The combination with the rails of an electric railway of a return conductor wire and wire connections provided with stems and slots, said wire being removably fixed in the slots; the wire extends and is



Pat. No. 513,777.

supported beyond the ends of one or more rails in each direction whereby when the wire is unfastened, as by unsoldering, so that the rails may be removed without interrupting the current.

Trolley Pole Stand—Gustav Valley Cleveland, assignor to the Steel Motor Company, same place.

This comprises a base plate for attaching to the car top, a trolley pole plate bearing a socket for engaging the trolley pole, such trolley pole plate being suspended by means of links the links; from the one side engage hooks or opposing members of the base plate; the links from the other side of the trolley pole plate engage a crosshead. A coiled spring connects with and acts on the crosshead in the direction to hold the links taut.

Spring Spoke Wheel—Gustaf Valley, Cleveland, O. No. 513,848.

Covers a wheel consisting of a rim provided with curved seats upon its inner periphery, flat spring metal spokes substantially U shaped, a recessed hub, and securing blocks and bolts adapted to detachably secure said spokes to the curved seat and hub.

Street Railway Brush—Philip A. Coonradt and Arthur R. Coonradt, Rockford, Ill. No. 513,888.

Covers the combination of a brush for each rail and a spring bar for each brush having an adjustable connection with a part of the truck, the brush having an adjustable connection with a bar, a shaft, a flexible connection between one spring bar, and shaft and a flexible connection between the other spring bar and the first mentioned flexible connection passing over suitable pulleys.

Power Transmitting Mechanism for Electric Locomotives—Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. No. 513,895.

Covers the combination with an electric motor and a shaft or wheel to be driven, of an electric speed reducing mechanism connected to the moving part of the motor and to the shaft or wheel, and consisting of two parts in close proximity to and adapted to electrically attract or repel each other. A friction clutch is also connected to the moving part of the motor, and to the said shaft or wheel.

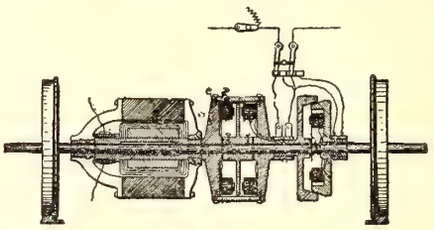
February 6.

Conduit Electric Railway—Rufus C. Beardsley, Lafayette, Ind. No. 514,056.

Comprises a slotted conduit, switch boxes arranged alongside the same, electric switches in the boxes, movable parts of which project into the conduit, and removable covers for the boxes upon which a portion of the switches is mounted.

Closed Conduit Electric Railway—Frank M. Ashley, Hawthorne, N. J. No. 514,112.

Comprises a closed conduit and a traveling switch moving in the the same, the latter consisting of a body mounted upon wheels, an armature carried by but movable, independent of the body, brake



Pat. No. 513,895.

shoes bearing upon the wheels, and a system of levers connecting the armature with the brake shoes, whereby a movement of the former will be imparted to the latter.

Electric Railways—Frank M. Ashley, Hawthorne, N. J. No. 514,113.

Embraces an overhead wire divided into sections, an underground wire divided into corresponding sections, branch wires connecting the corresponding sections of the two wires together, and a hanger located at the joints between the sections of the overhead wire, the same consisting of two metallic plates bolted to the opposite sides of a block of insulating material, the ends of the wire sections being connected respectively to the two metallic plates, and a said branch wire connected to one of said metallic plates.

Electric Railway Conduit—Frank M. Ashley, Hawthorne. N. J. No. 514,114.

Embraces a conduit divided into two compartments located in the same horizontal plane, one of which is closed and the other open, a traveling switch moving in the closed conduit and rails located above and below the switch upon which the latter runs, one of said rails being sectional, and a sectional conductor located in the open compartment with its sections connected respectively with the sections of the sectional rail.

Electric Railway—Oscar A. Enhohn, New York, assignor to Edward C. Reiss and John J. Ashley, Brooklyn, N. Y., and Frank M. Ashley, Hartshorne, N. J. No. 514,120.

Comprises a conduit divided into two longitudinal compartments, one sealed and the other open, a circuit controller running in the open compartment, and electro-magnetic apparatus carried with the collector and controlling the movements of the circuit controller.

Safety Guard for Street Cars—George T. Foster, Rochester, N. Y. No. 541,121.

Embraces cranked arms pivoted to a car, curved rods attached to said arms at one end and connected with slotted keepers on the car at the other end, a cross rod connecting the arms, a network attached to the cross rod and curved rods, and a pneumatic fender mounted on shafts provided with rollers, said shafts entering sockets in the cranked arms, and springs for forcing the fender forward. In connection with the foregoing employs a supplementary guard.

Underground Electric Conductor—Henry A. Seymour, Washington, D. C., assignor to the Short Electric Railway Company, Cleveland, O. No. 514,133.

Comprises a tube flexible on its under side, an electrical conductor located within the tube and supported therein out of contact with the inner walls of the tube, and electrical contacts secured to the under side of the tube and adapted to be lifted into contact with the electrical conductor by an under-running trolley.

Closed Conduit for Electric Railways—Henry A. Seymour, Washington, D. C., assignor to the Short Electric Railway Company, Cleveland, O. No. 514,134.

Embraces an inverted shell and an electric conductor secured to its under side, an electric conducting diaphragm secured to the depending edges of the shell, and retained out of contact with the conductor by its gravity, and adapted to be forced upwardly into contact therewith by an under-running trolley.

Safety Car Fender—George Latz, Baltimore, Md. No. 514,234.

A safety fender attached to the truck frame, and constructed with spaced slats, the higher portion of which is placed horizontally and the lower portion projecting forwardly and downwardly inclined with an eye at the lower end thereof, and a connecting bar which extends through the eyes of all the slats.

ELECTRIC TROLLEY WHEEL SHIELD—Henry S. Pruyn, Hoosick Falls, N. Y. No. 514,274.

In an electric railway, an electrical conductor mounted along the roadway, a hood or covering protecting said conductor and open on its under side, a car adapted to travel along the roadway, a current collecting device carried by the car and passing up under the hood to make contact with the conductor, and a shield carried by and protecting the contact device and extending under the edge of the hood. Also covers a trolley wheel for electric railways provided with a guttered shield.

TROLLEY WIRE SHIELD—Louis Eschner, Philadelphia, Pa. No. 514,353.

Embraces an open bottomed shield or guard, an internal insulating block mounted upon one side of said shield, and a conductor secured to said insulating block and having both an upwardly projecting and a downwardly projecting flange beyond the same whereby it is adapted for receiving a trolley either from above or from below.

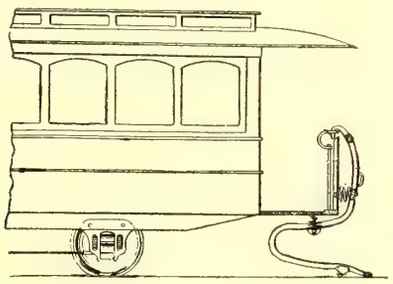
CABLE GRIP—John A. Tauberschmidt, Washington, D. C. No. 514,389.

A cable grip constructed with two pivoted and peforated jaws forming the lower grip member, and an upper grip member having lateral integral projections extending outward through the perforations of the pivoted jaws to engage the said jaws exteriorly and lock them.

FEBRUARY 13.

ELECTRIC RAILWAY—Paul W. Leffler, Minneapolis, Minn., assignor to Leffler Electro-Magnetic Railway Company, Chicago, Ill. No. 514,561.

Consists of a car having a system of armature magnets and a series of field magnets in the line of travel, the car being furnished with an automatic rotary pole changer and a rotary magnetic controller driving said pole changer and operated by the field magnets, whereby the adjacent magnetic members are excited with a constant and opposite polarity.



PAT. NO. 514,749.

CAR BRAKE—John Kerwin, Detroit, Mich., assignor of one-half to Andrew McBride and John Campbell, same place. No. 514,655.

A brake consisting of bands extending over the top of each of the truck wheels and a compensating lever fulcrumed between the wheels and connected at its extremities with said bands, and a lever for operating the band over the front wheel.

POLE FOR ELECTRIC RAILWAYS—Edw. W. Serrell, New York. No. 514,665.

A metallic pole composed of three or more members, having their bodies wider at one end than the other, and united at the center by angle irons throughout their length, and tie bands surrounding the pole at intervals.

BOND WIRE FOR ELECTRIC CONDUCTORS—Alfred Hoffman and Joseph Brogan, Milwaukee, Wis. No. 514,714.

A bond wire with laterally bent ends and washers with radial channels for the admission of the portions of the wire adjacent to the points, so that the wire may lie flush with the outer surface of the said washers.

ELECTRIC RAILWAY SYSTEM—Paul W. Leffler, Minneapolis, Minn., assignor to the Leffler Electro-Magnetic Railway Company, Chicago, Ill. No. 514,718.

Consists of a car or other travelling body, a magnetic field extending along the line of travel, a magnetic armature carried by the car, a magnetic pole changing mechanism operating according to the speed of the car, so that the forces of magnetic attraction and repulsion will co-operate to propel said car.

LIFE GUARD FOR STREET CARS—Theophile Euphrat. No. 514,749.

Consists of a scoop catcher suspended from above the bottom of the front edge of the car, having its front edge close to the rails and a little in advance of the front edge of the car.

TROLLEY—John A. Williams, Altoona, Pa. No. 514,801.

Consists of a hanger having the edges of the arms curved inwardly, and removable shaft blocks seated in said hanger, and trolley wheel shaft keyed to the said blocks and hanger.

INSULATING JOINT—Emil F. Gennert, Brooklyn, N.Y. No. 514,822.

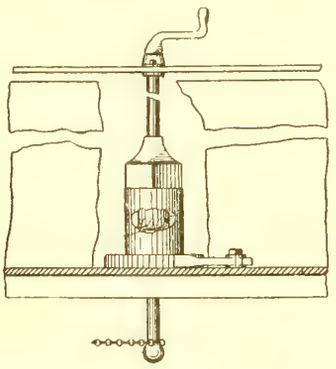
Consists of two sections provided with interlocking lateral flanges, strips of insulating material separating the ends and flanges, and a cup-shape ring pressed or clamped over them and separated therefrom by strips of insulating material.

ELECTRIC RAILWAY CONDUIT—Robert L. Hampton, Athens, Ga. No. 514,827.

A conduit having a trolley rail chamber with a slot in its top and a drainway below, and a cable way located at the side of the trolley rail and provided with removable rack bars to support and separate the cables.

ELECTRIC SWITCH FOR RAILROADS—Wm. M. Henderson and Wm. C. Henderson, Philadelphia, Pa. No. 514,850.

Consists of a combination of levers actuated by the wheels of the car and in connection with electric mechanism to operate the switch.



PAT. NO. 514,822.

ELECTRICALLY OPERATED STREET INDICATOR FOR CARS—Henry C. Barker, St. Louis, Mo., assignor to Jacob Stocke, Jr., and Henry C. Beekman, same place. No. 514,878.

Consists of an indicator carried by the car, a cam block located on the trolley wire, a contact piece on the trolley arm and a contact point on the car having electrical connection with said indicator and operating the same when the cam is engaged by the trolley.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. THE STREET RAILWAY PUBLISHING COMPANY, HAVEMEYER BUILDING, NEW YORK.

Annual Meeting of the National Electric Light Association.

The Seventeenth Convention of the National Electric Light Association was held in Washington, D. C., February 27, 28 and March 1, 1894.

Some of the topics for discussion were: "What is the Most Economical Size for Arc Dynamos?" "Arc Lights on Incandescent Circuits;" "How to Rate Arc Lamps;" "Underground Circuits;" "How to Wire Buildings;" "Commercial Alternating Motors;" "Electrolytical Effects of Return Currents;" "Motors *vs.* Flat Rates;" "Storage Batteries."

A paper entitled "Electric Lighting at the World's Fair, and Some of Its Lessons," was illustrated with stereopticon by T. C. Martin and L. Stiringer. There was also one entitled "The Importance of Complete Metallic Circuits for Electric Railways," by J. H. Vail, which is given on another page in this issue.

The Lake Shore Route.

The Lake Shore Route, between Buffalo and Chicago, is celebrated all over the world as affording the embodiment of luxury in travel. Its new Day Coaches are sixty feet in length, and will seat fifty-eight people, comfortably. They are fitted with the Gould platform and automatic coupler, Westinghouse air brakes and signal, heated with steam taken from the locomotive, and at night are brilliantly lighted with Pintsch gas, for which purpose five elegant bronze chandeliers depend from the roof of the car.

The interior of the coaches is finished in mahogany, highly polished and paneled. Each coach has a nice lavatory and toilet. The latest models contain separate toilet rooms—one for ladies and one for gentlemen. The car seats are of the style known as the Mason tilting, with high, spring backs and broad seats. They are richly upholstered in crimson plush. The windows, which are of plate glass, are large, and each is fitted with a spring-roller curtain, in shade to blend with the interior finish, and every feature is of the best.

The dining cars in service on the trains of the Lake Shore & Michigan Southern Railway are operated by the company. The cars are neat and tasty in all their appointments. Great care is exercised to provide the patrons of the Lake Shore Route with a service which shall prove satisfactory. As a result, dining on the trains of the road is accomplished in a very satisfactory and comfortable way.

The sleeping cars in service on the Lake Shore Route are of Wagner build. Ordinarily, they contain twelve sections, a state-room, a smoking apartment, and toilets for ladies and gentlemen. In some instances, however, there are cars containing sixteen sections, the state-room being omitted. Every valuable device is embodied in their construction.

The Lake Shore operates a most perfect sleeping car service between the cities of Chicago, Cleveland, Buffalo, New York and Boston in connection with the New York Central and Boston & Albany Railways. This is not only the direct, best and only double track route between the cities mentioned, but the Lake Shore is the only line from Chicago conveying passengers into New York City without a ferry transfer.***

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by Spencer Trask & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Feb 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	113	115
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	101	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	101	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	101	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	100	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102½	.....
" " " Debenture	1891	200,000	M. & N.	6	1901	112	.....
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	112	115
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	110	115

BALTIMORE STOCKS AND BONDS.—Corrected by Hambleton & Co., Bankers, 9 South Street, Baltimore, Md., Feb. 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	1,000,000	Quart.	3	.....	80	90
City & Suburban Ry. Co	50	3,000,000	.....	1	.....	30	33
Central Pass. Ry. Co	50	300,000	.....	...	.....	60	65
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	15	15¼

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort	1892	500,000	.....	5	.....	109	109½
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	105	105½
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	108	109
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D.	5	1942	101½	102
" " "	1891	1,250,000	M. & S.	6	1901	104½	105
City Pass. R. R. Co	1891	2,000,000	"	5	1911	111	111½

BOSTON STOCKS.—Corrected by R. L. Day & Co., 40 Water Street, Members of Boston Stock Exchange. Feb. 19. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,406,000	J. & J.	4	1887	76	77
West End Com'n	50	9,085,000	J. & J.	3	1890–1892	44⅓	44⅔

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. Staples & Co., 215 Montague Street, Brooklyn, Feb. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broooklyn City R. R. Co	10	6,000,000	Q.—J.	2	.....	162½	163½
Brooklyn Traction Co., pref	100	3,000,000	.....	...	1893	.....	.....
" " common	100	6,000,000	.....	...	1893	.....	.....
Coney Island & Brooklyn R. R. Co	100	500,000	Oct. 1.	4	.....	.....	.....
Long Island Traction Co	100	30,000,000			1893	17	18

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	.....	102
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	.....	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	104	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st	.....	3,000,000	J. & J.	5	July, 1916	107	109

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. Kaufman Charleston, S. C., Feb. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	0	.....	.....	70
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	6

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by William B. Wrenn, 167 Dearborn Street, Chicago, Ill., Feb. 21.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	300	315
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	226½	228
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	135	136

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	100	.....
Chicago Passenger	1883	400,000	F. & A.	6	1903	102	.....
North Chicago City, 1st mort	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	98	99½
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	102	.....
West Chicago Street	.....	4,100,000	M. & N.	5	.....	101¾	102
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	.....	98
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	102½	103

CINCINNATI STOCKS AND BONDS.—Corrected by Geo. Eustis & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Feb. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,750,000	Q.—J.	5	.....	105½	106
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	107½	110
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	60	65
" " " Pref.	100	100,000	.....	6	.....	95	100
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	-	.....	19	20½

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1894	100	.....
" "	.....	50,000	J. & J.	7	July, 1895	101½	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	99	100¼
	.....	150,000	J. & J.	5	.....	101	103
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	111½	112½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104¼	105
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	105	109
" " " "	.....	300,000	J. & J.	6	Jan. 1914	101	101½
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	.....
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	112½	115
S.Cov.& Cin. 2d Mort.gold 6's	.....	250,000	J. & J.	...	1932	112½	115

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. Hayes & Sons, Bankers, Cleveland, O., Feb 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co.	100	12,000,000	.....	....	1893	50	51
The Cleveland City Ry. Co	100	8,000,000	.....	....	1893	55	57

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	101	102½
" " City " "	1893	2,349,000	.....				

DETROIT STOCKS.—Corrected by CAMERON CURRIE & Co., Bankers and Brokers, 82 Griswold Street, Detroit, Feb. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. Feb. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	200	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	100	125

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Feb. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	84	85
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	33	34

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	98	98½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	114	115
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	114	115
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Feb 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$400,000	J. & J.	4	.....	50	55
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	.....	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Aug. 1, 1894	104	.....
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Feb. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.	100	1,200,000	Quart.	1½	1867	131⅛	136½
Crescent City R. Co.....	100	1,150,000	"	1½	.866	.....	87½
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	39¾	41
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	108	120
Orleans R. R. Co.....	50	185,000	"	2	1868	.....	60
St. Charles Street R. R. Co ..	50	600,000	"	2½	1865	59	62½

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	.....	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	100	.....
do do new	1886	40,000	M & N	6	1896	100	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	112¾	116¼
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	96	.....
St. Charles Street R. R. Co...	1881	120,000	J & D	6	'92-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, Feb, 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$2,000,000	M. & N.	4	May, '91.	167	169

BONDS.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....

NEW YORK STOCKS AND BONDS.—Corrected by JAMES MCGOVERN & Co., 6 Wall St., New York, Feb. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	.....	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	185	.....
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	140	145
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	135	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	123	126
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4	.....	.....	298
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	40	50
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	.....	236
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	118	120
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	190	200
Third Avenue.....	100	5,000,000	Q.—M.	4	.....	170	175
23d St.....	100	600,000	Q.—F.	2½	.....	.....	290
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	134	140
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	108	.....
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	104	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	103	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	103	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	97	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	115	.....
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	100	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	96	97
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	.....	57
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	104	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	.....	102
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	.....	111
23d St.....	.....	250,000	M. & N.	7	May, 1893	100	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	103

PHILADELPHIA SECURITIES.—Corrected by HUHN & GLENDINNING, 143 South Fourth st. (Bullitt Building), Philadelphia, Feb. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	265	270
Continental.....	50	1,000,000	J.—J.	6	1873	126	130
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	330	335
Germantown.....	50	1,500,000	Q.—J.	2¾	1858	110	112
Green & Coates...	50	500,000	Q.—J.	3	1868	121	125
Hestonville...	50	2,050,000	.....	...	1859	33	38
Lombard & South.....	25	500,000	A.—O.	8	1861	90	90
People's Traction Co.....	50	10,000,000	.....	...	.....	28½	29
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	152	153
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	76½	79
Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	93	94
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	225	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	206	210
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	223	225
Union.....	50	1,250,000	J.—J.	9½	1864	195	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	100½	101
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	101	102
Baltimore Traction.....	25	5,000,000	.....	1	1889	15⅝	15¾
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	40	55
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	13¼	14½

BONDS.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	108	109
" " Imp.	1892	1,250,000	M.—S.	6	1901	104½	105
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100	101
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Feb. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	**Date of Issue**	**Am't Out-stand-ing.**	**Inter'st Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr. 306 Times Bldg., Pittsburgh, Pa., Feb. 17. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	...	.....	19½	20
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	58¼	58½
Pitts. & Birmingham R. R. Co	.....	3,000,000	.....	...	.....	13 1/16	13¼
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	55	57
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	18	19
Pittsburgh, Allegheny & Man	.....	3,000,000	.....	1¾	.....	37	37¼
West End R. R. Co.	50	200,000	J. & J.	...	.....	.....	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	.....	3,000,000	.....	...	.....	22	22¾
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O.	5	1927	109½	110
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	105	107
Pitts. & Birmingham Traction Co.	1892	.....	.....	5	.....	94½	95
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	103½	104
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	98½	99
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	101	103
Central Traction Co.	1889	375,000	J. & J.	5	1919	101½	103
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1922	100	102
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	95
Suburban Rapid Transit.	.....	.....	.....	...	.....	96	100
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incl'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS, Bankers, Providence, Feb. 17.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	..	.....
BONDS.	**Date of Issue**	**Amo'nt Out-stand'g**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	95	100
Newport St. Ry. Co.	.....	50,000	.....	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Jan. 18.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	24	30
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	40	44
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	20	25
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	23	25
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	.....	80
do do Common.	100	4,000,000	.....	...	1892	13	20
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	.....	90
do do Common.	100	3,000,000	.....	...	1892	20	30
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	35	40
BONDS.	**Date of Issue**	**Amount Out standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid**	**Ask'd**
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	88	95
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	95	99
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	89	90
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	85	90
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	85	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Feb. 13.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	5	.....	99½	100⅛
Geary St., Park & Ocean R.R. Co	100	1,000,000	.....	1	.....	.....	100
Market Street Cable Co.	.....	17,892,000	.....	...	.....	39¾	40
Metropolitan Electric	.....	.....	.....	...	.....	.....	30
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	.....	20
Sutter St. R. R. Co.	.....	.....	.....	...	.....	.....	90
Bonds.	**Date of Issue**	**Am't Out-stand-ing.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Cal. St. Cable R. R.	.....	.....	.....	5	.....	102½	.....
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	104	104¾
Geary St., Park & Ocean	.....	.....	.....	...	.....	100⅝	.....
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	.....	119¾
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	113½	.....
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	.....	115
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	95	101
Powell Street R. R.	.....	700,000	M. & S.	6	1912	.....	118
Sutter St. Cable Co.	.....	.....	.....	...	.....	102½	103

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., Feb. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	50	60
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue	100	112,000	Dec. '88	2	1885	125	150
Lindell	100	2,500,000	.....	...	1890	72½	74
Missouri.	100	2,000,000	Q.—J.	2	1891	180	200
People's.	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis.	100	2,000,000	J. & J.	3½	1890	155	160
Fourth Street & Arsenal.	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	.....	...	1890	150	200
St. Louis & Suburban	100	2,500,000	.....	...	1891	30	40
Southern, Pfd.	.....	800,000	.....	...	.....	90	92
" Com.	.....	700,000	.....	...	.....	82	85
BONDS.	**Date of Issue**	**Amount Out-stand-ing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	96	98
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	102	103
Fourth St. & Arsenal.	1888	50,000	J. & J.	6	1898-1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895-1910	100	100
Missouri Cable	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	98	100
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable	1889	800,000	J. & J.	6	1889-1914	90	95
St. Louis Cable	1890	1,500,000	M. & N.	5	1900-1910	100	102
Union Depot	1890	4,000,000	A. & O.	6	1900-1910	104	105
Southern	1884	200,000	M. & N.	6	1904	100	102
Southern	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban	1891	1,400,000	F. & A.	5	1921	95	97
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	70	75

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Feb. 17. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	260	300
Metropolitan R. R.	50	750,000	Q. J.	2	1864	85	95
Columbia R. R.	50	400,000	Q. M.	1	1870	55	65
Capitol & North O St. R. R.	50	500,000	Q. J.	...	1875	18	.....
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	15	.....
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	.....
Rock Creek R. R.	100	401,700	.....	...	.....	.....	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Inter-est Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Wash'ton & Geo'town conv't.	'83-'91	3,000,000	J. & J.	6	1899-1929	125	150
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	.....	100
Capitol & North O St. R. R.	1921	240,000	J. & J.	6	1921	85	93
Metropolitan R. R. convert.	1901	200,000	J. & J.	5	1901	101	105
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

Financial.

THE annual report of the Winchester Avenue Street Railway Company, of New Haven, Conn., showed total receipts for the year $190,880.

$ $ $

THE Columbus (O.) Street Railway Company reports as follows as to its operations for January: Gross earnings, 1894, $42,193.36; 1893, $38,198.29; increase, $3,995.07. Operating expenses, 1894, $22,678.34; 1893, $28,769.66; decrease, $6,091.32. Net earnings, 1894, $19,515.02; 1893, $9,428.63; increase, $10,086.39.



Snow Sweeper with full length cab, the motorman operating same on the inside. Same as built by us for Scranton Traction Co.

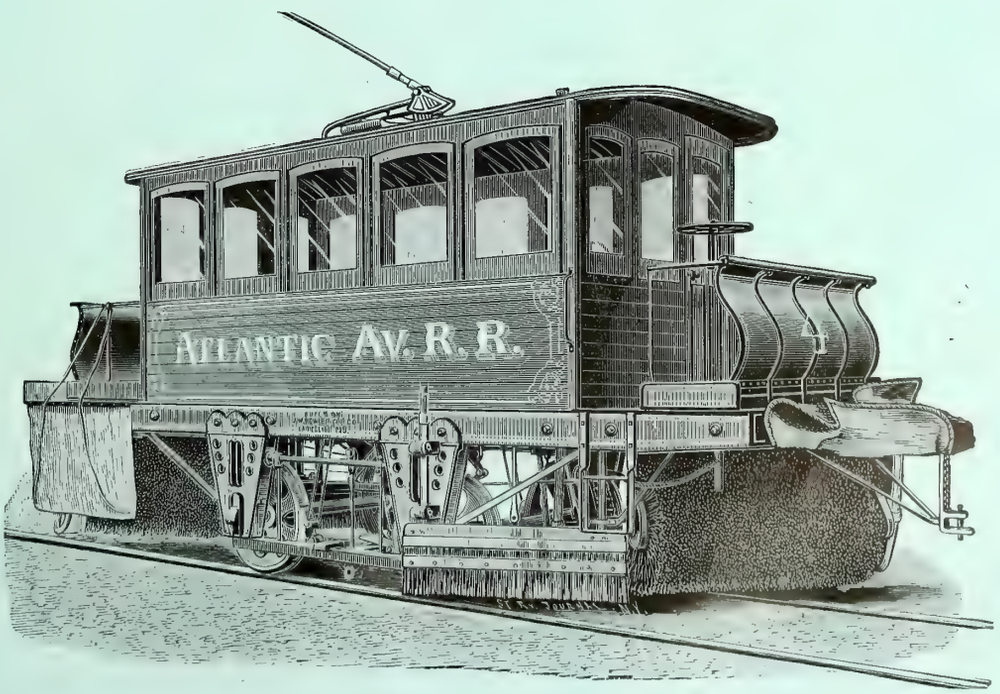
ELECTRIC SNOW SWEEPERS

BUILT BY THE

J. W. FOWLER CAR CO.

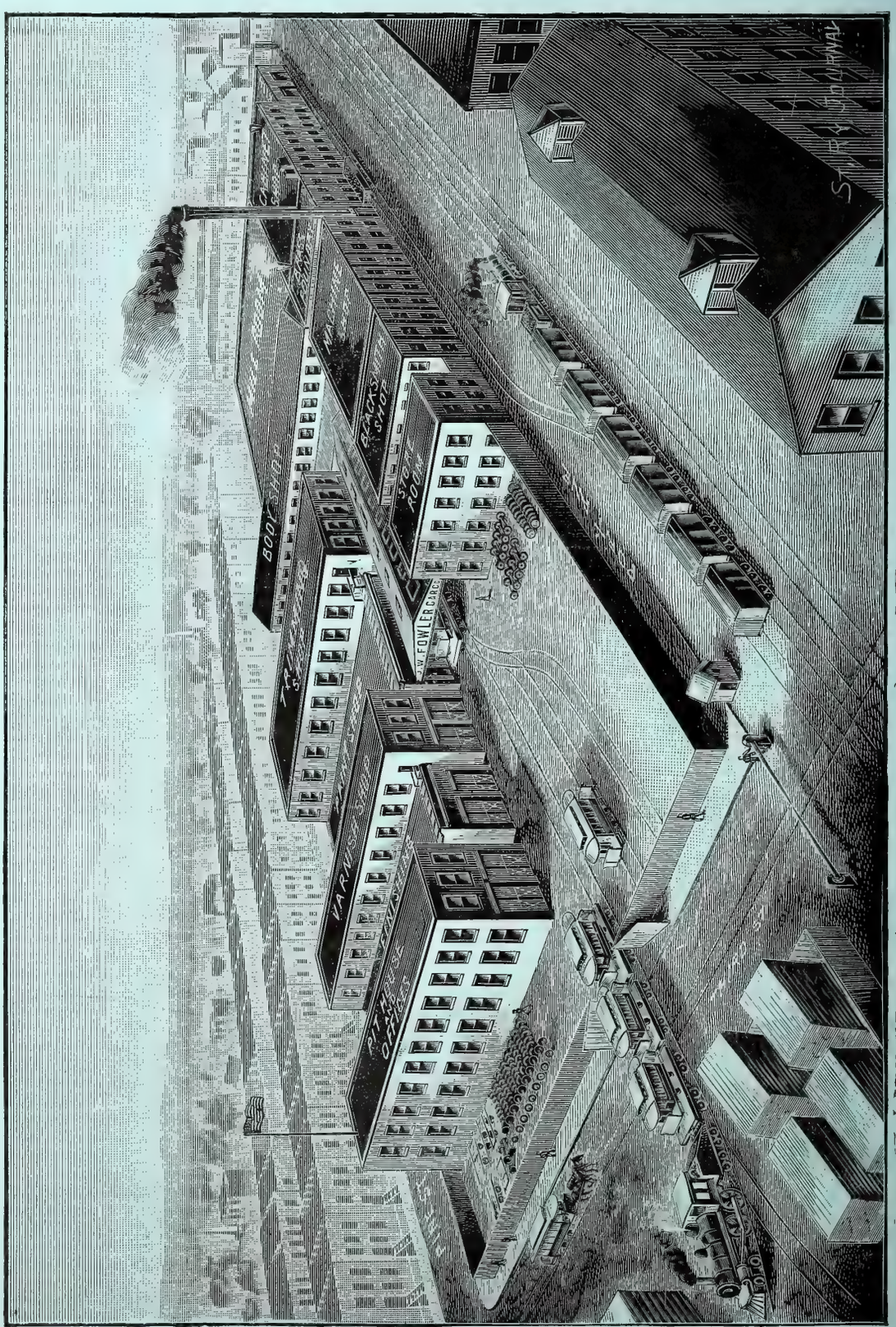
WORKS AND GENERAL OFFICE,
ELIZABETHPORT, N. J.

Electric Snow Sweeper to be operated with the motorman on the platform, motor operating the brooms inside cab. Same as built by us for the Atlantic Ave. R. R. Co., Brooklyn, N. Y.



J. W. FOWLER CAR CO.

BUILDERS OF OPEN AND CLOSED Electric, Cable AND Horse CARS.



WORKS AND GENERAL OFFICE,
ELIZABETHPORT, N. J.
NEW YORK OFFICE, HAVEMEYER BUILDING.

THE Milwaukee (Wis.) Street Railway Company has placed a second mortgage for $1,300,000 on the property, and these bonds go, it is said, into the treasury of the North American Company to pay for claims.

$ $ $

A. D. TITSWORTH, general manager of the Richmond (Ind.) street railway company, has been appointed receiver of the Electric Street Railway Company of that city, and not of a city in another state, as printed in a recent issue.

$ $ $

THE West End Street Railway Company has issued $2,000,000 twenty-year, 4½ per cent. gold bonds to a local syndicate. Receipts for the bonds sold during February at 94 and interest, and one house has sold more than $100,000. The bonds will be dated March 1, 1894.

$ $ $

THE Buffalo (N. Y.) Railway Company submits the following comparative statement of its operations for January: Gross earnings, 1894, $117,881.50; 1893, $101,874.44; increase, $16,007.06. Operating expenses, 1894, $73,373.56; 1893, $75,704.24; decrease, $2,330.68. Net earnings, 1894, $44,507.94; 1893, $26,170.20; increase, $18,337.74.

$ $ $

THE Pittsburgh (Pa.) & Birmingham Traction Company submits the following statement of its operations for January: Gross earnings, 1894, $23,006.70; 1893, $28,143.50; decrease, $5,136.80. Operating expenses, 1894, $11,803.11; 1893, $15,416.70; decrease, $3,613.59. Net earnings, 1894, $11,203.59; 1893, $12,726.80; decrease, $1,523.21.

$ $ $

THE Pittsburgh (Pa.) & Birmingham Traction Company submits the following statement of its operations for December: Gross earnings, 1893, $24,282.49; 1892, $30,425.56; decrease, $6,143.07. Operating expenses, 1893, $13,692.90; 1892, $14,669.01; decrease, $976.11. Net earnings, 1893, $10,589.59; 1892, $15,756.55; decrease, $5,166.96.

$ $ $

THE Denver Consolidated Tramway Company paid January 20 a dividend of 1 per cent. on its capital stock of $3,000,000, making the dividend $30,000. The dividend was for the six months ending December 31. The company has recently restored the service cut off during the panic of last summer, and reports a steady growth of revenue.

$ $ $

THE North Shore Traction Company, of Lynn, Mass., gives the following as a statement of its operations for January: Gross earnings, 1894, $74,206.85; 1893, $70,523.76; increase, $3,683.09. Operating expenses, 1894, $57,511.40. Net earnings, 1894, $16,695.45. We are unable to give the operating expenses for January, 1893, as the various companies now comprising the system were operated separately.

$ $ $

THE report of the Buffalo (N. Y.) Railway Company for the last quarter of 1893 is given: Gross income, $127,797; net income, $34,003; cash on hand, $38,227, and profit and loss (surplus), $345,756. For the same quarter last year the gross income was $106,070; net income, $24,103. The report of the Crosstown Railroad Company, of Buffalo, for the same quarter shows: Gross income, $26,415; net income, $4,726; cash on hand, $6,117; profit and loss (surplus), $56,594.

$ $ $

THE Paterson (N. J.) Railway Company submits the following statements of its operations for the months of December, 1893 and January 1894: December, gross earnings, 1893, $18,220.56; 1892, $22,756.56; decrease, $4,536. Operating expenses, 1893, $13,067.67; 1892, $15,907.80; decrease, $2,840.13. Net earnings, 1893, $5,152.89; 1892, $6,848.76; decrease, $1,695.87. January, gross earnings, 1894, $16,713.75; 1893, $19,243.77; decrease, $2,530.02. Operating expenses, 1894, $12,047.28; 1893, $14,405.52; decrease, $2,358.24. Net earnings 1894, $4,666.47; 1893, $4,838.25; decrease, $171.78.

$ $ $

AT the annual meeting of the shareholders of the London (Ont.) Street Railway Company, held on January 18, the following were elected directors for the ensuing year: H. A. Everett, T. H. Smallman, Greene Pack, E. W. Moore, S. R. Break. The following officers were also elected: H. A. Everett, president; E. W. Moore, vice-president; S. R. Break, secretary-treasurer and general manager. The annual report for 1893 shewed gross earnings to be $52,244.60, being an increase of $13,702.22 over the year 1892. The operating expenses for the same period were $40,686 93, leaving the net revenue $11,557.67, being an increase of $4,175.25 over 1892.

$ $ $

AT a recent meeting of the stockholders of the National Railway of Illinois, a corporation controlling five of the street railways of St. Louis—the St. Louis or Broadway line, Cass Avenue & Fair Grounds, Northern Central, Union, Citizens' or Franklin Avenue, and the Baden & St. Louis lines—the following board of directors was elected: W. T. Baker, E. Buckingham, T. J. Lefens, G. T. Smith, D. G. Hamilton, E. G. Foreman, C. L. Raymond. All are re-elections except Mr. Raymond who succeeds C. L. Hutchinson. The annual report of the president states that traffic was much interfered with by the depression in business and the reconstruction of certain parts of the road, but the policy of retrenchment was pursued. The following statistical statement was made:

Net gain from its properties to which the National Railway Company is entitled, $199,947.27, or 9.0885 per cent., against 10 per cent. for 1892. Of the five roads the total gross receipts have been for 1893, $1,416,817.74, showing a decrease from 1892 of $20,729.47, or 1.4 per cent. Operating expenses, $851,851.06, or 60.12 per cent., a decrease of $23,118.23; net receipts, $564,966.68; fixed charges (interest, taxes and insurance)—showing a decrease of $21,989.91—$309,683.85. Total, $255,282.83.

Trips made in 1893, 877,302; number of car miles, 11 844,031; passengers carried, 28,313,504. Gross receipts of cable lines, $1,035,445.03; gross receipts of horse and electric, $381,372.71; total, $1,416,817.74; decrease of cable, $50,987.91; increase of horse and electric, $30,258.44; net decrease, $20,129.47.

Operating expenses: Cable lines (59.4 per cent.), $607,649.73; horse and electric (64 per cent.), $244,201.33; total current and operating expenses, 1893, 60.13 per cent.; total current and operating expenses, 1892, 60.86 per cent.; decrease, 1893, .0028 per cent.

Mileage, cable lines, 9,368,758; mileage, horse and electric, 2,475,273; total, 11,844,031; decrease of mileage of cable, 425,453; increase of mileage of horse and electric, 322,127.

Cost of operating by cable per car mile, except interest, 7.32 cts.; including interest, 9.34 cts.; cost of operating horse and electricity per car per mile, 11.09 cts.; including interest, 13.11 cts. Cost to carry each passenger: Cable, including interest, 4.12 cts.; horse and electric, 4.25 cts. Passengers carried per car mile run: Cable, 2.257; horse and electric, 3.082. Operating expenses, including all fixed charges: Cable, 82.11 per cent.; horse and electric, 85.05 per cent.

California and the Midwinter Fair.

A more favorable opportunity than the present to visit California will probably never be offered. The rates for excursion tickets, via the Northwestern Line, are the lowest ever made, and, aside from the delightful semi-tropical climate of California, the Midwinter Fair at San Francisco, which is now in the full tide of success, is a most potent attraction to the tourist and pleasure seeker. The trip from Chicago to California is made, via the Northwestern Line, in the marvelously short time of three and a half days. Palace Drawing Room Sleeping Cars leave Chicago daily, and run through without change, and all meals en route are served in dining cars. Daily Tourist Sleeping Car service is also maintained by this line between Chicago and San Fran-

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cisco and Los Angeles, and every Thursday the party is personally conducted by an experienced excursion manager. Completely equipped berths in tourist sleepers are furnished at a cost of only $4 each from Chicago to the Pacific Coast, thus enabling passengers to make the journey in a most comfortable and economical manner. The Northwestern Line has issued a number of illustrated pamphlets descriptive of the Midwinter Fair, and also containing detailed information concerning rates, routes, etc., copies of which will be mailed free upon application to W. A. Thrall, General Passenger and Ticket Agent Chicago & Northwestern Railway, Chicago, Ill., if you mention this publication.⁂

Florida Winters.

The "Clyde Line" is the only line making the trip between New York and Jacksonville without change. Six beautiful, fast steamships, the "Algonquin," "Iroquois," "Cherokee," "Seminole," "Yemassee" and "Delaware" are assigned to this service, and they leave Pier 29, East River, Mondays, Wednesdays and Fridays at 3 P. M. By this line all the dust and annoyances incidental to railroad travel are avoided. A pleasant feature of the trip is the stopping at Charleston, S. C., for half a day. The visit to this "Venice of America" is certain to be amply repaid. The steamships have the most complete modern fittings and accommodations, including elctric light, call bells and elaborate saloons and cabins.

Write the "Clyde Line" for one of their "Facts About Florida," as they take pleasure in furnishing them free of charge.⁂

Of Interest to Travelers.

The Baltimore & Ohio Railroad announces that it has placed on sale round trip tickets at reduced rates to the winter resorts in Florida and the South, and also to such points of interest as Luray, Natural Bridge and Gettysburg. This company has also arranged to place on sale excursion tickets to San Francisco and other points in California, on account of the Mid-Winter Fair, at unusually low rates. Excursion tickets are now on sale to Baltimore and Washington via the famous Royal Blue line.

With its vestibuled train service, via Washington, to Cincinnati, St. Louis and Chicago, the Baltimore & Ohio is in the best of condition to handle Western and Southern travel. That the line is a popular one, is attested by the immense World's Fair business handled this summer.

Those contemplating a trip West or South this winter should write to C. P. Craig, general Eastern passenger agent, 415 Broadway, New York, for rates and other information.⁂

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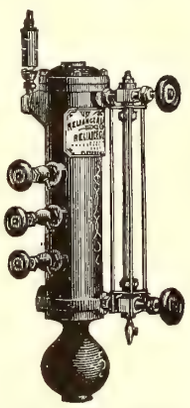
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THE STREET RAILWAY JOURNAL

Vol. X. NEW YORK & CHICAGO, APRIL. No. 4.

APR 6 1894 U.S. PATENT OFFICE

A Modern Car House.

An event of much interest to Pittsburgh railway men was the inspection of the new car house of the Citizens' Traction Company, of that city, on February 22, by the president and directors of that road, together with a few invited guests. The house stands at the intersection of Penn and Franklin Avenues at the terminus of the company's Penn Avenue cable line. The present building, a handsome structure with massive brick walls and interior supports of heavy iron beams and girders, is an enlargement and alteration on a radical scale of the shed that formerly occupied this site.

In the old quarters the storage space was so restricted that there was only room for three cars on the loop under the shed, and the storage and shifting had to be done by men and horses. While this was considered adequate at first, the business rapidly outgrew such slender provisions for service. When the cable cars were first put on, they were run under five minutes' headway; but at the end of one year, the business had so increased that the cars were run at intervals of only one and a half minutes during the busy hours of the day. The result was that with the limited room on the loop in the shed, the management often had to begin ahead and run cars in a waiting line on the street, in order to properly dispatch them on time. All this caused no end of inconvenience to the company, and finally became a source of considerable annoyance to the neighboring residents.

About a year ago the company decided to take steps to relieve the congestion of the street and to provide proper facilities for its increased and increasing business. It was left to J. E. Rugg, the widely known and efficient manager of the line to perfect and submit a plan of alteration suited to all the needs of the case. This he has not only done, but he has brought to bear on the task, as is shown by numerous details, knowledge that could only have been acquired through long years of experience.

The work was begun in April, 1893, and during its progress the operation of the line was continued as usual and, though the cars were often run under one minute headway, not a single trip was missed. In the carrying out of the project and the construction of the building, Mr. Rugg was ably seconded by the company's engineer, William Bradford.

The alterations included the enlargement of the old building by an additional structure, 175 × 101 ft. A part of the old shed was then converted into a housing station and terminus of the Wilkensburg electric division of the Citizens' Traction Company. The old loop was taken up, and a new rope, 400 ft. long, introduced, making a new loop. This enters the building at its west end from Penn Avenue; thence passes through it along the south and east walls to Frankstown Avenue; thence through the street along the north side of the house to Penn Avenue again.

Penn Avenue, at the intersection point, is considerably higher than Frankstown Avenue, and in the readaptation of the building this feature of the location has been ingeniously put to great use. As the cars enter the house from Penn Avenue, the cars drop the rope, and traverse all the loop by gravity. In addition to having a grade, the loop track is elevated, so that the grip does not have

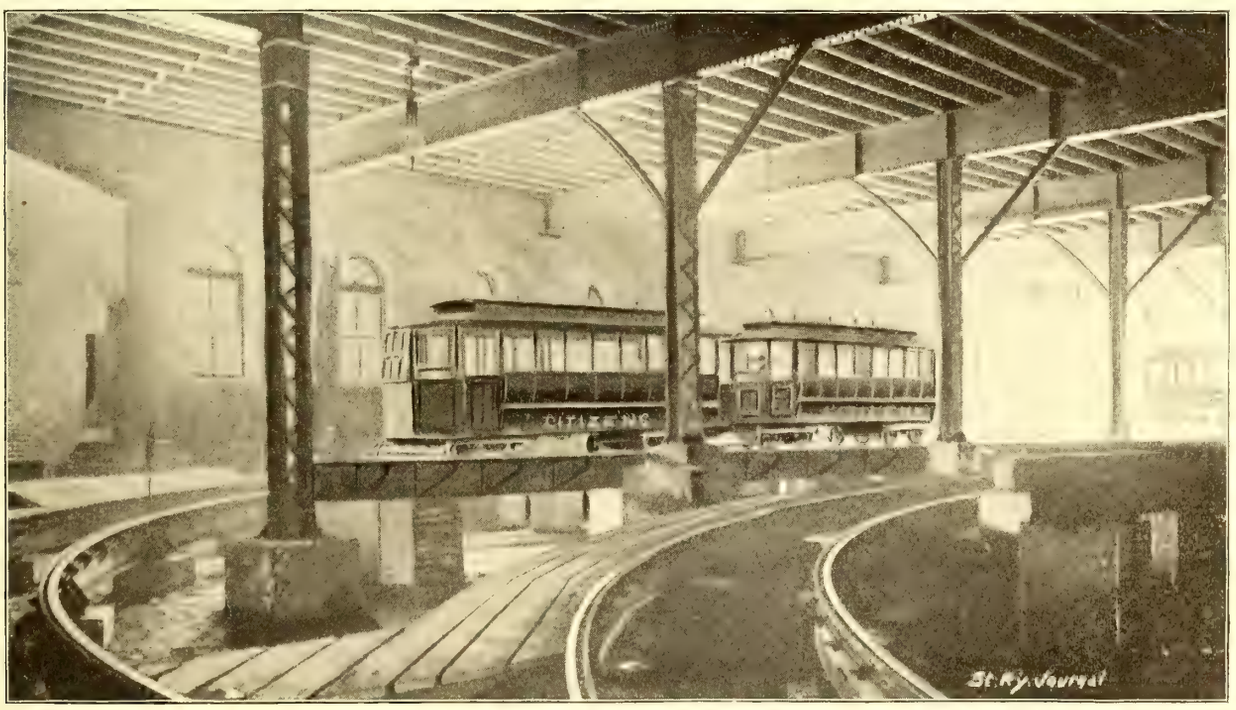
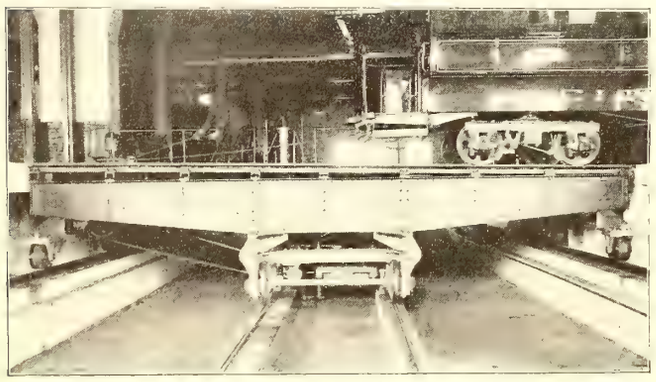


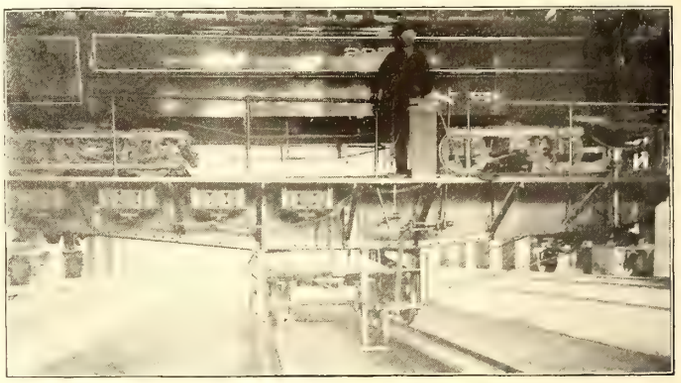
FIG. 1.—INTERIOR OF CAR HOUSE—CITIZENS' TRACTION CO., PITTSBURGH, PA.

to be taken out. (Fig. 1.) An interesting feature of this track is the compounded grade. From Penn Avenue to the curve of 48 degs. radius, shown in the engraving, the grade is 2 per cent.; at the curve, 3 per cent., and as the track leaves the building it falls to 0.6 per cent.

If it be intended to take the car out of service, as it enters the building it is shunted on to the switching track. As this track is slotted, and elevated above the floor of the house with a grade, the car runs by gravity on to the electric shifter, without the grip being taken up. The men. In the present arrangement there is employed one pitman to examine grips and do necessary cleaning, and one man has charge of the electric shifter and heating boiler. As a matter of time, the car can be taken off the cable connection on the street and put in proper place on the storage tracks in one minute. If in proper order of sequence, it can be put out for service in thirty seconds.

The building is thoroughly heated throughout, and steam pipes run under all storage tracks which are high





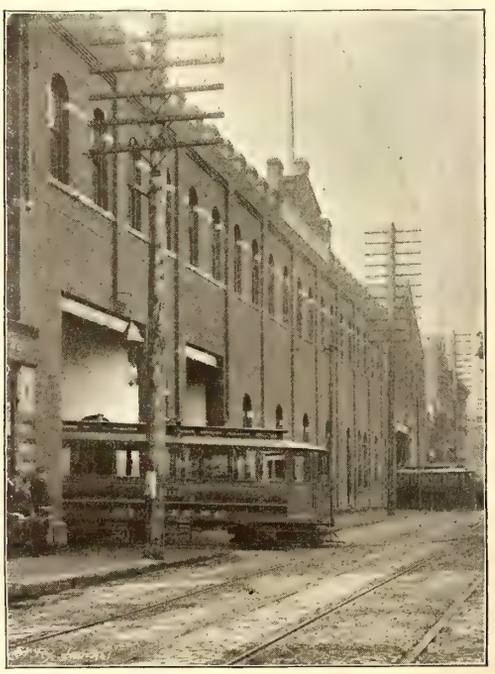
FIGS. 2 AND 3.—ELECTRIC TRANSFER TABLE—CAR HOUSE OF CITIZENS' TRACTION CO., PITTSBURGH, PA.

tracks on the transfer table of this shifter are about five feet above the rail on which the shifter works, and match, in grade and elevation, the storage tracks. When the shifter moves to a given position, the car runs off and to its place by gravity, and without taking up the grip. The shifter is designed to operate on a curve.

For bringing the car back on to the shifter, up the slight incline of the tracks, there is a little capstan on the transfer table. A rope with a hook, as shown in the engraving, is fastened to the car, and two or three turns enough to allow an inspector to examine the cars on them. There are no conduits in the building. All tracks are elevated and all inclined.

Other features of the house are a fireproof oil room and an admirably arranged office shown in Fig. 6. In this is a large box for receiving envelopes and reports, directly in front of the dispatcher. Beneath it is the cash drawer. Right behind the dispatcher is the telephone; on his left hand various drawers and cases of pigeon holes, while at the end of the office is the safe. Looking





FIGS. 4 AND 5.—VIEWS ON PENN AND FRANKLIN AVENUES—CAR HOUSE OF CITIZENS' TRACTION CO., PITTSBURGH. PA.

taken around the capstan; a man takes up the slack, and the car is pulled into position. To dispatch the car on to the line, the shifter is brought back to the switching track, and the car runs to its place on the loop by gravity, and without taking up the grip.

The advantages afforded by the ingenious substitution of gravity for power, and by elevated tracks leaving the grip untouched from the moment it enters the house until it leaves it, are obvious, both for economy of time and money. As compared with the method followed in the old shed, it means a saving of three horses and four through one window, the dispatcher can see down the street several hundred feet; without moving from his place he can see the tracks in the house through another. Behind the office is a room for the division superintendent, with every convenience, including provision for sleeping during storms or unusual service. Back of this is a large toilet, and at one side a room especially devoted to accident reports, so that the men can make them out calmly and without diversion of attention.

On the second story are large paint and repair shops lighted with monitor roofs, also a large forge, storage

rooms and additional storage tracks. The total storage capacity of the building is for 100 cars. The cars are taken to the second story by an electric lift elevator. The current for the electric lighting and all power purposes comes from the company's electric power house, more than two miles away. For dispatching, nine cars can stand on the loop in the house and four on the switching track, counting one on the shifter in line with it, thus making thirteen cars ready for service.

Throughout, the building is as orderly and clean as a well kept hotel. In convenient places waste barrels and

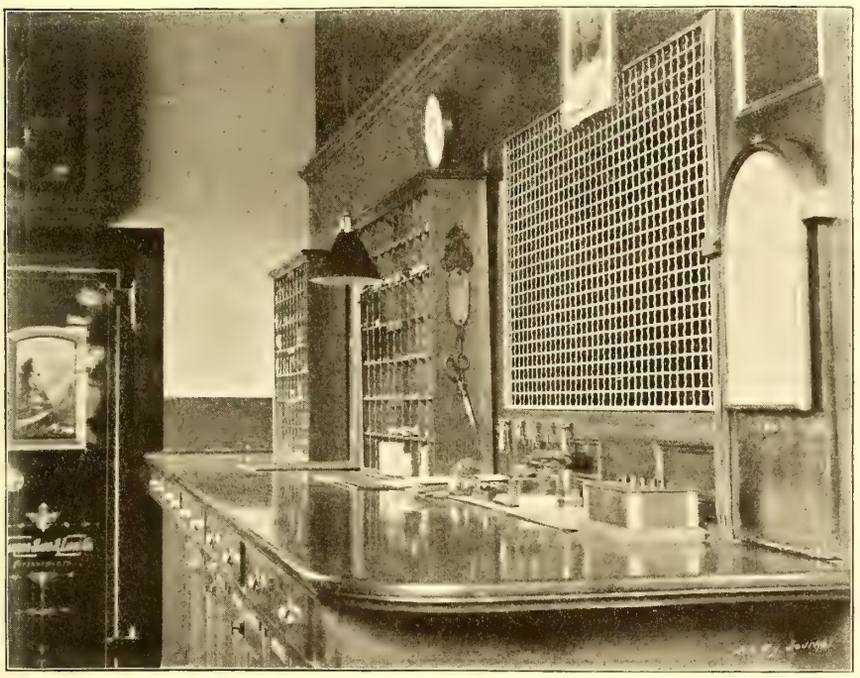


FIG. 6.—OFFICE OF DISPATCHER—CAR HOUSE OF CITIZENS' TRACTION CO., PITTSBURGH, PA.

cans for paper, oil rags, etc., are scattered through the house; and Mr. Rugg says that he is meeting with an encouraging use of them by the men.

Not the least of the excellent features, that strike a visitor to this house, are the provisions for the comfort of employes, coupled with a wise discipline. A lobby 29 × 19 ft., well heated and admirably lighted, is furnished the conductors and gripmen on the Frankstown Avenue side of the building. It is provided with an ample number of comfortable seats and connected with the office by electric calls. Out of it on one side opens a well kept lavatory, and on the other a coat room, 28 × 19 ft. In this each man has a separate locker, and each locker is provided with a wire door to let in light and heat on damp clothing. In the accident room previously referred to, a large shelf is provided, where the families of the employes can leave lunch or dinner pails. In speaking of this arrangement Mr. Rugg used these significant words: "We show the men that we respect them by doing this for them. Now, we expect them to respect themselves and show it by doing their duty to us."

The visiting party, consisting of John G. Holmes, president, H. L A. Stewart, C. L. Magee, James J. Donnell, John B. Jackson, directors, and George Wilson, solicitor of the company and a representative of the Street Railway Journal, expressed great satisfaction with the building and its arrangement.

The Pennsylvania Traction Company proposes to build an electric line from Philadelphia to Harrisburg. This, with the line between Baltimore and Washington already started upon, and that between Philadelphia and Jersey City well under way, seems to indicate that the application of electric power to long distance transportation is fast approaching.

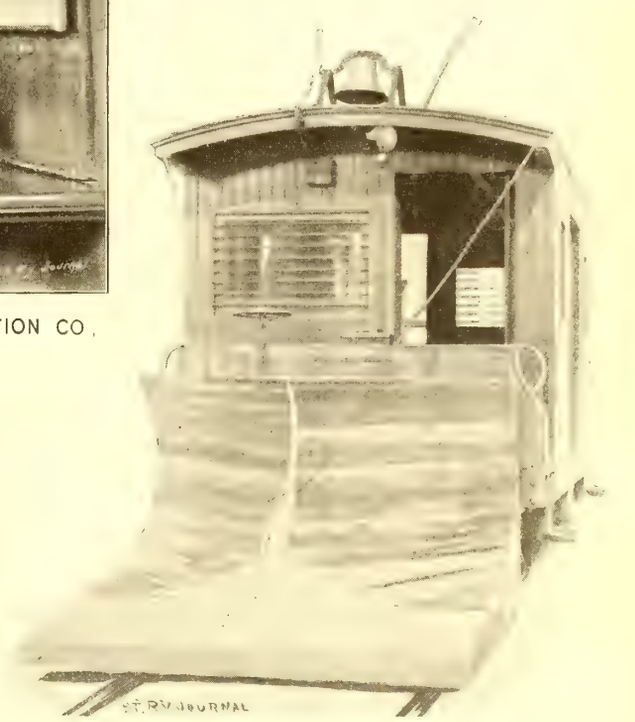
Superintendent George Coykendall, of the Kingston (N. Y.) Electric Railway, has invented a new fender which is being tried on the cars of that road.

A Snow Plow for Heavy Drifts.

We published in a recent issue of the Street Railway Journal a description of the electric locomotive of the Mousam River Railway Company of Sanford, Me., This locomotive weighs over ten tons, and has been found most convenient during the last winter for clearing heavy drifts from the track. The snow plow shown in the engraving on this page was used. With plenty of power and at full speed it was found that the car had no difficulty in throwing the snow, if not damp, a distance of seven feet from each side of the track.

February was the most severe month last winter for snow on this road, but in spite of the cold weather, business was carried on as usual. During the year ending March 1, 1894, over 38,000,000 lbs. of freight and 124,000 passengers were hauled on this line without the loss of an armature spool or diverter, or any other trouble, such as short circuits, grounds, etc. This is an excellent method, and speaks well for the care and management of Superintendent Day.

The results of operating a freight business on this railway have been so



ELECTRIC LOCOMOTIVE AND SNOW PLOW—SANFORD, ME.

satisfactory as to encourage other roads, so situated that a freight traffic is possible, to adopt a similar course.

Traffic of the Liverpool Elevated Railroad.

The result of the first complete half-year's working of the Liverpool Overhead Electric Railway, according to the London *Engineer*, has been that it carried 2,475,639 passengers, and ran 46,429 trains, of which 95.35 per cent. were punctual. The receipts amount to £18,518 4*s.* 7*d.*, and the working expenses to £13,732 11*s.* 2*d.*, or 74.15 per cent., a high proportion compared with the working expenses of other railways, but being only slightly over the working expenses of the South London Electrical Railway, the cost per mile of the former being 1*s.* 1½*d.*, and of the latter, 1*s.* 0⅜*d.* The amount available for dividend was £5,452, out of which dividends were declared of 5 per cent. on the preferred, 1 per cent. on the common stock, and £2,598 7*s.* 1*d.* carried forward to next half-year's account.

Electric Motors for the Erie Canal.

Frank W. Hawley, vice-president of the Cataract General Electric Company, secured March 11 from Superintendent Edward Hannan of the New York State Department of Public Works a fifty year permit for his electric company to put in some kind of an electric plant along the lines of the state canals by which boats may be operated by electricity.

The permit authorizes the company to enter upon all canal lands of the state for the purpose of constructing on or over or under either canal bank a system for propelling canal boats with electricity, without interfering with the present mode of operation. Central power houses may be erected. The rates for towage shall be subject to modification and review by the State Superintendent of Public Works, but such rate shall not exceed $20 an electrical horse power for any season of navigation. An important provision is that the company may, so long as the wants of the canal are supplied, employ its electric plant along the line of the canal in furnishing electric light, heat and power for distribution to any point or points beyond the line of the canal, and may thus furnish electricity for lighting and power purposes in all of the cities and villages along the canal. The company must furnish to the state, free of charge, sufficient power to operate motors to open all gateways leading to and from locks, and also electric lights sufficient properly to illuminate such locks at night. The company must have its plant in operation on the Erie Canal between Buffalo and Albany within three years from date, or forfeit the privileges accorded by the permit.

The permit has not yet been formally accepted by the company.

The directors and officers of the Cataract General Electric Company are: President William Mertens, of Von Hoffman & Company, bankers, of New York; vice-president, Frank W. Hawley; secretary and treasurer, Charlton T. Lewis, counsel for the Mutual Life Insurance Company, of New York City; Thomas C. Platt and ex-Senator Commodore P. Vedder.

There is another company, having the same directors as the Cataract Company, called the Erie Electric Towing & Power Company, with its principal office in New York City. This company will construct and put in operation as soon as possible a half-dozen tugboats operated by electricity, either on the storage or trolley system, with a view to showing the adaptability of electricity to canal navigation. These tugboats will also tow for a moderate consideration any horse boats, the captains of which desire to avail themselves of such method of navigation.

These two companies are subsidiaries of the Niagara Power Company. The principal stockholders of the latter company are: J. Pierpont Morgan, William K. Vanderbilt, D. O. Mills, Morris K. Jesup, Isaac N. Seligman, H. McK. Twombly, Brown Brothers, August Belmont and an English syndicate represented by Vermilye & Company, bankers, of New York City.

The Electric Railway System of Wheeling, W. Va.

Among the electric railways which have been installed in different sections of the country, that at Wheeling, W. Va., deserves mention for its excellent plant and the success which has attended its operation. This railway, situated close to extensive coal fields was in an excellent position to install electric power, and the results attained have been most satisfactory. The power station shown in Fig. 1 is a handsome brick structure with stone trimmings, on 42d Street, and measures 99 × 84 ft. The architect was M. F. Geisy, and the builders were Murray Brothers. The stack is octagonal in section, 125 ft. in height and fourteen feet in diameter at the base. The top is surmounted by an ornamental crown.

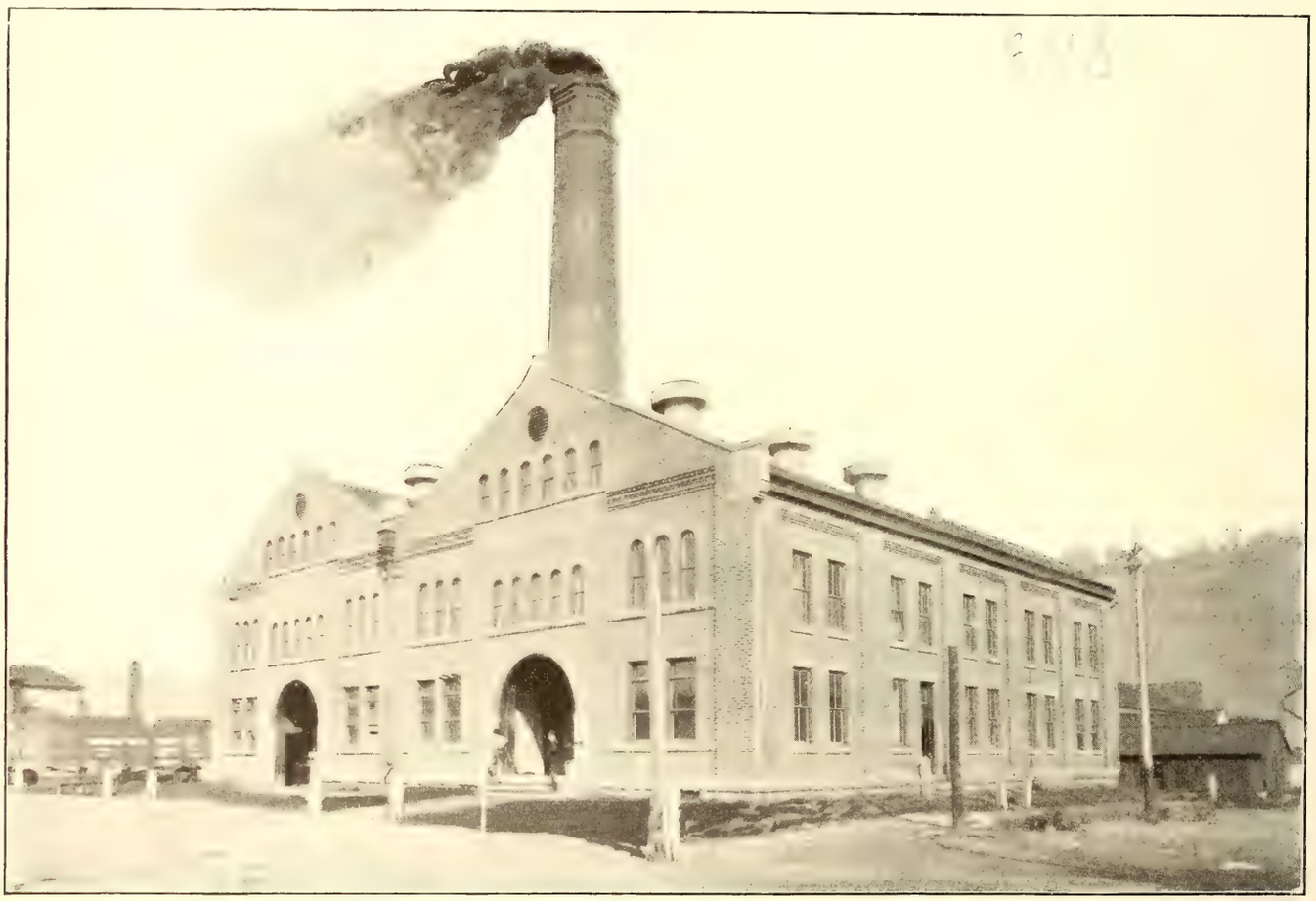


FIG. 1.—POWER STATION—WHEELING ELECTRIC RAILWAY.

The steam generating equipment consists of Abendroth & Root water tube boilers, shown in Fig. 3, and equipped with McClave grates. Abendroth & Root steam gauges, Stratton separators and Korting injectors are used. The piping is covered with magnesia sectional covering, and Jenkins valves are employed. The pumps were manufactured by the Titusville Pump Company.

A view of the engine room is presented in Fig. 2. The engine equipment consists of three Ball automatic, cross compound engines, of 250 H. P. each, with cylinder dimensions fifteen and twenty-five inches by fourteen inches. These are directly belted to one Westinghouse 270 H. P. and four General Electric M. P., 100 H. P. generators. The belts used were supplied by the Chas. Munson Belting Company and Gratton and Knight. The switchboard is located in the rear of the generators, on a raised platform, and is some distance from the wall, giving access to all connections. It is of the standard General Electric paneled type, equipped with all necessary ammeters, circuit breakers, switches, etc. A Yale & Towne traveling crane, which extends entirely across the room, completes the equipment of this portion of the station. The room is well lighted and ventilated by many windows.

The mileage of this company consists of two miles of single track and seven of double, or an equivalent of sixteen miles of single track. The maximum grade is 9 per cent., and the radii of the curves vary from forty to seventy-five feet. The track is laid principally with Johnson girder rails of from seventy-eight to eighty-five pounds in weight. Some fifty-two pound rails are also employed, and are laid with four inch bulb chairs. The ties are of white oak 6 × 8 ins. × 8 ft., and the rails are connected at the joints by six bolt fishplates. The paving is of vitrified brick. The return circuit is made by bonding the rails with riveted bonds of No. 0 wire, and also connecting to the water pipes. The trolley wire is No. 0 wire, and the feed wire No. 0000 and No. 00. The poles are octagonal and of wood, and were supplied by the Cleveland Cedar Company. General Electric and the Railway Equipment Company's line appliances are used in the overhead line.

We present in Figs. 4 and 5 two views of the car house. This is a handsome brick building, with a slate roof, and has a capacity sufficient for a very large number of cars. It measures 68 × 270 ft., and contains five tracks over pits 160 ft. in length. The appointments are very complete.

The rolling stock consists of twenty-five sixteen and eighteen foot motor cars, supplied by the J. G. Brill Company and the St. Louis Car Company, with nine trail cars of the St. Louis Car Company's make. The trucks used are of the Brill and McGuire types, and carry General Electric W. P. 30 motors. Lewis & Fowler and Meaker registers are used. The equipment of the road also includes one Walkaway snow plow and one tower wagon, made by the Toledo Wagon Company.

The repair shops of the company are equipped with a fourteen foot, thirty-three inch swinging-lathe, a shaper with twenty inch stroke, a thirty-six inch radial drill

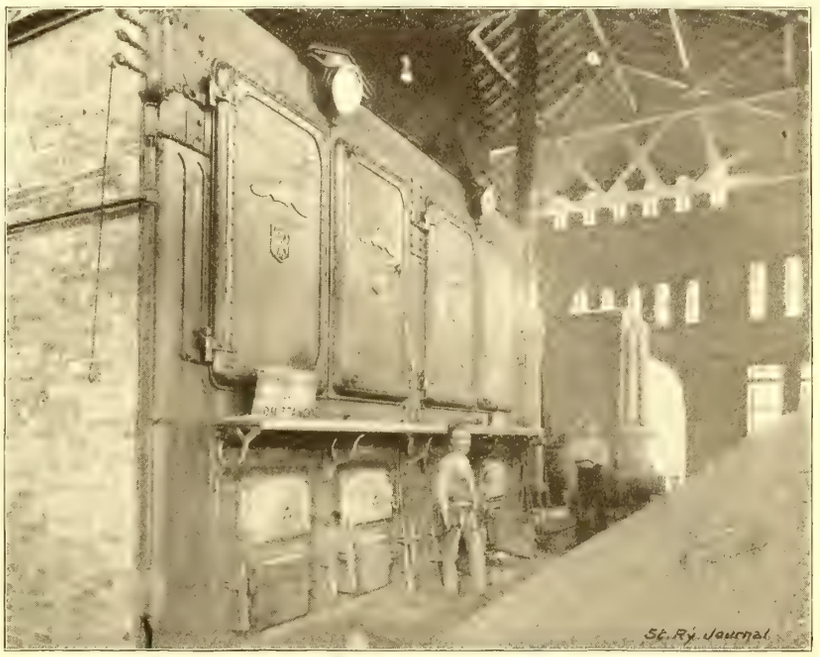


FIG. 3.—BOILER ROOM—WHEELING ELECTRIC RAILWAY STATION.

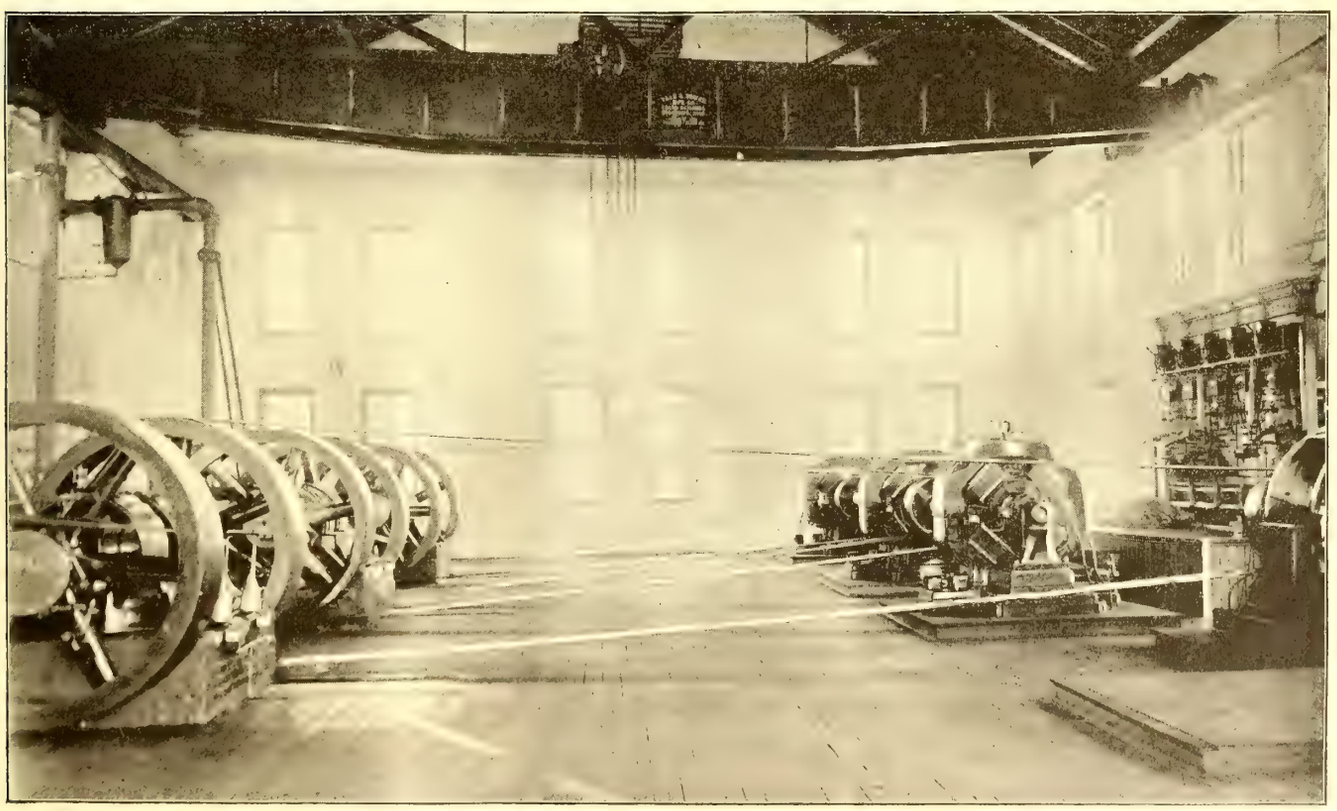


FIG 2.—INTERIOR OF ENGINE ROOM—WHEELING ELECTRIC RAILWAY STATION.

press, single spindle band and circular saw, wheel press, etc.

The company's capital stock consists of $700,000 authorized and issued, and its bonded indebtedness of $500,000 first mortgage, 6 per cent. bonds.

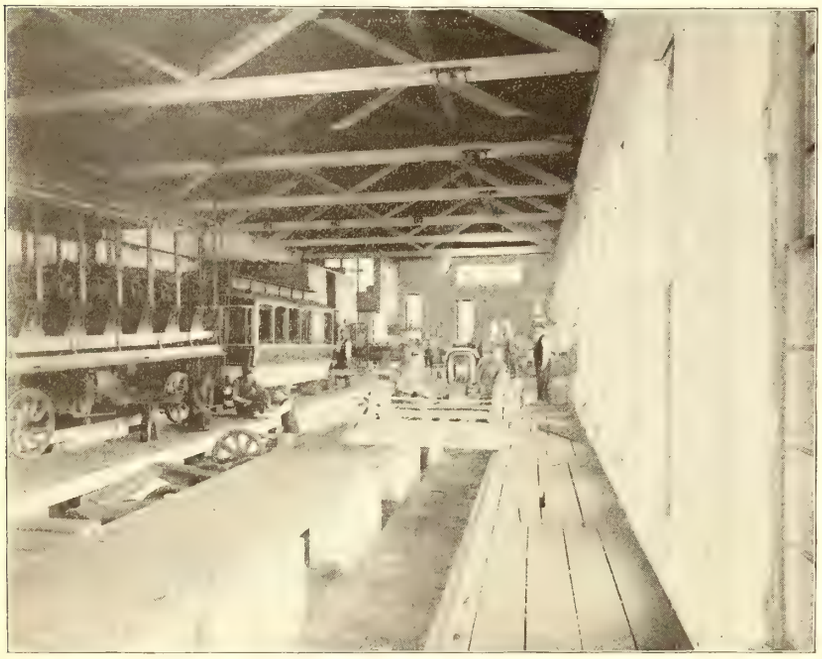


FIG. 4.—INTERIOR OF CAR HOUSE SHOWING REPAIRING DEPARTMENT—WHEELING ELECTRIC RAILWAY CO.

The officers of the company are: President, J. Jacob; secretary, W. A. Shirley, and general manager, A. M. Jolly.

New Vertical 600 H. P. Engine.

A new vertical engine of 600 H. P., which possesses a number of novel features, has recently been constructed by the Ball & Wood Company, of Elizabeth, N. J. An inspection of this engine was made by a number of prominent electrical, mechanical and consulting engineers, of New York and vicinity, on March 31, upon invitation of the Ball & Wood Company. The engine attracted a great deal of interest and admiration. It is destined for the Chicago Edison Company.



FIG. 5.—GENERAL VIEW OF CAR HOUSE INTERIOR—WHEELING ELECTRIC RAILWAY CO.

The Silvey Storage Battery Car.

The early history of the storage battery, together with the struggles of its inventors to perfect an economical, durable and reliable cell, are familiar to electricians generally. The repeated failures in this line can be traced largely to the crudeness of design and development of the different battery systems, and also in part to the use of motors designed and constructed for use with the overhead system.

In the year 1890 W. L. Silvey, of Dayton, O., began to make storage batteries after a long series of experiments on different types of batteries, and in the summer of the same year a train of cars on the Big Four Railway was equipped with the Silvey electric light. Twelve cells of battery and ten sixteen candle power, twenty-five volt lamps were used to each car. The light having been operated during a run of 90,000 miles between Cincinnati and Dayton, was so successful that fifty-five cars were similarly equipped on the Chesapeake & Ohio Railroad, and during three years no such thing as a short circuited cell or buckled plate has ever occurred. The relative cost of the oil, Pintsch gas and the Silvey storage battery incandescent light for the year 1893, is shown by the report of Chief Electrician W. S. Greene, of the Chesapeake & Ohio Railroad, just published, to be as follows: Electric light, $17.73 per year per lamp; oil lights, $24.12 per year per lamp, and Pintsch gas light, $29.42 per year per gas burner or tip. The relative candle power of each light was: Oil, ten candle power, gas, eight candle power, and electric light, sixteen candle power.

In the spring of 1893 Mr. Silvey undertook the construction of the storage battery car here described. This car has a sixteen foot car body, built especially for the work by the American Car Company, of St. Louis, provision being made for placing batteries in iron trays, and sliding them under the seats through openings at the end of the car. A McGuire truck is used, with especially heavy axles. Fastened crosswise to the truck frame are two ten pound Carnegie I beams which support the motor.

The motor proper is constructed as follows: Two rings of steel, having numerous wedge shaped pole pieces, are wound with coils of wire, the winding being in such a way as to make a consequential pole out of each projection. These two rings are tied together by rods extending from one to the other, and constitute the field magnets. The armature is composed of a central, non-magnetic spider and rim, around which is wound and securely fastened a ribbon of the best quality of soft iron, until a diameter is produced as large as the field magnet rings. The armature is turned true on each face, and provided with notches for the coils. Each slot is thoroughly insulated by mica troughs, and the armature being very narrow, the coils are completely insulated from each other, rendering a burned out coil a matter of almost absolute impossibility; besides, no bands are required. The armature coils are connected to a multiple bar commutator, as shown in the cuts. By this arrangement a very light motor has been produced.

This motor has an armature ring three and three-quarters inches through, and twenty-four inches in diameter, wound with 2,000 turns of No. 14 B. & S. double insulated wire, weighing about forty pounds. The entire machine, complete, weighs 1,350 lbs., and develops forty horse power. The entire equipment of the motor,

together with all gears, gear cases, etc., weighs less than 2,000 lbs. It will be observed that the motor is placed with its armature shaft at right angles to the car axles, and is geared to both, the proportion being 5 to 1. The motor proper is placed entirely on the frame of the truck, the car axles carrying no weight, except the large bevel gears which are entirely encased and run in oil. A cushioned coupling is employed between the motor shaft and the shaft carrying the small bevel gears, by which the car wheels are free to move in any direction without in any way affecting the other parts; at the same time the gears are always kept in alignment. As an experiment, the truck has been made to ascend a 17½ per cent grade, being stopped and started on this gradient without the use of sand. The entire lower half of the machine is encased in a waterproof case. The upper half of the field magnets are made removable, enabling any ordinary mechanic to rewind a section in the armature in an hour, without removing it from the motor or taking the truck from under the car body. It has been the aim to make every part so simple as to be easily accessible, easy to repair, strong, light and durable.

The aim in the construction of the battery has not been to push the efficiency of the apparatus to the utmost limit, making it very light in weight, but rather to make an apparatus capable of withstanding almost any amount

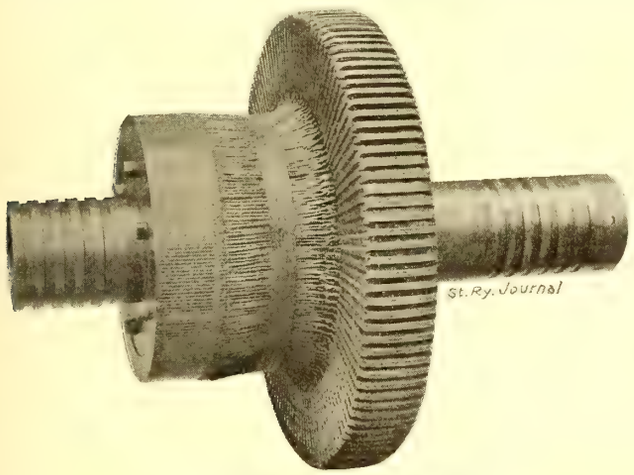


FIG. 1.—ARMATURE—SILVEY MOTOR.

of hard usage. The batteries used have been doing constant service, operating the street car for the last nine months, without trouble from short circuits or buckled plates. Cells having a rated capacity of thirty amperes discharge have frequently been entirely discharged at the rate of 120 amperes, and charged at the rate of 100 amperes without doing any harm. These extreme charges are of frequent occurrence as the batteries are charged in three hours and discharged every three and a half hours. The battery plate proper consists of an inoxidizable, alloyed lead metal grating 5 × 7 ins. and about one-eighth of an inch thick, twenty-one of which constitute a complete battery cell. The perforations in the grid are filled with superficially oxidized particles of metallic lead and oxide of lead, after which they are subjected to a pickling process which hardens the charging material into a firm, coherent mass, and by which it becomes firmly fixed into the holes and forms a surface layer over the entire plate. The plates are clamped together by means of a lead screw passing through the holes, a nut being placed between each plate and firmly screwed down, making a metallic contact, after which they are all welded on the surface. In case it becomes desirable to take the cell apart, it is easily done by removing these nuts, breaking the welded parts. The filling for the battery plates is chemically pure lead which has been found in practice to give a useful working output of about 20 per cent. greater efficiency than is possible with batteries employing a mechanically filled plate of lead oxide alone, which necessarily contains large quantities of impurities.

Between each set of plates there is placed a sheet of a porous separating material, the edges of which are saturated with a preservative compound and which has been treated until it becomes practically indestructible in the electrolyte, and capable of absorbing about fifty times its own weight of the acids used in the battery. The latter, in fact, becomes nearly a dry cell, as there is very little free liquid to become spilled. Should the rubber cell ever become broken, the liquid held in suspension in the separating material is sufficient to operate the car properly during a trip. In order to prevent splashing of the free liquid, the cell is made very deep, and as an additional

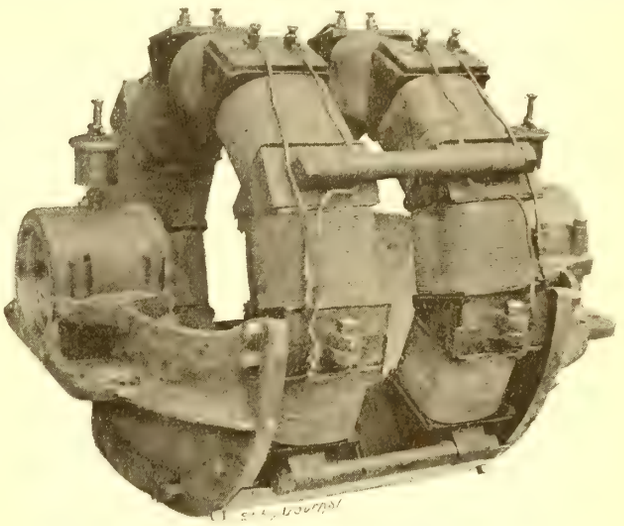


FIG 2.—FIELD—SILVEY MOTOR.

precaution a sort of wooden crate, also shown in Fig. 3, is placed on top of the plates, dividing the interior of the cell into small pockets, preventing the formation of waves incident to a car in rapid motion over an uneven road.

In the operation of the car 108 cells of battery are employed, each cell weighing twenty-seven pounds, making a total weight of batteries of about 3,000 lbs., which practice has demonstrated will in every day service operate the car about thirty miles at each charge running at full

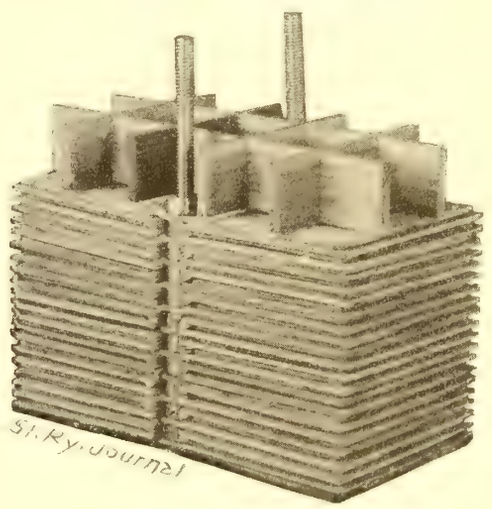


FIG 3.—STORAGE BATTERY PLATES.

speed. In a test run made in November last, the car made a round trip over the Third Street road in Dayton, O., in thirty-five minutes, the distance being nine miles. This included several complete stops besides climbing two hills, each about 1,500 ft. long and 4½ per. cent. grade, crossing sixteen railroad tracks and a bridge 500 ft. long, so that it is evident the car can easily make twenty to twenty-five miles an hour if desired. The car has a controller on each platform containing a reversing switch and three complete changes of electrical circuits, by means of which three speeds of the car are produced. The changes are accomplished entirely by commuting the batteries, no resistance of any description being employed.

The car up to March 21, 1894, had made 6,000 car miles, and neither the batteries nor the motor have required any repairs, except a new set of carbon brushes.

The total expense of every kind has been $2.50, all of which was applied to the trucks. It is claimed that with this system a car can easily be operated at a cost not to exceed eight cents per car mile. The batteries at present are apparently nearly as good as new and good for several thousand miles more before requiring the renewals of the positive plates. By a process on which patents are now pending, the worn out plates are taken and the material worked over so that there is practically no waste whatever. The patentee is now prepared to maintain the positive plates of a battery at three cents per mile, and has found by actual test in building batteries that for every 1,620 miles, at three cents per mile, he can entirely rebuild a set of batteries of 108 cells, or for the two sets required to keep a car in constant use, 3,240 miles at three cents per mile. As these batteries have already made 6,000 miles and are still in good condition, it is evident that there is a wide margin for profit at three cents per mile, and that a car can be easily operated for eight cents per car mile total cost.

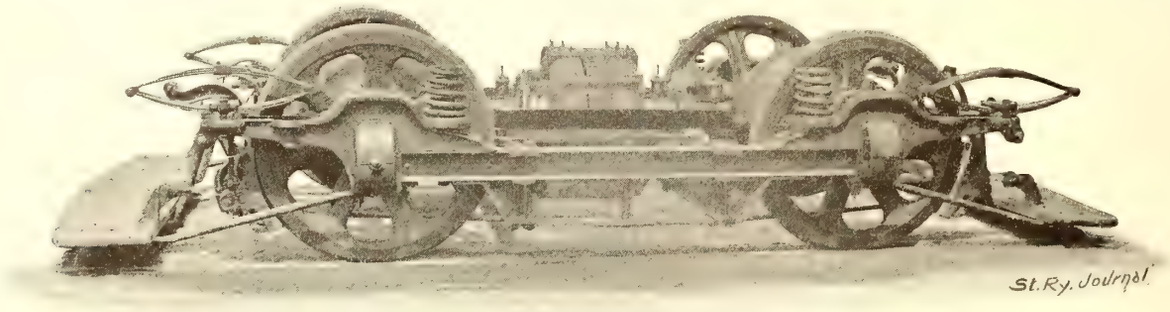


FIG. 4.—MOTOR TRUCK AND EQUIPMENT.



FIG. 5.—INTERIOR OF STORAGE BATTERY CAR.

St. Louis Car House Fire.

The Cardinal Avenue car house of the Laclede Avenue Division of the Missouri Railway Company, at St. Louis, was struck by lightning March 21, and burned to the ground, causing a loss of $100,000, fully covered by insurance. Eleven motors and fifty-three trailers were destroyed.

Possibility of an Underground Trolley in New York City.

The competition for the prize of $50,000 offered last December by the Metropolitan Traction Company, of New York, for a system of street railroad motive power superior to the overhead trolley system, and equally cheap in respect to operating expenses, is likely to result in the substitution of an underground trolley system on some of the company's lines.

Over 3,000 applications for the prize have been received by the company from all parts of the world. Many of the schemes proposed are ludicrous. One inventor proposed to furnish motive power by means of windmills on the top of the cars. Another proposed to utilize the force exerted by the rise and fall of the tides at Sandy Hook, and a third made a proposition to run street railways by harnessing the cars to balloons.

President H. H. Vreeland, of the Traction Company, said last month to a representative of the Street Railway Journal, that the underground trolley system at present in operation in Buda-Pesth, Hungary, was under consideration. This system was introduced five years ago by Siemens & Halske, and an account of the method and results of operation has been published in former issues. Plans have also been submitted by the General Electric Company, the Westinghouse Electric Company and other companies, which are also under consideration.

This company does not propose to change the cable system on Broadway. For thoroughfares where passenger traffic is heavy enough to warrant the outlay required to build cable roads, that system is regarded by the managers of the Traction Company as superior to all others. For this reason the company is at present engaged constructing cable roads on Lexington Avenue and Columbus Avenue, on which roads heavy passenger traffic is expected.

Should a test of the underground trolley prove satisfactory, it will be introduced on all the other lines at present operated by the Traction Company as horse car routes. These roads include, among others, the lines in University Place, Seventh Avenue below Fiftieth Street, Avenue C, Twenty-third Street, Bleecker Street, Fourteenth Street, Forty-second Street, and Sixth and Ninth Avenues.

A bill recently passed by the Legislature giving the Commissioners authority to pass on the merits of the various plans submitted to the Metropolitan Traction Company is now in the hands of Governor Flower awaiting signature.

Battling the Snow in St. Paul.

The heavy falls of snow in St. Paul have compelled the management of the roads in that city to take special means for clearing the tracks of this obstruction. Some new principles have been put into application in this work, and a new type of snow plow has been devised. By this the snow, instead of being brushed to one side, is raised from the track by a series of conveyors somewhat similar in principle to the ordinary bucket conveyor. The blades of this are of five-sixteenths inch steel, measure 24×6 ins, and are riveted to an endless sprocket chain running on rollers. There are altogether sixty-six blades in the front conveyor. The snow is then carried to one side by a side conveyor, and thrown to one side of the car, where it is taken care of by wing plows which clear the roadway of the drifts which would otherwise be piled at the side of the track by the ordinary type of plow.

The snow plow is mounted on two Bemis pivotal trucks, having seven foot six inch wheel bases, and twenty foot pivotal centers.

Car Manufacturing.

The Census Department, Washington, D. C., has just issued an extra bulletin presenting preliminary totals for all classes of manufacturing industries in the United States, as prepared by the Division of Manufacturers. In the line of "cars, general shop construction, and repairs by street railroad companies," appear the following figures: Number of establishments reporting, seventy-eight, representing an aggregate capital of $2,351,162, employing a total number of 2,034 men. Under the heading of "street railway cars, not including operations of railroad companies," seventy one establishments are reported, with a capital of $2,468,351 in the aggregate, and employing 1,873 men.

The Columbia & Donegal Railway.

One of the latest roads in the State of Pennsylvania to be put in operation is the Columbia & Donegal Railway. This company was organized on January 4, 1893, with the following officers: President, Wm. B. Given; treasurer, H. L. Haldeman; secretary, Frank S. Given. The road is a little over five miles in length, and is full of grades, there being hardly a level piece of road from the time the car leaves Columbia until it reaches Marietta. The railway, with that of the Columbia & Ironville Street Railway Passenger Company, is operated by the Columbia Traction Company, which has the same officers as those given above, with F. S. Given as general manager. The route of these two lines is most picturesque, owing to the variety of the scenery, and the beautiful glimpses of the winding Susquehanna and Donegal valleys which it discloses.



FIG. 1.—VIEWS ON THE LINE OF THE COLUMBIA & DONEGAL RAILWAY—COLUMBIA, PA.

To add to the other attractions, the company owns on the line of route a pleasure resort of about seventy acres, called Chickies Park. This is a well wooded tract of land, furnished with running water, dancing pavilion, merry-go-round, dining hall and other features. This point is about 300 ft. above the river and commands an extensive view of the river, Blue Ridge range of mountains and the Donegal valley. It has become a popular resort for the towns of Lancaster, Columbia, Marietta and other towns reached by electric lines.

Some of the engineering features of the Columbia & Donegal road are quite interesting. One of these is the long bridge and trestle built over the Chickies Creek, and shown in Fig. 1. This is 960 ft. in length, and where it crosses the creek is thirty-two feet high. It was constructed of North Carolina pine.

The power station, which is located on Commerce Street, Columbia, is of brick, and has two stacks each sixty-five feet in height. The engine equipment consists

of one Westinghouse engine of 150 H. P. and one Ball & Wood engine of 125 H. P., which operate two Westinghouse generators of 150 and 100 H. P. each. Steam is generated in three 150 H. P. boilers supplied by the Supplee Steam Engine Company, of Columbia. Korting injectors and Worthington pumps are used.

The roadbed has been well constructed. Several



FIG. 2.—CHICKIES PARK—COLUMBIA & DONEGAL RAILWAY CO

views of the track are given on page 223. The rail employed in the towns is sixty-six pounds in weight, and outside of the towns a fifty pound T rail is employed, all from the Johnson Company. The track is ballasted with six inches of broken stone.

The rolling stock consists of eight cars, sixteen feet in length, four of which were supplied by the J. G. Brill Company, and four by the Lamokin works. These are mounted on Brill and Robinson trucks. The motors are of the Westinghouse type, sixty horse power to a car. St. Louis registers are used.



WM. B. GIVEN,

PRESIDENT COLUMBIA & DONEGAL RAILWAY CO. AND COLUMBIA TRACTION CO.

There are a number of extensions proposed for the near future, and before the close of the present year Maytown, Mt. Joy and Ironville may be connected by electric railway with Columbia.

William B. Given, the president of the Columbia & Donegal Railway Company, is also president of the Columbia Traction Company, and is interested as stockholder in all the electric railways of Lancaster County. Mr. Given is thirty-nine years of age, a member of the legal profession and enjoys a large and lucrative practice. He is a director in the Columbia National Bank, Keeley Stove Company, East Columbia Land Company and numerous other organizations having for their object the industrial and corporate growth of Columbia.

Heating by Exhaust Steam at Springfield, Ill.

The practicability of utilizing the exhaust steam from electric light and power plants for heating purposes, and the distribution of the same to consumers situated within moderate distances of the central station, by means of underground pipes, has been proved by successful experiment and use to be both practicable and economical for the consumer as well as for the plant furnishing the supply. The utilization of exhaust steam for this purpose opens a new source of profit to numerous central stations situated in densely populated localities, where the users are located within a comparatively small radius, so as to justify the expense of underground piping. It is a well known fact that only about one-tenth of the total heat in the steam is utilized by passing through the engines, and the ability to recover for heating purposes the greater part of the remaining nine-tenths, without materially increasing the back pressure at the engines, opens a wide field for this system. The question of income accruing to the power company through this means of utilization of what would otherwise be a waste product, is one of the greatest importance, as heat may be furnished to the consumers at a price that will make it an object to them, and at the same time yield revenue to the company.

Through the courtesy of A. L. Ide, of the Springfield (Ill.) Electric Light & Power Company, we are enabled to present some recent information in regard to the very successful results obtained by the system at that plant. The exhaust steam system used is that controlled by the American District Steam Company, of Lockport, N. Y., and known as the Holly system, which was illustrated and described in the Street Railway Journal of July, 1893. This system uses exhaust steam at about five pounds, or less, back pressure, and, by an arrangement of condensing coils and indirect radiators at each point of consumption, dispenses altogether with return and drip pipes. It is also arranged so that in case the exhaust steam is not sufficient, live steam from the boilers may be passed into the pipes through suitable reducing valves.

The system at Springfield has been in use about three years. The original plant was installed in the winter of 1890, and was supplied from the lighting station. The plant has been steadily increased since that time, and now supplies heat to over 100 buildings. Last fall about 1,500 ft. of ten inch steam pipe was put in to connect with the power house of the Consolidated Railway Company, thus allowing the utilization of the exhaust from its engines. This supply enables the company to warm fifteen additional buildings containing over 1,000,000 cu. ft. of space. No difficulty has been found in keeping buildings warm with five pounds pressure in the mains when the temperature was 15 degs. below zero. The greatest distance steam is carried is about 4,000 ft. from the station, and heat is supplied to over 100 buildings. Exhaust steam from seven 14 × 14 in. Ideal engines in the electric light station, and one 200 H. P. Corliss engine in the power house of the Consolidated Railway Company, is utilized. When the railway company has twenty cars in operation all its exhaust steam is utilized; this in addition to the steam from three of the 14 × 14 engines is sufficient to warm about 4,000,000 cu. ft. of space. If all the engines are running, the exhaust steam will warm 5,000,000 cu. ft. of space. Experience has shown that exhaust steam from 100 H. P. of engines will warm, satisfactorily, about 1,000,000 cu. ft. of space. The entire system requires very little attention, and is proving a profitable investment to the

power company. In the winter of 1893 the company received about $3,000 from heating, at an additional expense on its coal bill of about $100.

Heat is furnished by contract agreement with the consumers at the rate of twenty cents per year per square foot of direct radiation, and twenty-five cents per year per square foot of indirect radiation. Where a contract for five years or longer is entered into, the company agrees to make all connections with the street main to the consumer's building wall, and furnish cut-off valve, etc. On contracts for less than five years' lease the consumer pays the cost of connection. The company requires all new consumers to have a cooling coil inserted between the steam trap and the sewer connection, to utilize the heat in the condensed water before letting it pass into the sewer. This coil is used as an indirect radiator, but is charged for, according to surface, as direct radiation. An arrangement is also made, where the customer has a steam boiler already installed for heating purposes, to pass the water of condensation through this boiler and trap the same to the sewer automatically, so that in case of any cause of shutdown at the station the consumer's plant is ready to furnish steam at very short notice, the boiler already being partially filled with hot water. The engravings, which are from the *Electrical Engineer*, give a view of the interior of the station and of main and exhaust connection.

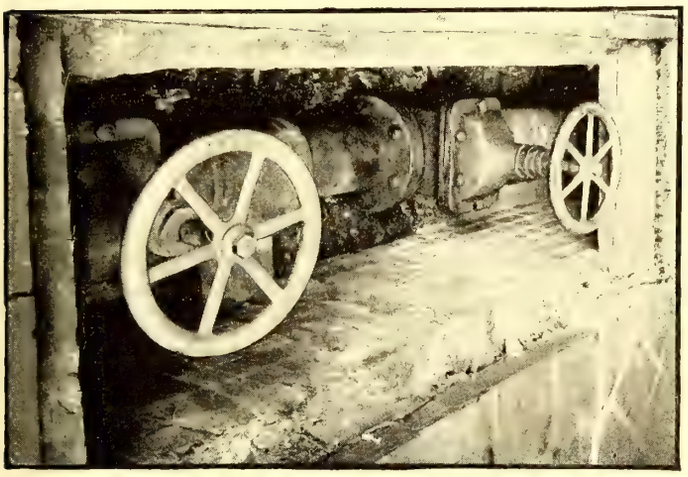


FIG. 1.—CONNECTION OF MAIN AND EXHAUST PIPING.

The same system has given very satisfactory results in connection with the plant of the Cedar Rapids (Ia.) Electric Light Company, and elsewhere. The boiler plant of the Cedar Rapids company consists of two 150 one 200 and one 125 H. P. boilers, all of which are used to supply steam to the engines. The exhaust is distributed through over two miles of underground mains, the longest single lines being about three-quarters of a mile long, running in opposite directions from the stations. With six pounds pressure in the exhaust mains at the station, perfect circulation is obtained. The charges are $1 per 1,000 units on the inch meter, which corresponds to about $8 per ton for anthracite coal, which is the price in the local market. The steam supply business is constantly growing, and is a source of profitable income, the receipts at present from this source being about $15,000 per annum. The manager of the company is authority for the statement that the exhaust steam plant is by far the best paying part of its business, and further, that without it the station could not be made to pay in that location. The heating is almost entirely done with exhaust, only a small amount of live steam being used in the middle of the day in extremely cold weather when some of the engines are shut down.

From these facts it would seem as if the exhaust steam plant should be regarded almost in the light of a necessary feature in connection with any electric system so situated that this principle may be utilized, as by the use of the exhaust system what might be called a by-product, and otherwise be allowed to run to waste, becomes one of the principal features of income.

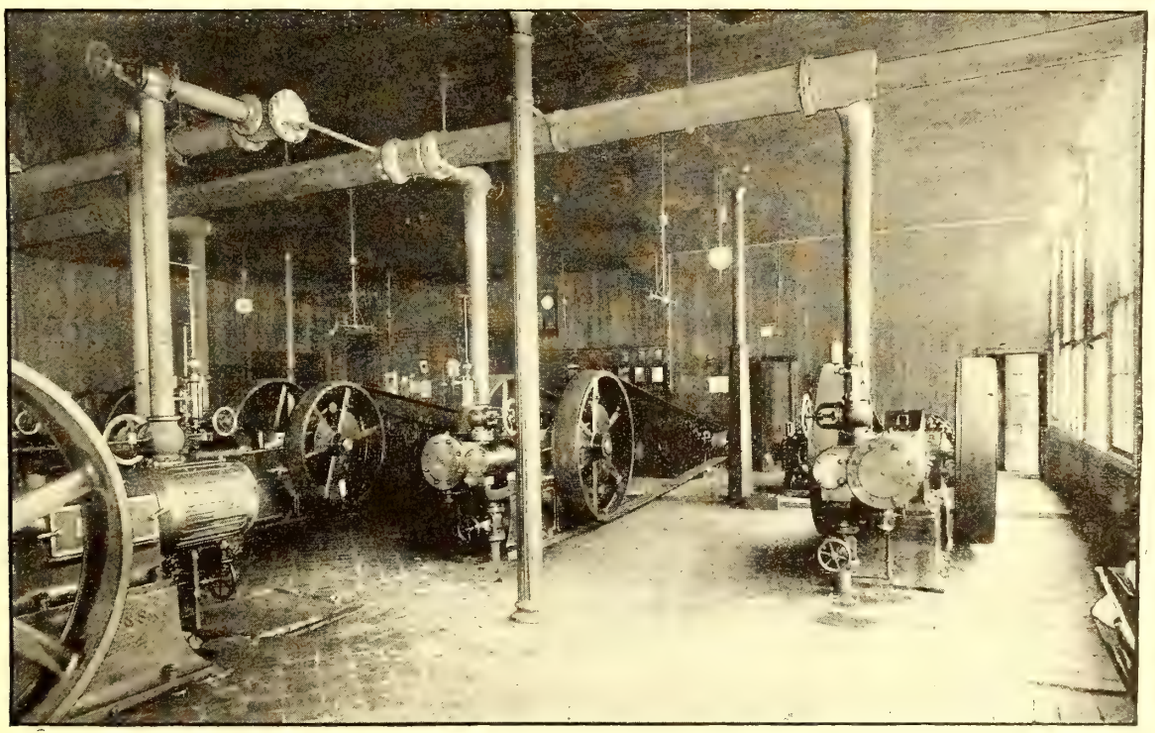


FIG. 2.—INTERIOR OF STATION—SPRINGFIELD ELECTRIC LIGHT & POWER CO.

The Compagnie Générale d'Electricité has now at its works at Lyons a new high speed electric locomotive, nearly completed. The dimensions of this are: Length, 16½ ft.; height, 11½ ft.; width, 8 ft. It runs on four wheels 46 ins. in diameter. The locomotive weighs 30 tons, and has been constructed for a normal speed of 30 miles per hour.

Formal announcement has been made that the line of the Consolidated Traction Company, of New Jersey, between Newark and Jersey City, will be opened to the public on April 8.

THE INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS.*

By Edward E. Higgins.

FOURTH PAPER.

Class IV. Surface Railways in American Cities of from 50,000 to 100,000 Inhabitants.

There are thirty cities in the United States having a population of from 50,000 to 100,000 by the census of 1890. Twenty-two are in the Eastern States, four in the Southern, three in the Central and one in the Western. The total track mileage is nearly 1600, of which 81 per cent. is operated by electricity, 15 per cent. by horses, and the balance by various systems of motive power.

Twenty-three of these cities are repesented in the Table of Statistics, twenty appearing in the class now under consideration. The population of two cities with their suburbs exceeds 100,000, one is connected with a metropolitan system and cannot be represented separately, and the statistics of the remaining seven cannot be obtained in a sufficiently complete form for present purposes. Two cities of less than 50,000 inhabitants are also represented in the table, being brought into this class by reason of the suburban population served, and one city is represented twice, first alone, and again with the added population of a suburb served by another and separate road.

At the end of the various fiscal years ending in 1890, eleven of the twenty-three systems represented in the table were in operation wholly by horses, one wholly by electricity, six had commenced equipment by electricity, four were in operation by horses, cable, steam and electricity in varying proportions, and one—the "metropolitan system" referred to above—had not built its suburban line and is not therefore represented in 1890. At the end of the fiscal years of 1892, eleven systems were in substantially complete operation by electricity, two by horses, and ten were still in the process of conversion from horses to electricity. In 1890 445 miles of track were in operation by horses, and 145 miles by electricity and other motive powers; while in 1892, 258 miles were in operation by horses, and 564 miles by electricity and other motive powers.

THE HORSE RAILWAYS OF 1890.

Again we find that the horse railways of 1890 were not in general overcapitalized. 16 per cent. of the total mileage had no funded debt, the funded debt of 38 per cent. was less than $10,000 per mile, that of 38 per cent was between $10,000 and $20,000 and that of only 8 per cent. exceeded $20,000 per mile. The total capital liabilities of 42 per cent. were less than $20,000 per mile.

The sixteen horse railways now under consideration may be separated into four clearly defined groups based as usual on the passenger earnings per capita. The first group contains two systems which earned $.98 and $1.32 per capita respectively. The second group contains five systems which earned from $1.98 to $2.31 per capita; the third group contains seven systems which earned from $2.62 to $3.24 per capita; and the fourth group contains two systems which earned $3.76 and $4.03 respectively.

Case No. 94 was practically a new road in 1890 and was developing rapidly. Its passenger income for the year ending December 31, 1890, was nearly $100,000, and as will be seen by the table, it had risen to over $200,000. by 1892. Case No. 85 is a horse railway system connecting three townships of from 3,000 to 6,000 inhabitants with a manufacturing city of 45,000 inhabitants. It operated but 7 miles of street and but 5 car miles per capita, and in spite of small passenger income it earned 20 per cent. on capital liabilities of $7,400 per mile of track.

The five systems of the second group earning from $1.98 to $2.31 per capita with horses may be passed over with brief mention. Case No. 80 is a system serving a sleepy Southern city well laid out for moderately large street railway traffic, but with a large colored population and with little local enterprise. Cases No. 81 and 82 are combined residential and manufacturing towns of some importance. Cases No. 83 and 91 are railroad and manufacturing cities. The track mileage in these five cities ranges from 15 to 26, and the street mileage (reported) from 12 to 20. The car mileage in cases No. 80 and 82 were probably sufficient to secure the maximum traffic, but the low car mileage of Case No. 91 is partly responsible for the small gross earnings. The net earnings of the three roads reporting are fairly good, the returns being equivalent to about 5, 8 and 11 per cent. respectively on capital liabilities of from $17,200 to $19,600 per mile of road.

The average gross earning power of the horse railways of this class seems to be best represented by the seven systems of the third group, earning from $2.62 to $3.24 per capita. These systems all serve busy manufacturing cities, six of the seven being in three of the Eastern Atlantic States. It is at once evident that the track and street mileage of this group is considerably greater than that of the second group, the average street mileage being 20.4 as against 16.9 in the second group This is probably responsible in part for the better average results. The car mileage per capita ranges from 8 to 16, the one Western city showing 22. The percentage of net income to capital liabilities is quite satisfactory, the smallest return being 5 per cent. on capital liabilities of $32,800 per mile of track, and the largest 16 per cent. on $22,000 per mile of track. The operating expenses of three systems are between 73 and 78 per cent., of three systems between 87 and 90 per cent., while the Western city referred to is apparently operating at 66.7 per cent., and $.09 per car mile, an unusual but perhaps not impossible figure.

The two systems of the fourth group show the maximum horse railway gross earning power of the class. Case No. 98 served an important railroad, manufacturing and residential city, with 21 miles of road and 27 car miles per capita. It earned $4.03 per capita gross, operated at 70 per cent. of the passenger income and $.10 per car mile and returned 6.1 per cent. on capital liabilities of nearly $50,000 per mile of track, which is decided overcapitalization of costs. Case No. 100 served a city of 61,000 inhabitants and suburban townships aggregating 34,000 inhabitants, with 16.5 miles of road and 12.6 car miles per capita, and earned nearly 10 per cent. on capital liabilities of $33,000 per mile of track. Both these population centers are nearly the largest of the class.

THE STREET RAILROADS OF 1892.

Passing now from the horse railroads of 1890 to the discussion of later results, it will be found profitable to divide the entire list of cases into three groups, the first containing five systems which have been so fully developed that their 1892 reports may be considered as exhibiting nearly or quite their maximum permanent earning power, the second containing ten systems whose earning power was not in that year a maximum, and the third containing eight systems which are not fully reported in 1892.

DISCUSSION OF FIVE SYSTEMS EXHIBITING PROBABLE MAXIMUM EARNING POWER IN 1892.

The gross and net earning power of three of these systems is unsatisfactory, while that of the other three is extraordinarily good.

Case No. 85 has been already referred to as a horse road in 1890, whose gross and net earnings were small in amount, but which was so moderately capitalized that the net was equal to over 20 per cent. on the capital liabilities

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of 1890. Its extension of mileage, equipment by electricity and increase in car service, brought about a substantial increase in both gross and net income in 1892, but the latter was equivalent to a return of but 8 per cent. on the new capital liabilities of $31,200 per mile of track. It may be said here that the gross income in 1893 was greater than that of 1892, but a much larger increase in operating expenses effected an actual reduction in the net income, and as before stated, it is probable that the net earning power of this system is not much in excess of $40,000, although the gross income will undoubtedly show a gradual increase from year to year, due to, and commensurate with increase of population served.

Case No. 92 was one of the few street railway systems of this class which were in nearly complete operation by electricity as early as 1890. It serves a prosperous mining and manufacturing city with large street and track mileage; its passenger income is gradually increasing, but is decidedly small in proportion to the population served; its operating expenses in spite of cheap fuel are nearly 70 per cent. of the passenger income, probably because of the purchase of early and inferior apparatus; and the net income, although reasonably good, is equivalent to the return in 1892 of less than 5 per cent. on capital liabilities of $37,500 per mile.

One of the best and most conservative street railway statements so far discussed is that of Case No. 89. This system has never indulged in the luxury of a funded debt, it has promptly paid off its floating debt, which is to-day merely nominal, and it has always been carefully and conservatively managed both with horse and electric operation. It has not been "syndicated" and its capitalization is probably but little in excess of the actual present value of the tangible assets, including real estate, cash assets, etc. It is one of the few roads which have established a reserved fund in anticipation of increased depreciation. It reaches several suburban townships tributary to a principal city of 44,000 inhabitants, and its road mileage is therefore large. Its car service is good but not excessive. Its passenger income in 1892 was $5.22 per capita and in 1893 about $6.00; its operating expenses in 1892 were but 61.4 per cent. of the income, but in 1893 the percentage had risen to 75, partly because of the charge to operating expenses of the reserve fund credit; so that while the net income in 1892 was sufficient for a return of 13.2 per cent. on the capital liabilities, that in 1893 was but about 10 per cent.

Another excellent operating report is that of Case No. 98 previously mentioned. In this case the net income in 1893, while considerably in excess of interest charges, is equivalent to a return of but 3.3 per cent. on the total capital liabilities. I believe it probable that this net income will be little if any greater in succeeding years than at present owing to increasing depreciation of plant and equipment. While it is not impossible that a system of this size, if equipped with the best apparatus and material, can be operated at from 60 to 65 per cent. of the passenger income, it is also true that few roads are at present so equipped, or are free from the burdens of mistaken judgment in engineering matters, and the establishment of a proper reserve or depreciation fund would naturally increase the percentage of operating expenses to passenger income as with Case No. 89.

Case No. 84 is a remarkable instance of the saving power of electricity. In years gone by, local capitalists conceived the idea that a cable system in this city would be a profitable investment. Instead of choosing the main business thoroughfare (which was then in the hands of another corporation), and thereby minimizing the inevitable loss, they built a road out into the suburbs, with results which can be imagined. A little later a consolidation was effected with the larger and fairly prosperous horse railway system of the city, and, in the hope of repairing some of the previous losses, new capital was obtained for the electrical equipment of the cable as well as of the horse lines. The results have more than justified the most sanguine expectations. A practical engineer and business man was retained as manager, and under his wise supervision the road has been reconstructed with great economy and is handled with unusual skill. The system is earning over $7.00 per capita gross, $16,500 per mile of road, and $.17 per car mile on an unusually large car service; is operating at $.11 per car mile and 64 per cent. of the passenger income; and its net earnings are equivalent to a return of 4.3 per cent. on the accumulated capital liabilities of $88,000 per mile of track. It is probable that this net earning power will not be much greater in subsequent years, but even at present figures the results are interesting, and, to the owners of the property, decidedly satisfactory.

DISCUSSION OF TEN SYSTEMS WHOSE EARNING POWER WAS NOT A MAXIMUM IN 1892.

Four of these systems earned less than $3.00 per capita gross, four earned between $3.00 and $3.75, and two between $4.25 and $4.50.

Two of the four systems earning less than $3.00 per capita were still practically horse roads in 1892, since which time they have been equipped for electrical operation, and will doubtless develop their maximum earning power in 1895. The third system, Case No. 95, the electrical equipment of which was not completed in 1892, shows gross earnings in 1893 of about $3.40 per capita as against $2.65 in 1892; an operating percentage of 68 as against 86 in 1892; and net earnings nearly three times as great as those of 1892, equivalent to a return of 6.8 per cent. on capital liabilities of about $26,000 per mile of track. The maximum earning power of this property will not be exhibited until 1894 or possibly 1895. The information given concerning Cases No. 94 and 81 are insufficient for a just criticism.

Three of the systems earning from $3.00 to $3 75 per capita in 1892 have been only partially equipped by electricity even at present. Case No. 83 is a moderately good horse railway statement. Case No. 96 is an excellent statement for a comparatively small system as yet undeveloped, the net earnings being equivalent to about 7.4 per cent. on capital liabilities of nearly $34,000 per mile of track. Case No. 99, with a far larger track and road mileage, a considerable portion of which was operated by electricity in 1892, earned but little more gross and net than Case No. 96. The capital liabilities are excessive, the net income being equivalent to less than 2 per cent. thereon, and the system is now in the hands of a receiver, because of default in interest charges.

Case No. 101 is Case No. 96 with the addition of a suburban city and road. It is evident that this addition is important and profitable since the net income of the combination materially increased the percentage return on the capital liabilities, as well as the passenger income per capita served. Case No. 100 has always been an important and profitable system, whose original owners have retained their property and equipped it by electricity without calling upon outside capital, and its comparatively low percentage of operating expenses to passenger income shows that "early apparatus," when carefully handled, is capable of producing quite satisfactory results. Its net income in 1892 was equivalent to over 13 per cent. on capital liabilities exceeding $50,000 per mile, and both gross and net income were materially increased in 1893.

DISCUSSION OF SEVEN SYSTEMS NOT FULLY REPORTED IN 1892.

Five of these systems may be dismissed with no further comment than that they are capable of much better returns than are shown in 1890, and have doubtless already achieved a considerable increase in both gross and net income, although but one has as yet been fully equipped by electricity. Cases No. 90 and 93 are noteworthy as showing fairly high gross earnings per capita in 1890, when but partially equipped electrically. Since that date both gross and net income have been much increased, but the systems have been burdened with excessive capital liabilities and are passing through partial reorganizations, one being now in the hands of a receiver, and the other having arbitrarily scaled down its interest charges. I can but believe that the road and track mileage is far greater

TABLE IV.—AMERICAN STREET RAILWAY SYSTEMS

PART I.—STATISTICS OF CAPITALIZATION.

See "Intrinsic Value of Street Railway Investments." Horse Railways are given in Roman figures.

Case Number	Miles of Track					Miles of Street	Capital Stock			Funded Debt			Capital Liabilities			Floating Debt		Case Number
	Horse	Electric	Cable	Miscel.	Total		Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Memo.	
A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T
79	16.0	.....	.....	12.5	28.5	21.4	150,000	5,300	2.90	75,000	2,600	1.50	225,000	7,900	4.40	73,055	B.A.P	79
	.....	*19.0*	.....	.....	*19.0*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
80	26.0	.....	.....	.....	26.0	20.7	365,000	14,000	6.60	144,000	5,500	2.60	509,000	19,600	9.30	.....	.....	80
	28.8	.....	.....	.....	28.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
81	21.0	.....	.....	.....	21.0	.....	126,100	6,000	2.20	190,000	9,000	3.30	316,100	15,000	5.50	53,400	.....	81
	.....	*32.0*	.....	.....	*32.0*	.....	*1,500,000*	*46,900*	*26.30*	*521,100*	*16,300*	*9.10*	*2,021,100*	*63,100*	*35.40*	*380,401*	.....	
82	15.0	.....	.....	.....	15.0	14.1	250,000	16,700	4.30	250,000	16,700	4.30	500,000	33,300	8.60	3,127	.....	82
	11.5	6.8	.....	.....	18.3	z 17.4	250,000	13,700	4.30	350,000	19,100	6.00	600,000	32,800	10.30	33,713	.....	
83	18.5	3.2	.....	.....	21.7	20.5	293,450	13,500	4.90	112,000	5,200	1.90	405,450	18,700	6.80	32,920	B. P.	83
	25.0	8.7	.....	.....	z 33.7	31.5	580,000	17,200	9.70	112,000	3,300	1.90	692,000	20,500	11.50	26,243	B. P.	
84	30.8	.....	11.6	.....	42.4	28.6	750,200	17,700	12.50	1,201,000	28,200	20.00	1,951,200	46,000	32.50	235,288	B.A.P	84
	.....	*44.1*	.....	.....	*44.1*	*25.7*	*1,500,000*	*34,000*	*25.00*	*2,380,000*	*54,000*	*39.70*	*3,880,000*	*88,000*	*64.70*	.....	.....	
85	10.8	.....	.....	.....	10.8	7.1	80,000	7,400	1.30	.....	.....	.....	80,000	7,400	1.30	19,431	Net.	85
	.....	*17.0*	.....	.....	*17.0*	*12.3*	*180,000*	*10,600*	*3.00*	*350.000*	*20.600*	*5.80*	*530,000*	*31,200*	*8.80*	*105,676*	"	
p 86	4.9	3.3	.....	.....	8.2	7.8	168,653	20,600	2.80	130,000	16,000	2.10	298,653	36,500	4.90	35,000	B.A.P	p 86
	4.7	*9.3*	.....	.....	*14.0*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
p 87	30.0	.....	.....	.....	30.0	15.7	725,375	24,200	11.90	.....	.....	.....	725,375	24,200	11.90	.....	.....	p 87
	33.0	15.5	.....	.....	48.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
88	23.0	3.0	.....	.....	26.0	18.0	200,000	7,700	3.20	100,000	3,800	1.60	300,000	11,500	4.80	84,785	B A P	88
	20.0	15.0	.....	.....	35.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
89	18.9	2.5	.....	.....	21.4	20.8	400,000	18,700	6.40	.....	.....	.....	400,000	18,700	6.40	62,709	Net	89
	3.0	*29.5*	.....	.....	*32.5*	*29.0*	*1,000 000*	*30,800*	*15.90*	.....	.....	.....	*1,000,000*	*30,800*	*15.90*	s *96.173*	"	
90	27.5	13.3	.....	11.0	51.8	47.4	477,475	9,200	7.20	807,000	15,600	12.20	1,284,475	24,700	19.40	109,215	B.A.P	90
	.....	*66.0*	.....	.....	*66.0*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
91	17.4	.....	.....	.....	17.4	12.3	300,000	17,200	4.10	.....	.....	.....	300,000	17.200	4.10	s 1,812	Net.	91
	17.5	.....	.....	.....	17.5	12.4	300,000	17,200	4.10	750,000	42,900	10.10	1,050,000	60 000	14.20	s 723,850	"	
92	.....	*26.0*	.....	.....	z *26.0*	z *22.0*	*525,000*	*20,200*	*7.00*	*400,000*	*15,400*	*5.30*	*925,000*	*35,600*	*12.30*	.....	.....	92
	.....	*30.0*	.....	.....	z *30.0*	z *27.0*	*525.000*	*17,500*	*7.00*	*600,000*	*20,000*	*8.00*	*1,125,000*	*37,500*	*15.10*	.....	.....	
93	.....	*40.0*	.....	*9.8*	*49.8*	*38.6*	*1,100,000*	*22,100*	*14.50*	*2,600,000*	*52,200*	*34.20*	*3,700,000*	*74,300*	*48.70*	.....	.....	93
	.....	*56.5*	.....	*16.3*	*72.8*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
94	17.0	.....	.....	.....	17.0	14.0	135,000	7,900	1.70	183,000	10,800	2.30	318,000	18,700	4.10	a 19,917	.....	94
	.....	*35.0*	.....	.....	*35.0*	.....	*1,105,000*	*31,600*	*14.20*	*845,000*	*24,100*	*10.80*	*1,950,000*	*55,700*	*25.00*	*394,000*	.....	
95	21.9	5.2	.....	.....	27.1	20.8	300,000	11,100	3.80	100,000	3,700	1.30	400,000	14,800	5.00	136,566	Net.	95
	7.4	*33.2*	.....	.....	*40.6*	*28.5*	*300,000*	*7,400*	*3.80*	*600,000*	*14,800*	*7.50*	*900,000*	*22,200*	*11.30*	*292,173*	"	
96	20.4	.....	.....	.....	20.4	12.5	350,000	17,100	4.10	150,000	7,400	1.80	500,000	24,500	5.90	124,864	Net.	96
	21.5	3.6	.....	.....	25.1	16.6	700,000	27,900	8.20	150,000	6,000	1.80	850,000	33,900	10.00	s 27,353	"	
97	26.1	.....	.....	.....	26.1	20.9	464,900	17,800	5.40	110,300	4,200	1.30	575,200	22,000	6.70	84,329	B.A.P	97
	22.4	12.3	.....	.....	34.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
98	34.8	.....	.....	.....	34.8	21.0	1,100,000	31,600	12.50	619,000	17,800	7.00	1,719,000	49,400	19.50	.....	.....	98
	.....	*55.0*	.....	.....	*55.0*	*35.0*	*3,000,000*	*54,500*	*34.10*	*2,802,500*	*50,900*	*31.80*	*5,802,500*	*105,500*	*65.90*	.....	.....	
99	38.7	4.0	.....	.....	42.7	33.9	851,700	20,000	9.00	550,655	12,900	5.80	1,402,355	32,800	14.70	14,147	Net.	99
	37.8	17.8	.....	.....	55.6	38.9	2,250,000	40,500	23.70	1,984,400	35,600	20.80	4,234,400	76,100	44.50	156,985	"	
100	26.1	.....	.....	.....	26.1	16.5	534,700	20,500	5.60	334,155	12,800	3.50	868,855	33,300	9.20	s 42,956	Net.	100
	3.8	*24.4*	.....	.....	*28.2*	*17.6*	*1,090,000*	*38,700*	*11.50*	*333,955*	*11,800*	*3.50*	*1,423,955*	*50,400*	*15.00*	*13,039*	"	
101	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	101
	21.5	16.6	.....	.....	38.1	29.1	970,536	25,500	10.00	150,000	3,900	1.60	1,120,536	29,400	11.60	56,058	Net.	

a. From all sources. b. Operating expenses include interest payments and cannot be properly represented. z. Approximate.
p. This report does not include one insignificant horse road. s. Current assets exceed current liabilities.

than is necessary for cities of this size and that the comparatively large passenger income has been obtained at too great a cost. The combination of excessive mileage and excessive capital liabilities per mile cannot fail to be disastrous to any property.

There now remains for final consideration the usual comparison between the horse and electric statements of those roads in which the process of conversion to electricity has been practically completed between the years 1890 and 1892.

DISCUSSION OF FIVE SYSTEMS OPERATING CHIEFLY BY HORSES IN 1890 AND BY ELECTRICITY IN 1892.

There are two fully reported systems of this number which were in operation by horses, with but small electric railway mileage in 1890; two which were in operation by

SERVING FROM 50,000 TO 100,000 POPULATION.

PART II.—STATISTICS OF OPERATION.

Electric, Cable and Steam Railways are given in italics.

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Case Number	Population Served	Area	Population Per Mile Street	Population Per Square Mile	Year Ending	Car Mileage Total	Car Mileage Per Capita	Passenger Income Total	Passenger Income Per Mile Street	Passenger Income Per Car Mile	Passenger Income Per Capita	Operating Expenses Total	Operating Expenses Per Car Mile	Operating Expenses % Passenger Income	Net Earnings Total	Net Earnings Per Car Mile	Net Earnings % Passenger Income	Net Earnings % Cap. Liab.	Case Number
a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u
79	51,000	....	2,400	.....	6-30-1890	1,009,800	19.8	89,323	4,200	.088	1.75	72,047	.071	80.6	19,225	.019	21.5	8.5	79
	.....	....	.....	.....	.....	.....	....	.....	.....	....	....	.....	...	....	.....	....	....	....	
80	55,000	....	2,700	.....	n 1890	1,005,870	18.4	126,952	6,100	.126	2.31	107,531	.107	85.4	25,059	.025	19.8	4.9	80
	.....	....	.....	.....	.....	.....	....	.....	.....	....	....	.....	....	....	.....	....	....	....	
81	57,000	....	.....	.....	12-31-1890	.....	.....	a 124,004	.....	....	2.18	b	....	.....	.....	....	....	....	81
	57,000	....	.....	.....	*12-31-1892*	.....	.....	a *175,792*	.....	....	*3.09*	b	....	.....	.... ..	....	....	....	
82	58,000	....	4,100	.....	6-30-1890	802,828	13.8	114,869	8,200	.143	1.98	.....	....	.....	.....	....	..	....	82
	58,000	....	3,300	.....	12-31-1892	.....	.....	159,868	9,200	....	2.76	.....	....	.....	.....	....	....	....	
83	60,000	....	2,900	.....	6-30-1890	.....	.....	130,649	6,400	....	2.18	96,529	....	73.7	34,120	....	26.0	8.4	83
	60,000	....	1,900	.....	6-30-1892	.....	.....	a 183,321	5,800	....	3.05	152,577	....	83.6	30,883	....	16.9	4.5	
84	60,000	....	2,100	.....	6-30-1890	2,423,012	40.3	234,791	8,200	.097	3.92	215,357	.089	91.5	21,534	....	9.2	1.1	84
	60,000	....	*2,300*	.....	*7-31-1893*	*2,444,967*	*40.7*	*424,255*	*16,500*	*.173*	*7.07*	*270,949*	*.111*	*63.9*	*165,477*	*.067*	*38.9*	*4.3*	
85	60,000	....	8,500	.....	9-30-1890	294,000	4.9	79,251	11,000	.270	1.32	64,083	.218	80.9	16,298	.056	20.6	20.4	85
	60,000	....	*4,900*	.....	*9-30-1892*	*461,953*	*7.7*	*123,413*	*10,000*	*.266*	*2.05*	*81,348*	*.176*	*66.1*	*42,605*	*.092*	*34.6*	*8.0*	
p 86	61,000	....	7,800	.....	6-30-1890	483,021	7.9	89,167	11,400	.184	1.46	68,190	.141	76.4	22,181	.045	24.9	7.4	p 86
	.....	....	.....	.....	.....	.....	....	.....	.....	....	....	.....	....	....	.....	....	....	....	
p 87	61,000	....	3,900	.....	6-30-1890	1,353,060	22.1	185,999	11,800	.138	3 05	124,487	.091	66.7	66,206	.049	35.6	9.1	p 87
	.....	....	.....	.....	.....	.....	....	.....	.....	....	....	.....	....	....	.....	....	....	....	
88	62,000	....	3,400	.....	6-30-1890	758,572	12.2	168,568	9,400	.223	2.70	147,530	.195	87.6	26,135	.034	15.5	8.7	88
	.....	....	.....	.....	.....	.....	....	.....	.....	....	....	.....	....	....	.....	....	....	....	
89	63,000	....	3,000	.....	9-30-1890	683,991	10.9	180,991	8,700	.265	2.87	157,635	.231	87.3	30,473	.045	16.9	7.6	89
	63,000	....	*2,200*	.....	*9-30-1892*	*1,088,965*	*17.3*	*328,800*	*11,345*	*.302*	*5.22*	*201,602*	*.185*	*61.4*	*131,949*	*.121*	*40.1*	*13.2*	
90	66,000	....	1,400	.....	n 1890	1,268,893	19.2	289,109	6,100	.228	4.38	219,014	.172	75.8	69,829	.055	24.2	5.5	90
	.....	....	.....	.....	.....	.....	....	.....	.....	....	....	.....	....	....	.....	....	....	....	
91	74,000	....	6,000	.....	9-30-1890	499,219	6.7	154,748	12,600	.311	2.09	122,973	.246	79.4	34,327	.069	22.1	11.4	91
	74,000	....	6,000	.....	9-30-1892	551,926	7.5	175,417	14,100	.317	2.36	135,063	.245	77.1	42,478	.077	24.3	4.1	
92	*75,000*	....	*3,400*	.....	*6-30-1890*	.....	.....	*146,801*	*6,700*	....	*1.96*	*99,331*	....	*67.6*	o *47,470*	....	*32.3*	*5.1*	92
	75,000	....	*2,800*	.....	*6-30-1892*	.....	.....	*174,048*	*6,400*	....	*2.32*	*120,835*	....	*69.5*	o *53,213*	....	*30.6*	*4.7*	
93	*76,000*	....	*2,000*	.....	*6-30-1890*	.....	.....	*350,346*	*9,000*	....	*4.60*	*256,907*	....	*73.4*	*94,739*	....	*27.1*	*2.6*	93
	.....	....	.....	.....	.....	.....	.....	.....	.....	....	....	.....	....	....	.....	....	....	....	
94	78,000	....	5,600	.....	6-30-1890	542,755	7.0	76,484	5,500	.141	.98	61,861	.114	80.9	14,975	.028	19.6	4.7	94
	78,000	....	.....	.....	*12-31-1892*	....	.....	*215,190*	.....	....	*2.76*	.....	....	.....	.....	....	....	....	
95	80,000	....	3,800	.....	9-30-1890	988,658	12.4	209,830	10,100	.211	2.62	188,755	.191	90.0	22,628	.023	10.8	5.7	95
	80,000	....	*2,800*	.....	*9-30-1892*	*1,027,058*	*12.9*	*212,314*	*7,400*	*.206*	*2.65*	*182,423*	*.177*	*85.8*	*30,147*	*.029*	*14.2*	*3.3*	
96	85,000	....	6,800	.....	9-30-1890	706,905	8.3	232,475	18,600	.328	2.73	178,382	.253	76.7	57,017	.081	24.6	11.4	96
	85,000	....	5,100	.....	9-30-1892	1,045,571	12.4	314,004	18,900	.299	3.69	255,496	.243	81.2	62,977	.060	20.1	7.4	
97	86,000	....	4,100	.....	6-30-1890	1,366,841	15.9	279,238	13,300	.204	3.24	203,126	.148	72.8	91,731	.067	32.8	15.9	97
	.....	....	.....	.....	.....	.....	.....	.....	.....	....	....	.....	....	....	.....	....	....	....	
98	88,000	....	4,200	.....	n 1890	2,424,500	27.5	354,751	16,900	.147	4.03	250,151	.103	70.4	104,196	.043	29.3	6.1	98
	88,000	....	*2,500*	.....	*12-31-1893*	*3,560,790*	*40.5*	*532,191*	*15,200*	*.149*	*6.05*	*336,949*	*.095*	*63.3*	*189,773*	*.053*	*35.7*	*3.3*	
99	95,000	....	2,800	.....	6-30-1890	.....	.....	299,249	8,800	....	3.14	233,932	....	78.3	70,428	....	23.5	5.0	99
	95,000	....	2,400	.....	6-30-1892	.....	.....	352,783	9,100	....	3.72	277,712	....	78.8	77,964	....	22.1	1.8	
100	95,000	....	5,800	.....	6-30-1890	1,194,994	12.6	356,868	21,600	.300	3.76	272,964	.229	76.5	83,936	.071	23.5	9.7	100
	95,000	....	*5,400*	.....	*6-30-1892*	.....	.....	*419,415*	*23,800*	....	*4.41*	*233,205*	....	*55.6*	*188,119*	....	*44.9*	*13.2*	
101	.....	....	.....	.....	.....	.....	.....	.....	.....	....	....	.....	....	....	.....	....	....	....	101
	97,000	....	3,300	.....	9-30-1892	1,418,509	14.6	414,850	14,300	.292	4.28	322,914	.227	77.8	97,119	.068	23.4	8.7	

a. From all sources. b. Operating expenses include interest payments and cannot be properly represented. o. From operation.
n. Fiscal years of the several roads end at different dates. p. This report does not include one insignificant horse road.

horses only; and one which was in operation partly by horses and partly by the cable system. In 1892 the process of conversion to electricity was substantially completed in four of the five systems, the fifth still operating about 25 per cent. of its track mileage by horses. The total track mileage was increased from 128 (108 horse, 8 electric and 12 cable) in 1890 to 162 (14 horse, 148 electric) in 1892. The funded debt in 1890 was $12,800 per mile of track and in 1892 $22,600, while the total capital liabilities which were $28,900 in 1890 were $47,700 in 1892. The later figures represent a large overcapitalization of the present value of the tangible assets, although, for reasons which have been partially explained in the discussion of the separate roads, the overcapitalization of actual costs is probably not extreme.

The passenger income of these five roads in 1890 was

$1,061,731, equivalent to $11,300 per mile of road, and $2.96 per capita. The passenger income in 1892 was $1,508,197, equivalent to $13,400 per mile of road and $4.21 per capita, an increase of 42.1 per cent.

The operating expenses in 1890 were 84.8 per cent. of the passenger income and in 1892 64.2 per cent. This is a remarkable reduction which will hardly be fully maintained in subsequent years.

The net income in 1890 was $174,866 and in 1892 $558,297, an increase of 218.9 per cent. The return on the capital liabilities was 4.8 per cent. in 1890, and 7.2 per cent. in 1892. If we may consider the funded debt, averaging $22,600 per mile of track, as a fairer measure of the real cash value of the tangible assets, the net income in 1892 would be equivalent to over 15 per cent., but in cities of this size it would probably be impossible to duplicate the tangible assets for less than from $25,000 to $30,000 per mile of track.

GENERAL CONCLUSIONS.

1. Well managed electric street railway systems of from 25 to 40 miles in length in the best American cities of from 50,000 to 100,000 inhabitants will probably develop a maximum earning power of from $5.00 to $6.00 gross per capita, with one or two exceptional cases rising above these figures; a larger number will earn from $4.00 to $5.00 per capita; and few will be unable to earn $4.00 per capita.

2. Those properties which have been improperly constructed and equipped, particularly in the matter of roadbed, cannot probably be permanently operated at less than 75 per cent. of the passenger income, higher figures rather than lower being probable. Those properties which have postponed equipment until a comparatively recent period and which have been carefully and thoroughly built can usually be operated at from 65 to 70 per cent. of the passenger income.

3. Under the most favorable conditions of operation a maximum net earning power of about $2.00 per capita is possible, but more usual figures will range from $1.00 to $1.50 per capita.

4. $1.50 per capita is a return of 12 per cent. per annum on capital liabilities of $12.50 per capita, which represents about the average present cost of building and equipping in the most perfect manner electric railway systems of average length in cities of this class, where the cost of taking up and replacing pavement forms an important item of original investment. In general therefore it may be said that these properties are, intrinsically, investments returning from 10 to 15 per cent on the actual value of tangible assets apart from franchises.

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 50,000 TO 100,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
MILES OF TRACK.				
No. of miles operated	444.8	145.4	257.9	563.6
FUNDED DEBT PER MILE OF TRACK.				
No. of miles not reporting	.....	.....	147.0	171.8
" " having no funded debt	79.6	.....	.....	32.5
" " " an indebtedness less than $5,000 per mile	107 7	.....	71.8	.....
" " " " " from $ 5,000 to $10,000 "	89.1	.....	25.1	.....
" " " " " " 10,000 to 15,000 "	85.8	.....	.....	68.8
" " " " " " 15,000 to 20,000 "	09.8	26.0	18.3	32.0
" " " " " " 20,000 to 30,000 "	42.4	.....	.....	82.0
" " " " " " 30,000 to 50,000 "	.....	.....	73.1	.....
" " " " " over 50,000	.....	49.8	.....	99.1
CAPITAL LIABILITIES PER MILE OF TRACK.				
No. of miles not reporting	.....	.....	147.0	171.8
" " capitalized at less than $10,000 per mile	39.3	.....	.....	.....
" " " at from $10,000 to $ 15,000 "	53 1	.....	.....	.....
" " " " 15,000 " 20,000 "	124.5	.....	.....	.....
" " " " 20,000 " 30 000 "	128.3	.....	71.8	40.6
" " " " 30,000 " 40,000 "	92.0	26.0	43.4	79.5
" " " " 40,000 " 50,000 "	77.2	.....	.....	.....
" " " " 50,000 " 75,000 "	.....	49.8	17.5	95.2
" " " over 75,000 "	.....	.....	55 6	99.1

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 50,000 TO 100,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
POPULATION SERVED PER MILE OF STREET.				
No. of roads not reporting	2	.....	4	6
" " serving less than 2,000 inhabit. per mile	1	.....	1	.....
" " " from 2,000 to 3,000 " "	5	1	1	5
" " " " 3,000 " 4,000 " "	4	1	2	.....
" " " " 4,000 " 5,000 " "	3	.....	.....	1
" " " " 5,000 " 6,000 " "	2	.....	1	1
" " " " 6,000 " 8,000 " "	3	.....	1	.....
" " " over 8,000 "	1	.....	.....	.....
CAR MILEAGE PER CAPITA.				
No. of roads not reporting	4	2	7	8
" " giving a service of less than 5 car miles per capita	1	.....	.....	.....
" " " " of from 5 to 10 " " "	4	.....	1	1
" " " " " 10 " 15 " " "	5	.....	1	2
" " " " " 15 " 20 " " "	4	.....	.....	1
" " " " " 20 " 25 " " "	1	.....	.....	.....
" " " " over 25 " " "	2	.....	.....	2
PASSENGER INCOME.				
No of roads not reporting	1	.....	4	4
" " earning less than $100,000 gross per annum	4	.....	.....	.....
" " " from $100,000 to $125,000 gross per annum	2	.....	.....	1
" " " " 125,000 " 150,000 " "	2	1	.....	.....
" " " " 150,000 " 200.000 " "	4	.....	3	2
" " " " 200.000 " 300,000 " "	6	.....	.....	2
" " " " 300 000 " 400,000 " "	2	1	2	1
" " " over 400,000 " "	.....	.....	1	3
PASSENGER INCOME PER MILE OF STREET.				
No. of roads not reporting	2	.....	4	6
" " earning less than $5,000 per mile	1	.....	.....	.....
" " " " $5,000 " $6,000 per mile	1	.....	1	.....
" " " " 6,000 " 7,000 "	3	1	.....	1
" " " " 7,000 " 8,000 "	.....	.....	.....	1
" " " " 8,000 " 9,000 "	4	.....	.....	.....
" " " " 9,000 " 10,000 "	1	1	2	.....
" " " " 10.000 " 15,000 "	6	.....	2	2
" " " over 15,000 "	3	.....	1	3
PASSENGER INCOME PER CAR MILE.				
No. of roads not reporting	4	2	7	8
" " earning less than 10 cents per car mile	2	.....	.....	.....
" " " from 10 to 15 " " "	5	.....	.....	1
" " " " 15 " 20 " " "	1	.....	.....	1
" " " " 20 " 25 " " "	4	.....	.....	1
" " " " 25 " 30 " " "	2	.....	2	1
" " " " 30 " 35 " " "	3	.....	1	1
PASSENGER INCOME PER CAPITA.				
No. of roads not reporting	1	.....	4	4
" " earning less than $1.50 per capita	3	.....	.....	.....
" " " from $1 50 to $2.00 per capita	2	1	.....	.....
" " " " 2.00 " 2.50 "	4	.....	1	2
" " " " 2.50 " 3.00 "	4	.....	1	2
" " " " 3.00 " 3.50 "	3	.....	1	1
" " " " 3.50 " 4.00 "	2	.....	2	.....
" " " " 4.00 " 4.50 "	2	.....	1	1
" " " " 4.50 " 5.00 "	.....	1	.....	.....
" " " over 5.00 "	.....	.....	.....	3
OPERATING EXPENSES PER CAR MILE.				
No. of roads not reporting	5	2	6	9
" " operating at less than 10 cents per car mile	3	.....	.....	1
" " " from 10 to 15 " "	5	.....	.....	1
" " " " 15 " 20 " "	3	.....	.....	3
" " " " 20 " 25 " "	4	.....	3	.....
" " " " 25 " 30 " "	1	.....	.....	.....
PERCENTAGE OF OPERATING EXPENSES.				
No. of roads not reporting	3	.....	5	6
" " operating at less than 60 % of pass. income	.....	.....	.....	1
" " " from 60 to 65 % " "	.....	.....	.....	3
" " " " 65 " 70 % " "	1	1	.....	2
" " " " 70 " 75 % " "	3	1	.....	.....
" " " " 75 " 80 % " "	6	.....	3	.....
" " " " 80 " 85 % " "	3	.....	2	.....
" " " " 85 " 90 % " "	3	.....	.....	1
" " " " 90 " 95 % " "	2	.....	.....	.....
NET EARNINGS.				
No. of roads not reporting	3	.....	5	6
" " earning less than $20,000 net	3	.....	.....	.....
" " " from $20,000 to $30,000 net	5	.....	.....	.....
" " " " 30,000 " 40,000 "	3	.....	1	1
" " " " 40,000 " 50,000 "	.....	1	1	1
" " " " 50,000 " 75,000 "	4	.....	1	1
" " " " 75,000 " 100,000 "	2	1	2	.....
" " " " 100,000 " 200,000 "	1	.....	.....	4
PERCENTAGE OF NET EARNINGS TO CAPITAL LIABILITIES.				
No. of roads not reporting	3	.....	5	6
" " earning less than 2½ % on capital liabilities	1	.....	1	.....
" " " from 2½ to 5 % " "	2	1	2	4
" " " " 5 " 7½ % " "	5	1	1	.....
" " " " 7½ " 10 % " "	6	.....	1	1
" " " " 10 " 12½ % " "	2	.....	.....	.....
" " " " 12½ " 15 % " "	.....	.....	.....	2
" " " over 15 % " "	2	.....	.....	.....

A CONSOLIDATION of the Savannah (Ga.) roads, it is reported, has been consummated; the City & Suburban Railway being united to the Savannah Electric Railway.

New Electric Railway Apparatus of the Walker Manufacturing Company.

The announcement that the Walker Manufacturing Company, which as our readers well know, has for many years enjoyed the highest reputation in the construction of cable railway equipments, power transmission plants, and all classes of very large machinery, has now added to its extensive business an electrical department, was made in a recent issue. The company now enters the market, ready to supply electric generators for both direct and alternating currents of any capacity, from 150 to 5,000 H. P., with an electro-motive force varying from 500 to 10,000 volts; and a complete line of electric motors for both direct and alternating current work. These new machines, both generators and motors, are constructed for street railway use, ordinary power transmission, mining, also in a special line in which is anticipated large developments in the near future, extra large alternating machines for long distance transmission of power.

The plant of the Walker Manufacturing Company is one of the largest and most complete in the country, and was fully described and illustrated in our Souvenir number for 1892, issued just before the Cleveland Convention of the American Street Railway Association. The buildings cover about 250,000 sq. ft. of ground, are constructed of brick, iron and glass, and are situated on the shore of Lake Erie, at Cleveland, O. The machine shop consists of three long bays, each containing a thirty ton traveling crane, which moves through its entire length. Iron galleries at either end are fitted up as winding rooms, and for the manufacture of insulating materials. The testing room is equipped with switchboards and resistances for testing generators, brakes for testing motors, and a 1,000 H. P. engine will be erected immediately for testing the large multipolar, direct coupled generators. The tracks of the Lake Shore & Michigan Southern Railroad enter the testing room below the floor level, and all machines can be lifted by the large cranes from the testing racks directly to the cars. The pattern shops occupy a large two-story building completely fitted up with modern wood working machinery. Two large foundries occupy another building, and are perfect in their equipment. They contain four mammoth cupolas, spacious core ovens, numerous traveling cranes, from five to thirty tons capacity each. Fifty tons of iron can be poured at once into a single mould, which enables the company to cast its large machines in fewer parts, thereby attaining greater rigidity.

The generator for street railway and direct current power transmission, shown in Fig. 1, is 250 H. P., of the well known four pole type, slow speed. The frame is cast in one piece, with three bearings which are of the ball and socket, self oiling type. The field magnets are of wrought iron, and are wound with enough copper to allow them to run perfectly cold. The armature is series wound, and insulated entirely with mica. With the two path windings—the only kind used by this company—there can be no unbalanced armatures, no sparking and no heating. The windings are entirely below the surface of the armature, which is iron clad, with no binding wires. There are no joints in the windings, except where the wires connect with the commutator bars, and the insulation throughout the entire machine is sufficient to withstand at least ten times its normal requirements. The armature and commutator are thoroughly ventilated, as a current of cool air passes all through the interior of the machine. The commutator is excessively large, and runs cold in regular operation.

The small machines of this type are belted machines, and the larger ones are usually built on the engine shaft.

Experience has taught street railway men that one of the greatest expenses in operating roads by electric motors has been the repairs made necessary by the rapid deterioration of the track and rail joints. The only way to correct this evil is to entirely disconnect the motor itself from iron to iron contact with the axle, and prevent, not only the hammer blow due to the weight of the motor, but the inertia blow due to the unyielding mass of the motor. Attempts have been made to accomplish this by suspending the motor at or near the center of gravity. This eliminates the weight, but not the inertia blow.

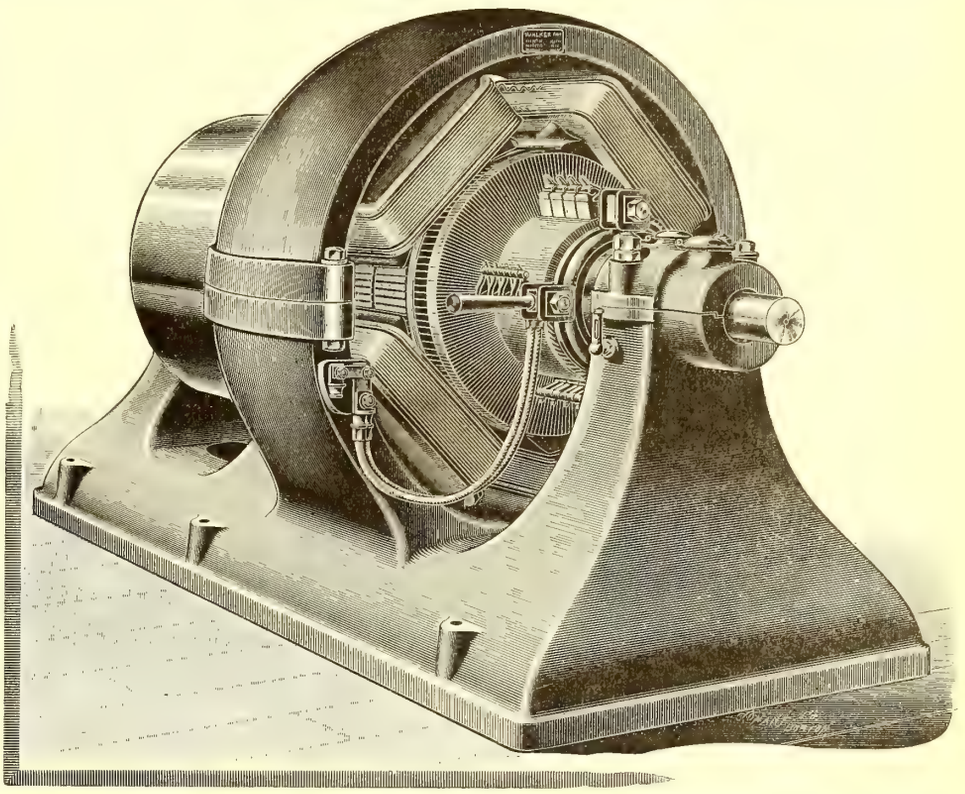


FIG. 1.—WALKER 250 H. P. GENERATOR.

This has forced those interested to the conclusion that the perfect motor must weigh as little as possible, be extremely strong in mechanical construction, should work to twenty-five horse power without heating, and not be in any way attached to the axle and wheels, except through springs which will do away with the hammering of the the track to the greatest possible extent. This method of suspension gives the freedom of movement necessary for the removal of strain in rounding curves. The motor being built by the Walker Manufacturing Company combines these suggestions of practical experience. It is a four pole, steel motor, weighing 1,200 lbs., has an easy capacity of twenty-five horse power, will run at any speed up to twenty-five miles an hour, is controlled by a series-parallel controller of superior type and simplicity, and is not attached to the axle in any way, except through yielding supports.

The illustration (Fig. 2) given shows the general form of the motor, mounted upon thirty inch wheels and ordinary truck, portions of the truck being cut away to enable the motor to be more readily seen. The motor is entirely water and dust tight, the only opening being the lid over the commutator, which enables the two brushes to be easily reached. The frame is in two parts and made of steel. The gear housing and commutator lid are of malleable iron. Both gears and pinions are of steel.

The shaft is large, being three and a half inches in diameter and two and a half inches in the bearings. The bearings are very long and arranged for thorough lubri-

cation with grease. The efficiency of the motor is 90 per cent.

For the better understanding of the flexible support and other important points, detail cuts are shown on this page.

Fig. 3 shows an end elevation of the motor with one wheel taken away. B is a cast iron, U shaped frame, the

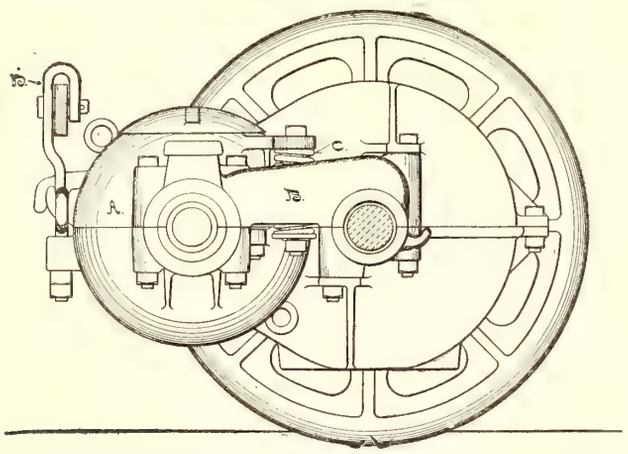


FIG. 3.—METHOD OF SUSPENSION—STEEL MOTOR.

rounded end being journaled on the car axle in the ordinary way. Swinging freely between the arms of this U is the motor, A, trunnioned by its bearings, but not touching the axle. The motor is then supported at the rear by spiral spring, C, between lugs on the frame and the arms of the U, and at the front end is supported by a swinging arm from the ordinary spring truck bar, D. It can be seen that, with this suspension, the motor rides freely on springs, readily adjusting itself to varying conditions, without bringing a strain or shock on any part. The gear centers are always maintained because of the U shaped frame.

Fig. 4 shows how the lower half of the frame is made to swing down, while the armature remains in place, one man being able to let it down and replace it after inspection and cleaning. The armature may be removed, if desired, from below; or, if the motor should not be over a pit, the upper half may be swung up and the armature removed from above.

By referring to the figures it will be seen that all the bearing caps come off from below, and all the bolts pass down from above; and, should a nut come off, no part of the motor can fall. The bolts are not made to take the weight of the motor, and the nuts are all locked with pins.

The bearings are entirely outside of the motor casing or frame, as shown by Fig. 5. They are solid shells, A, filled with the best babbitt and are supported by the bolt, B. The grease, which comes out between the end of the thrust collar and the inner end of the bearing, falls

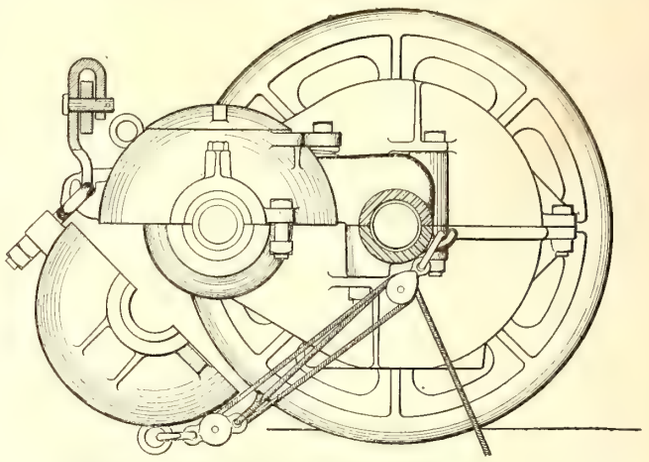


FIG. 4.—METHOD OF REACHING ARMATURE FOR INSPECTION.

to the ground through the opening, C, which is 4 × 2½ ins., and cannot be clogged. No grease can get into the motor.

Fig. 6 shows a section of the armature, the core, A, of which is built on a separate sleeve, which receives the shaft, B. This shaft, when worn out, can be replaced by removing the nut, C, drawing out the shaft and inserting a new one, thus saving the expense of tearing the armature down and rebuilding, as not even a wire connection is disturbed. The commutator is on a tapered portion of the shaft, the same as the pinion, and can be more easily drawn off for refilling. Both commutator and pinion are held in place by nuts properly locked by an ingenious lockwasher.

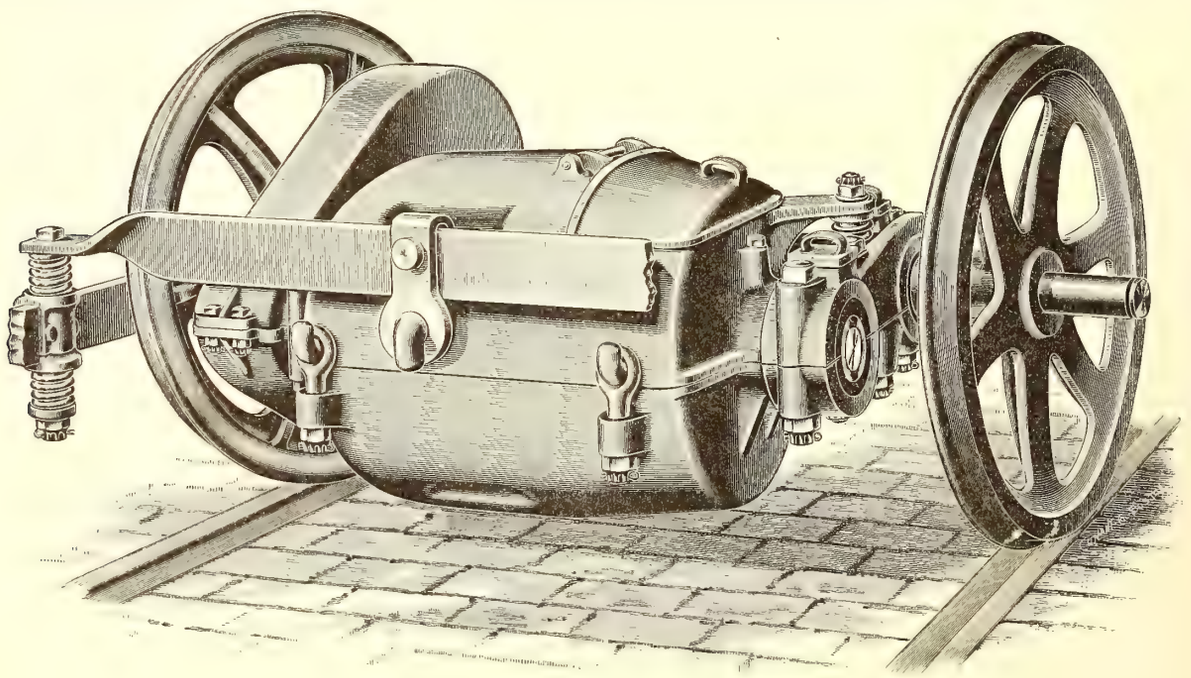


FIG. 2.—WALKER STEEL MOTOR—"SPRING MOUNTED."

This motor contains all the long tried constructional points which experience has proven to work well, and the weak points existing in other types are claimed to be eliminated. Being flexibly supported, it will remove all trouble with rail joints, as in practice the motor runs as quietly as the old horse car. Not even the gear noise is heard, as the gears are enclosed in airtight housings and run in oil. The excellent workmanship, for which the Walker Company is famous, tells greatly in this class of machinery.

The thirty-five horse power motor shown in Fig. 7 weighs 2,500 lbs., and is intended for heavy street railway work, where very large cars or trains of cars are used. It is made of cast iron, and has an efficiency of nearly 90

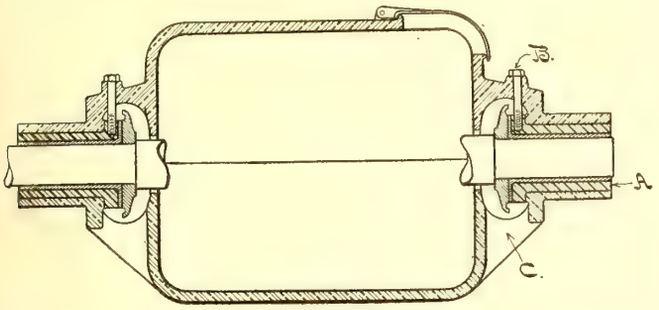


FIG. 5.—BEARINGS OF MOTOR.

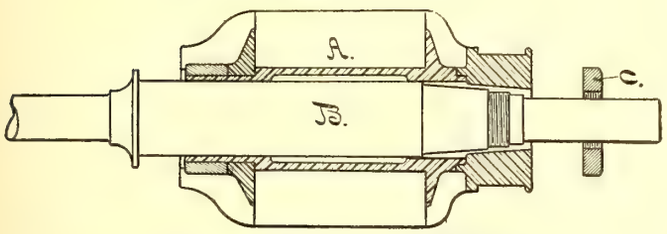


FIG. 6.—SECTION OF ARMATURE.

per cent. It is built on the same general type as the steel motor, but it is not spring mounted, being journaled on the axle like all other makes. This motor is exceedingly small and light for its output, being of about the same weight as other makes of twenty-five horse power capacity. It will operate on thirty inch wheels with plenty of clearance.

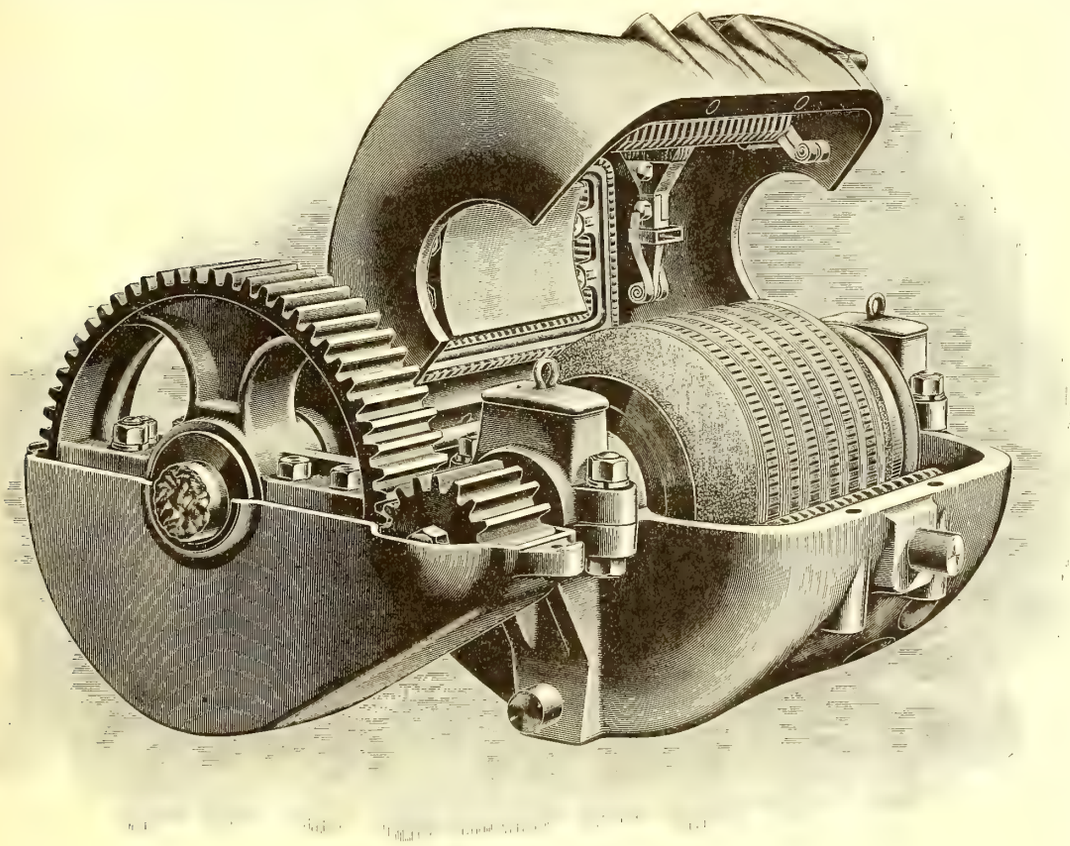


FIG. 7.—CAST IRON MOTOR OPEN.

The designs are already completed for large motors to operate elevated trains, or suburban and interurban railways which will be run at high rates of speed.

The life and activity which the Walker Company is manifesting in entering the market with every kind of electrical machinery required for the largest and most perfect work, the manufacture of apparatus under the supervision of those thoroughly familiar with the detail of electrical machinery, with consequent ability to avoid the experimental stage of the business, and the company's unsurpassed facilities, assure its great future success.

Narrow vs. Broad Gauge Electric Railways.

By E. A. Merrill.

In the discussions that have at various times taken place over the commercial value of electric railway systems radiating from towns into the surrounding country, for the purpose of supplanting the farmer's horse in the transportation of farm supplies and products, and for carrying the farmer himself to and from town, there has several times appeared the suggestion to construct a narrow gauge road, in place of the standard gauge now so universally used. If thereby we can effect an economy while performing the necessary service in an equally satisfactory manner as with the broad gauge, it will certainly be of great advantage to many communities; it is, therefore, of interest to examine the question by comparing the two systems under similar conditions.

The case most frequently met with and which would naturally be first considered, is that of a single center with radiating lines running into the surrounding country. As a fair example we may assume the following conditions, which can be duplicated in many towns with populations varying from 5,000 to 15,000:

Broad gauge to be the standard gauge of four feet eight and a half inches; narrow gauge three feet, this being about as narrow a gauge as motors of the present types can be accommodated to. Length of road twenty-one miles, consisting of three branches of seven miles each, and operated from one power house situated at a central point. Traffic of the ordinary description and distribution, and such that, based on a broad gauge standard, a total of eight thirty foot freight cars, each equipped with two thirty horse power motors, and sixteen sixteen foot passenger cars, each equipped with two twenty-five horse power motors are required, this number being sufficient for all contingencies. Single track with turnouts and sidings, side pole, bracket overhead construction, fifty-six pound T rail for the broad gauge and forty-five poundT rail for the narrow gauge road. Track located at the side of an ordinary country road and no paving required.

Of course in both cases the same traffic must be handled and with equal facilities; to accomplish this will require for the narrow gauge road, sixteen twenty foot freight cars each equipped with two twenty-five H. P. motors, and ten sixteen foot motor and eight sixteen foot trail passenger cars, each motor car being equipped with two fifteen H. P. motors.

Any advantage resulting from the substitution of the narrow gauge for the broad gauge will be found either in decreased first cost, in decreased operating expenses and maintenance, or in both. Assuming that rights of way

are granted without cost, and that preliminary expenses are distributed over the various items in proportion, we may divide the first costs as follows: Real estate, power house, car house, steam plant, electrical plant, cars and equipment, track work, overhead work.

The first five items are dependent on the variation in the sixth, as is also the eighth, while the seventh is independent of any variation in the others, and can be determined by itself alone; taking, therefore, the sixth item first, we find for the broad gauge that there is approximately 144 tons and for the narrow gauge 170 tons of dead weight to be moved with all cars in service, while the live or paying weight is the same in both cases; this difference is not enough to increase the power plant, as we should naturally install surplus power in the first instance at least 25 per cent. in excess of the usual demands; the same would be true of the feeder system if carefully figured, and therefore no increase need be made in the overhead construction account; in the operating expenses, however, the additional dead load would entail increased coal consumption, which we will take into account later. As the steam plant is unchanged, the electrical plant likewise remains constant, and therefore the costs of the first five items and also the last will be the same with either broad or narrow gauge.

The item "Cars and Equipment" will be greater for the narrow gauge road than for the broad gauge of the same capacity; this is due to the fact that the cost of cars does not diminish anywhere near in proportion to the decrease in carrying capacity; the trucks will be but slightly less for the narrow gauge, and the same is also true of the costs of car equipments, the difference in cost between a thirty horse power and fifty horse power equipment being hardly more than nominal; thus the decreased cost of each part is more than overbalanced by the increased number of parts.

In the cost of the track work is found the only source of saving. This item will be considerably less for the narrow gauge road since the number of parts is the same for both gauges, and the costs nearly in proportion to their dimensions, though nowhere near the ratio of gauges or of carrying capacity for the same number of cars. The items of saving are principally in the rails, ties, excavation, labor and freight; there will be but a nominal difference in the costs of deep cuts and fills, bridges, culverts, cleaning, ditching and the like, so that the larger the proportion of these to the total cost the less will be the relative saving.

A substantial broad gauge road of the above description, designed for economy and durability, and built in a thoroughly first class manner, can be erected, under average conditions, for $315,600, the power house and car barn being constructed of brick and iron, the steam plant compound condensing, the electrical plant of high efficiency, the cars and equipments substantial and durable, rails laid on first quality ties of ample dimensions and in a roadbed reasonably ballasted, poles of wood, iron brackets and trolley properly sectioned. The percentages of the total amount for each of the principal items, and for both broad and narrow gauge, are given in the table below, each item covering all charges properly coming under its head, while all preliminary expenses, such as surveys, legal advice, specifications, etc., are distributed over each item in proportion to its size:

RELATIVE COSTS FOR EQUIVALENT CARRYING CAPACITIES.

Part of Equipment.	Broad.	Narrow.
Real estate	.0158	.0158
Power house and car barn	.0350	.0350
Steam plant	.0684	.0684
Electrical plant	.0475	.0475
Cars and equipment	.2154	.2757
Track work	.7911	.3643
Overhead work	.1267	.1267
Total	.9999	.9334

The difference in first cost is 6.65 per cent. of the total amount or $21,000, and the interest on this at 6 per cent. is $1,260 per year, a substantial profit if not offset by increased operating or maintenance charges which we will now examine.

With the exception of "Cars and Equipments" and "Track," the maintenance will be practically the same with either system; the maintenance of cars and equipments will be greater for the narrow gauge road, and about in proportion to the number of cars, maintenance of the track may be less for the narrow gauge, but this is doubtful, as the rail is much lighter, and in any event the difference would probably be balanced by the increased cost of car and equipment maintenance.

On the side of operating expenses, all office expenses for clerk hire, etc., the attendance at the power house, and probably at the car barn, would be the same in either case; the cost of fuel, however, would be somewhat greater for the narrow gauge road, as it has a greater dead load for the same live load, and the loss in the line would also be greater for the same reason; the exact amount would be difficult to estimate, and we will simply charge it on the side of car and equipment maintenance, so as to leave no possible doubt that the latter charge is unbalanced. But it is in the operation of the cars that the greatest difference is found. In operating a system of single units, the expenses, due to conductors and motormen, must increase almost with the number of units; in the present case we have for the narrow gauge road forty cars against twenty-four for the broad gauge, and for operating this additional number at least fifteen extra men would be required, at an annual expense of $9,750, allowing each man an average of $650 per year; the difference between $9,750 and $1,260, or $8,790, represents the annual saving with the broad gauge road; this is 2.7 per cent. of its entire cost, a very substantial increase to the dividends.

For heavier traffic the advantage is still more in favor of the broad gauge, for lighter traffic less favorable, but it is difficult to conceive of a lighter traffic that would be profitable or even pay expenses. So long as we adhere to the single unit, the broad gauge will be more economical than the narrow, but when we take the case of long lines with light traffic accommodated by trains instead of single units, we find a possible field for the narrow gauge road. For example, take a road forty-two miles long, with a traffic accommodated by the cars specified in our first proposition, operated by a system requiring but one power house, and costing the same amount per mile for construction, the operating and maintenance charges will be almost identical, in fact may be less for the narrow gauge, while their respective costs will be $510,600 and $449,600, a saving in favor of the narrow gauge of $61,000. Unfortunately for electric traction, however, such roads are at present both more cheaply constructed and more economically operated by narrow gauge steam locomotives than is possible with any electric system.

Proper Rail Bonding.*

An electric current always chooses the path of least resistance. Hence, when using the earth return, if there should be along the line water pipes the current will naturally take its path along these until it meets a joint of a higher resistance than the surrounding earth, it then takes its course through the earth, but the pipe past this joint being again a continuous and good conductor, the current returns to it, and this operation repeats itself at every joint of high resistance. The water which surrounds the pipe is by this action decomposed, the oxygen going to the anode, the hydrogen being liberated at the cathode. Oxygen in the nascent state is, as we all know, a very active elemen' and, therefore, the iron in the pipes is immediately oxidized and rust 'ormed along the entire space where such action takes place. If there is a great deal of moisture the amount of water thus decomposed is increased, and the destructive action is greater. What is the consequence of this deviation of the current from the pipe to earth and back to the pipe? You will find that the pipe is eaten away at both places, one part being more affected than the other, but on either side of the joint the iron is speckled and bits of it removed, the appearance being very much like the zinc of a Leclanché cell that has been short circuited; this appearance being, as a rule, only along a short zone some few inches each side of the joint.

The many possible causes for damage and losses which exist when using the earth as a return, make me believe strongly in the advocacy

*Abstract of a paper read before the New Orleans Electrical Society by H. J. Malochee, electrical engineer, March 3, 1894.

of the all-metal return, not by means of supplementary wires; not by means of overhead return feeders, but by the simple use of the rails themselves. In order that this system be successful in every particular, it is necessary, of course, that the relative conductivities of the earth and rails be such as to render the amount of current going through the earth absolutely negligible.

Suppose we take, as an example, a double track road, with ninety pound rails, such as are used in all large cities. These rails, being each nine square inches in cross section, and iron and copper being as 1 to 6 in conductivity, the equivalent in copper would be one and a half square inches, and the four rails together would equal six square inches of copper in cross section. The carrying capacity of this conductor would be at least 6,000 amperes, and as compared with No. 0000 wire, in order to have the same conductivity, the number of wires of this size required would be more than twenty-eight. Just think of it! Twenty-eight No. 0000 wires bunched together! How ridiculous it does sound to hear some people speak of using one No. 0 wire, or one No. 0000, or even two of the latter size as supplementary wires, when we have as an absolutely necessary part of the equipment such a splendid path for our current.

It being admitted, therefore, that the rail is the proper thing to use, if it is possible to make it electrically continuous, the problem then resolves itself into properly bonding the joints or otherwise reducing their resistance.

The first idea was the driving of a pin in each rail, wrapping a No. 4 B & S wire around it and soldering. This was, of course, too unmechanical and temporary to be used very long, and I believe that probably not one road out of a hundred could be found thus equipped to-day. Then came the channel pin which consisted of a tapered pin with a channel in it for the reception of the wire; this pin was then driven in a hole in the web of the rail, but this, apart from the poor contact made by the wire is very objectionable on account of its liability to get loose from the constant vibration caused by the passing car wheels; it is also bad on account of the chances for moisture to get in between the iron and the copper, rust the joint out and so on.

After the channel pin came the split bushing which nearly encircles the whole of the bond wire and is better mechanically than the former joints; however, in an electrical sense it is not as good, for the reason that there are four joints between rail and rail, and the moisture can also get between the iron and copper, and by electro-chemical action injure the connection very seriously.

The welding of rail joints was next tried, and probably if this plan were carefully carried out by means of electric welding of the entire cross section of the rail, instead of joining only a portion of it, as was done, this method would be most excellent both in a mechanical and electrical sense.

Some recent devices are the solid end bond, the hollow rivet bond, the Acme bond, and the Vail bond. The solid end bond is made in two sizes eight and a half inches and thirty inches long. It consists of one single piece of from No. 0 to No. 000 wire at each end of which a rivet head and body is formed; this piece is riveted into any portion of the rail in which it is thought best to insert it. The rivet portion of the bond being larger in diameter than the wire itself, the contact with the iron is larger than in the primitive styles of bond wires; further, this contact is made still larger by the fact that the rivet head and that formed by the riveted end are pressed tightly against the side of the web by the riveting, thus forming perhaps as perfect a joint as can be made by the use of a rivet.

The hollow rivet consists in having, instead of a solid rivet at the end, a hollow wire whose outer surface is forced against the walls of the hole in the rail by a tapered iron pin which is hammered into the hollow end of the wire; this end, being split a short distance, may be turned over so as to prevent its getting loose or the pin from backing out. This is mechanically very strong, and, if the surfaces are bright, there should be a very perfect electrical joint, due to the fact that the metal is pushed outwardly at the same rate in every direction, and the two metals can be so clamped together as to form a very intimate connection inside of the hole. In this bond, the size of the outer diameter of the part which goes into the rail is necessarily much larger than the wire itself, and the electrical connection is thus made far more perfect, as will be explained later on.

A very recent addition to the number of good rail bonds is the Acme bond, which consists of a copper sleeve with a tapered end. This sleeve has a channel cut on the side, thus making the wall of the sleeve rather weak in that particular place. The hole is drilled about one-thirty-second of an inch smaller than the largest outside diameter of the sleeve, and this latter is driven over the wire, in the hole in the rail, the connection is made very solid, and the material in the sleeve shapes itself to all the inequalities in the hole and on the wire. The Vail bond has been but very recently designed by J. H. Vail, and is probably one of the best on the market. It is substantially made, and contains a number of advantages which few other bonds have. It consists of two heavy sockets of copper, one on each rail, and connecting cables of copper wires between the two. The sockets have two or more studs which are riveted into the web of the rail, and these, together with the shoulder, when the bond is in position, furnish quite a good electrical connection, provided, of course, the work is done in a thorough manner, and the surfaces are bright at the time of their connection.

Each of these bonds has its own peculiar advantages, but the special, and by far the greatest advantage of these last described bonds, is the increased area of the joint with the rail. In considering the general subject of resistance at the joint, we certainly cannot fail to remember that iron has about one sixth the conductivity of copper, and therefore the area of the junction surface should be no less than six times the area of the copper wire which we use as bonding wire.

This result can of course be reached either by increasing the diameter of the wire or by lengthening the joint. The latter is difficult to do, and it would be costly as compared to the first method. If we adopt the scheme of increasing the diameter, what would be the result of doubling the diameter of the bond wire at the point where it connects with the rail? Suppose we have No. 000 copper bonding wire connected to two rails by holes in the web, this part being three-eighths of an inch thick. The area in square mils of No. 000 B & S wire being 131,790, the area of the joint should therefore properly equal seven times 131,790 sq. mils. The joint if made with No. 000 wire three-eighths of an inch long equals the diameter (410 mils), times 3.1416, times 375 mils, equals 483,000 sq. mils. As we want an area equal to six or seven times 131,790 or 922,530 sq. mils. we can get that area immediately by doubling the area of the wire, and the joint will have an area equal two times 483,000 sq. mils equal 966,000 sq. mils, which makes the conductivity of the iron portion of the joint equal to that of the wire itself. However, what is the conductivity of this wire as compared with that of the iron rail itself? Take a seventy pound rail which is seven square inches in cross section and whose value in terms of copper is one and one-sixth square inches. This bar of copper half an inch thick and two and one third inches wide has a section equal to 1,166,000 cir. mils. And the No. 000 wire has a cross section of 167,805 cir. mils; thus it would take seven No. 000 wires to equal the conductivity of the rail and make it electrically continuous. Whether the seven wires should be used or not would have to be determined by the number of cars to be run, the distance from the power house, etc. In general, I should say that the very heaviest bonds would have to be used nearest the dynamo and the lightest at the farther end of the line. Still, each installation would have to be treated independently according to the special circumstances surrounding it.

A suggestion which was made some time ago and which should receive some attention, in my opinion, is the increase in the length of the rails; this would decrease the number of joints per mile. A number of rolling mills have declared their ability to furnish 100 ft. rails. This alone would reduce the number of joints from 176 the number now used, to fifty-three per mile, making the cost of bonding less, and also decreasing the chances for trouble caused by electrolysis, bad connections, etc.

Another suggestion which seems to be very important is one recently made by Prof. Brown Ayres, of Tulane University, viz., the electric welding of the bonds to the rails. This means of connection is most important, for certainly if we use a bond no matter how large, if we make the area of the connection large enough to counteract the lesser conductivity of the iron, still, if the real jointing of the bond with the rail is not perfect and permanently so, the above provisions for a good return circuit are of little avail. The small cost and light weight of the electric welding machines necessary for such work would make this further provision a very practical remedy for any trouble from electrolysis at the joint, rusting out of the same, and the consequent increased resistance of the bond and rail joint, which after all neutralize any other provision that may have been made to increase the conductivity of the entire return circuit. This method has the advantage over the welding of the rails themselves in so far as the flexibility of the joint is retained and yet the continuity of the metallic circuit is preserved.

Another thing to which I desire to call your special attention is the difference which exists between the various lengths of bond wires, in so far as resistance is concerned. For example: The number of eight and a half inch bonds necessary for one mile of single track have a resistance of .00885 ohm, whereas the thirty inch bonds for the same track would have a resistance of .0265 ohm; this is for No. 0 B. & S. wire. The loss in volts due to the resistance of the bonds themselves, independent of any loss in the joints, would be for that distance, with 100 amperes of current and the eight and a half inch bonds, .88 volt, and with the thirty inch, 2.65 volts.

Is the cost of a thorough bonding excessive and prohibitive? Figures will answer this question. One mile of No. 000 B & S wire weighs 3,380 lbs; at fifteen cents per pound equals $407. This is the cost of the supplementary. Now 176 bonds thirty inches long weigh 275 lbs; at fifteen cents will increase the cost $45, making a total of $452.

As a comparison I will give you the cost of the longest bonds used, say, three feet of wire, No. 0000 B & S. We have seen that in order to make the ninety pound rail electrically continuous we must have seven of these wires bunched together; this equals twenty-one feet at each joint, making for the first 176 joints in the rails a total of 3,700 ft., weighing 2,370 lbs.; at fifteen cents per pound, equals $355. Thus the cost of material is less for heavy bonding as compared to light bonding and one No. 0000 supplementary wire, but the cost of manufacture being probably higher for the special form in which this material is furnished, it is reasonable to think that the entire cost in the two cases would be very nearly the same. However, when it is considered that in one case the circuit has a conductivity of 7, and in the other a conductivity of 2 at the most, no manager would hesitate a minute to adopt the latter method, even if the cost be higher.

What are the conclusions that seem to have been reached? First, we must use our rail for a return circuit. Second, we must make this circuit of greatest conductivity and least resistance. Third, our bonding wires should be of equal carrying capacity to that of the rails. Fourth, the connecting surfaces of these bonds with the iron rail should be no less than seven times the circular milage of the bonds themselves. Fifth, the connection, electrically speaking, should be as perfect as possible, so as not to cause electrolysis at and destruction of the contact. Sixth, the connection from the rails to the dynamo should be amply large to carry the current which it is intended to carry, with practically no loss in that distance. Seventh, the entire cost of a good rail return is no more costly per mile than the return by means of a supplementary and light bond wire.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

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It is Dangerous for a street railway manager to permit himself to lapse into such satisfaction with his achievements in securing the introduction of mechanical traction, as to neglect opportunities for improvements in the many little details that please the patrons, increase the income, and place the business on a substantial financial basis. The operations of every system should be broadened so as to embrace all features which will tend to make the business popular, and to increase the income more rapidly than the expenses. Unless this is done, some rival company may, even without the advantages of location, eventually obtain control of the traffic, or else the directors will manifest a disposition to make a change in the management.

A Correspondent in this issue calls attention to the great desirability of selecting some system of accounting for street railway companies, which will be considered as standard. We are very glad to publish this plea, for we consider the call for a standard, such as that suggested by our correspondent, a most urgent one, and will be glad to give space to any suggestions which our readers have to offer towards a satisfactory solution of this question. The development of the electric railway business has been so rapid that there has been hardly time for the fixing of standards, either in the operating or accounting departments, although the need of such action has been widely felt. Valuable work in this line has been accomplished by the committee on standards of the American Street Railway Association, and we understand that the subject will be taken up carefully by the committee again, in time for the Atlanta Convention.

Boulevards, Neutral Grounds or Reservations in the middle of the streets on which street railways can operate are most desirable features of a modern city street system, and it is a wonder that this method is not followed in the laying out of all new cities, or in the extensions of older cities where the conditions are favorable. There are many advantages that result from this arrangement, both to the city and to the street railway companies. The streets are cheaper to maintain, as it is necessary to pave only a comparatively narrow roadway on each side; the neutral ground can be kept in grass or transformed into a park and bordered with shade trees, so that it always presents an attractive appearance. In the matter of safety to the public it is very desirable, as it admits of a high rate of speed for the cars without danger to persons or vehicles, and in the matter of boarding or leaving a car the passenger is in less danger from passing vehicles. Track repairs do not interfere with the street traffic, the expense of paving the track is obviated, and in addition, a cheap type of rail can be employed. In this respect the street railway companies in many of the Southern cities have an advantage over those at the North, for the operating expenses are generally reduced where these conditions prevail. An ideal street railway city would have a neutral strip on all its main thoroughfares upon which its tracks could be laid.

The Earning Power and Security of an investment are not the only factors determining its value. An important element is the ease with which the capital represented can be withdrawn according to the pleasure or need of the security holder. In other words, the convertibility of any property is the most important consideration affecting its value, and often commands for certain stock or bond issues a relatively higher price than they would otherwise possess. It is for this reason that some steam railroad shares, listed and largely dealt in on the New York and other city exchanges, show quotations much higher than stock in corresponding industrial or mercantile enterprises of the same reliability and earning power, whose shares change hands only at private sale. The securities of street railway companies, except those situated in important cities, have never been largely traded in on stock exchanges, and the general investing public, until recently, has not given this class of securities a great deal of attention. The amount of capital required for the equipment of electric lines, however, has lately given street railway properties financial prominence, and they now form, among many, a favorite investment. The peculiar advantages which they present to capitalists should give them wide sale, and this can be done by listing them on the exchanges and by published reports of the returns at stated times. The value of properties will become generally known in this way, and the convertibility of the stock will give it an added value.

The Importance of Adequate Rail Bonding is a matter that is being brought very prominently to the attention of electric railroad managers all over the country through the agitation on the subject of the damage by electrolysis, of water and gas pipes and metallic subway conduits. Recent investigations in a number of the larger cities where electric roads are being operated show that the electrolytic action has been greater than was supposed, and has been an active agent in the deterioration of the different underground systems. According to well known laws the return current will pass from the car wheels to the station by as many paths as may be

presented, dividing itself among them according to the conductivity presented by each. One remedy then is to provide a metallic return which shall not only have a greater conductivity than that through the earth and pipes, but so much greater that the amount passing by the latter circuit shall be so small as to be practically negligible. If the electrical carrying capacity of the rails is sufficient for this purpose, the problem is one simply of bonding, care being taken to make all parts of the return circuit of equally high conductivity.

"I Am Shriveling Up" said a street railway manager to us recently; "I have been in the employ of this company in various positions for nearly thirty years, and during that time have never traveled outside of this immediate neighborhood for the purpose of studying street railways. I am a casual reader of street railway literature, but having had experience with only animal traction I find it difficult to comprehend what is written regarding other methods. I have had a strong desire to attend the meetings of the American Street Railway Association, and hope to be present at the Atlanta meeting in October, but the directors of this company have never been willing to grant me the time or means." This was from a man whose lines in every particular rank favorably with the half dozen other lines in the same city, yet he feels, as stated above, that his powers are being dwarfed and that his work comes far short of what it might be, had he the opportunities for studying the operations of other lines and of meeting with his fellows engaged in a like occupation. This is one of the many evidences that we find that street railway managers and superintendents, as a general thing, appreciate the advantages to be had from a membership in the American Street Railway Association, but are deprived of its benefits through lack of appreciation on the part of the managing directors. Those who find themselves in this condition would doubtless be able to effect a change and secure more consideration from their employers were they to occasionally place before them the articles that are constantly appearing in this publication regarding special advantages of a membership in the Association.

In the Progress of Electric Traction the South has played an important role and stands to-day with heavy invested interests, not only in railways, but also in the lighting field. Although electricity has had to win its way slowly, it is now being generally introduced and is coming into such favor that it must soon supplant the mule in nearly every Southern city. The first steps have been taken, and well taken, by the introduction of excellent systems in the principal cities, but to stop with present developments would be folly. Electric traction must necessarily advance until all the lines in all the large cities and many of those in smaller cities shall have been equipped after the most improved plans of construction and management. There are many advantages which Southern street railways, especially those in the coast cities, possess over those of the North and West; the routes are generally level; there is no expense for removing snow, and the winters are so mild that the patronage is good all the year; labor is cheap, and where the service is reasonably good the patronage is liberal. Coming as it has, electricity marks an epoch in the material advancement of the South. So great an achievement in this line by and among a people who have been since the war conservative almost to a fault, cannot fail to attract the attention of the financial world, nor to infuse and re-encourage the people of the South themselves to even greater endeavors to utilize their abundant natural resources in other directions. The resulting benefits to Southern cities from the introduction of electric traction cannot be measured by the advancement of this industry alone; the influence radiates into other channels of enterprise. Capital will come from the North and from Europe, and home capital will be unlocked for local and other enterprises. But the process of transformation from animal to electric traction is as yet barely inaugurated. The number of lines already equipped does not even approximate the number invited by the needs of the present or the early future. Naturally the South has shared in the industrial depression which the entire country has experienced during the last few months, but Southern street railways have weathered the storm well and have shown, during this ordeal, that they had behind them as a reserve power unequaled natural advantages. This fact having been demonstrated, Southern street railway investments will attract the confidence and respect of the outer world. Capital must also soon recognize these advantages, and the surplus which is now comparatively idle will begin to move; in fact, it is already peeping forth from the hiding places it has occupied during the period of business depression. Unless all signs fail, the South is entering upon a period of the broadest and most profitable activity which it has ever known, and which will be fully manifest when the clouds that have lowered over the financial horizon of the entire country for the past few years shall have rolled away.

Directors are not usually as careful students of street railway problems as are the superintendents or other executive officers. This fact is frequently accountable for faulty construction and poor discipline for which the manager himself, unfortunately, bears the censure of the public. We have in mind an electric system on which the construction is first class in every particular, except the roadbed, but this is in a most deplorable condition. On inquiry it was found that in the original construction the judgment and advice of the superintendent were ignored, and now he is blamed to a certain degree by the directors. The same is sometimes true of discipline, in cases, for instance, where the selection and discharge of employes is in the hands of a committee or of an officer who is influenced more or less by political motives rather than the best good of the service. It may be stated, as an axiom, that in order to secure good discipline, and consequently good service, the management of the men should be entirely in the hands of an officer whose duties bring him in contact with the employes, and through him all orders should be issued. In the street railway service this work generally belongs to the superintendent or manager, who should be allowed the largest liberty and then held strictly responsible for the results. If he proves incompetent, the services of another should be secured, but a two headed or mixed management will never succeed. The employes will learn to disobey one or the other and form a contempt for both. The financial head of the street railway system should not undertake to control the operating department, because in the multitude of duties which devolve upon him he can rarely give sufficient attention to important questions of operation or to the selection of motormen and conductors who

will efficiently and honestly perform their dutes. It should be the aim of every street railway company to employ good men and then keep them as long as possible in the service. In the matter of accidents, no company, however prosperous, can ignore the safety of its patrons. If heavy damages are not sufficient inducements for solicitude in this respect, it is still true that one life is worth more than all the railways in the city, and a sense of danger on the part of a community from reckless running will soon result in hostile local legislation, which will tend to injure the street railway business at large, for what is done in one city in the way of municipal regulations is likely to be adopted in other cities. No street railway company, however poor or prosperous, has a right to ignore general practice in methods of discipline or management. There is an invisible bond uniting the companies of the entire country, so that the acts of one affect all the others for good or evil. This bond can be strengthened by a membership in the American Street Railway Association, which is designed to give to all the results of others' practice, and assist in defending their local rights, while it tends to lift the entire service to a higher standard of excellence. There is a science in street railway business, in so far as management is concerned, whatever may be said regarding the mechanical department, and every one in the business is bound to study it, or failure will be the result.

An Extensive New Electric Railway System in Brooklyn.

Contracts which called for about 100 miles of electric railway track to be laid in Brooklyn, were let last month, and construction on the road will be begun promptly. The company interested is the Nassau Electric Railway Company, which was organized some time ago, by P. H. Flynn, of Brooklyn. Franchises were secured at that time, but work was not commenced. Among those interested at present are A. L. Johnson, of Cleveland, R. T. Wilson the New York banker, and others. A number of erroneous statements have been published in the daily papers in regard to this road, so that the following facts will be of interest:

The rail used will be the heaviest which has ever been laid for street railway purposes in Brooklyn, and will be a nine inch, ninety-three pound Johnson girder rail. The electric welding process will be used, and several portable electric welders, similar to those used on the West End Railway, of Boston, have been ordered for this work. The special work will be about the only part of the track which will be bolted. The rails will be laid on ties measuring 5 × 8 ins. × 7 ft. They will be of yellow pine and laid two and a half feet between centers.

Construction is to be commenced on two routes, one extending from 39th Street, South Brooklyn, to the Broadway Ferry, through a number of the principal thoroughfares of Brooklyn, a distance of about eight and a half miles. The second line will extend from Broadway to Canarsie. Probably only from thirty to forty miles of track will be laid this summer.

The plans for the road contemplate the ultimate erection of two or more power stations, but at present only one will be built. The site of this will be at the foot of 39th Street, Brooklyn, where it will be located on New York Bay, and will have the best of facilities for the receipt of fuel, etc., and plenty of salt water for condensing purposes.

The station to be built will measure 120 × 157 ft., and will have an ultimate capacity of 5,000 H. P. The Babcox & Wilcox boilers will be used, and an independent stack will be built for each battery of boilers. No automatic stokers will be used and no force draught apparatus will be installed. The engines will be of the Corliss type, and three of 750 H. P. each will be employed until the needs of the traffic are such that a larger capacity in steam power is needed. The engines will be direct connected to the generators which will be of the Westinghouse type.

The rolling stock will be supplied by the John Stephenson Company, Ltd., of New York, which has the order for sixty closed cars, and will be extremely tasteful and handsome. The cars will be equipped with Westinghouse motors.

Legal.

Electric Street Railway—Injunction. 1. The use of a street for an electric railway will not be enjoined because the construction of the track will prevent an abutting owner from loading his drays by standing them at right angles to the sidewalk, such a method of obstructing the use of the streets being in violation of a city ordinance.

2. The operation of an electric street railway by the overhead wire system is not so dangerous to those who reside or do business on a public street as to authorize its restraint by injunction.

Louisville Bagging Man'f'g. v. *Cent. Pass. Ry. Co.*, Ky. Ct. of App., October 24, 1893.

Elevated Railway—Consent of Property Owners to Construct. Where, by a written instrument, not under seal, owners of land bounded on certain streets, to whom they had no title, gave unconditional "consent to the construction and operation of an elevated railroad over and through and along such streets," by a designated company, which, with others, afterwards built and operated the road.

Held, that such consent, after being acted on by the company, operated as an abandonment by such owners of their easement in the street, so far as was reasonably necessary for the construction and operation of such road, and that they or their successors in title could not revoke such consent, and recover damages already sustained, and enjoin the further operation of such road.

White et al. v. *Manhattan Ry. Co. et al*, N. Y. C. A., October 3, 1893.

Street Railways—Negligence—Contributory Negligence—Expert Testimony—Pleadings. In an action by plaintiff against the defendant company in which the latter appeals from an adverse judgment it is

Held, 1. That the jury are warranted in finding that an electric street railway company was negligent in sounding the gong, and not slacking the speed of a car which was coming up behind an obviously frightened team.

2. Whether a woman who drove from a cross street into a street on which was an electric railway without looking to see if a car was approaching, and who was injured by the horse becoming frightened at a car, was guilty of contributory negligence, is a question for the jury.

3. Whether it was contributory negligence for a woman to drive a horse on a street on which there was an electric railway, and where the horse became frightened and injured her, is a question for the jury.

4. A general averment of negligence on the part of a street railway company in running its car is sufficient to include negligence in sounding the gong on approaching a frightened team.

5. In an action for injuries claimed to have resulted in a miscarriage, a physician may be asked whether an accident would, under certain circumstances, cause a miscarriage, and the effect of such an accident on a pregnant woman. Exception to plaintiff's judgment overruled.

Benjamin v. *Holyoke St. Ry. Co.*, Mass. S. J. C., November 20, 1893.

The Belgian Consul at Adrianople writes that a street railway will be built in that city. Engineers are already engaged upon the plans.

EDITORIAL CORRESPONDENCE.

MONTGOMERY, MOBILE, NEW ORLEANS—PART I.

Montgomery.

What was said of Charleston in our last issue, as being the spot where the first scenes of our civil war were laid, is partially true of Montgomery, for this city was also prominently identified with the "Lost Cause," and is aptly styled the "Cradle of the Confederacy," for here on the front steps of the State Capitol, on February 4, 1861, the first assembly of the delegates of the six seceding states was held, and here was organized the Government of the Confederate States of America. On the front steps of the Capitol, Jefferson Davis was inaugurated President, on February 18, 1861, with A. H. Stevens as Vice-President. One of the most interesting relics of the early days of the Confederacy is the bible on which Mr. Davis took the oath of office, and which is carefully preserved in the Treasurer's office in the Capitol. The fly leaf bears the following record: "The oath of office as First President of the Provincial Government of the Confederate States of America was administered to Jefferson Davis upon this bible by Howell Cobb, President of the Provincial Congress, at the front portico of the Capitol at Montgomery, on the 18th day of February, 1861."

The Confederate White House, as it is still known, is also a relic of the "Lost Cause," it being the home of Mr. Davis after his inauguration until the removal of the Capitol to Richmond.

Montgomery is not only prominently identified with the early days of a civil power which has passed from the nations of the earth forever, but is also inseparably connected with a mechanical power which is rapidly revolutionizing transit methods, not only in this country, but throughout the world, and which doubtless will be as durable as civilization itself. We refer to electricity as a motive power, and the early experiment, in its application to street railway purposes, made by Charles J. Van Depoele, in 1887, by the equipping of nine miles of track in Montgomery with the overhead trolley system.



FIG. 1.—VIEW ON DEXTER AVENUE—MONTGOMERY, ALA.

Although the experiment in this particular case proved a failure, because of several unfortunate accidents, including the killing of a horse of Governor Seay, from coming in contact with a fallen wire, and later the burning of the car station, yet it paved the way for the final success of the system which is now so general, and which is being successfully employed on the principal railway lines of Montgomery; although it was later installed here in the face of strong prejudice and protest on the part of the citizens, all of which is now forgotten, while every facility is offered for the development of new lines.



FIG. 2.—STATE CAPITOL AND CONFEDERATE MONUMENT—MONTGOMERY, ALA.

Montgomery, a city of about 30,000 inhabitants, is delightfully located in the basin formed by a row of hills which rise to the height of 100 ft. or more above the bluffs of the Alabama River, on the south or east bank of which it is located. The city is forty miles below the union of the Coosa and Tallapoosa rivers, and 400 miles above Mobile. The river is navigable all the year, and has recently been improved, so that boats now enter the Coosa River for a considerable distance, from which direct shipments are made to the Gulf of Mexico. Added to the facilities of river transportation, Montgomery has excellent railroad connection with all parts of the state and neighboring states, and being surrounded by a region embracing one of the richest agricultural districts of the state, the soil of which is composed of black prairie and river bottom lands; it has all of the important factors for becoming a large and prosperous city.

The elevation of the city provides for splendid natural drainage, which is supplemented by an improved plan of sanitary sewers, and it is claimed to be one of the healthiest cities in the world, the annual death rate for a long period, including both races, being only thirteen per 1,000 of population. The mean annual temperature for a period of fifteen years was 64 degs. and the average rainfall, fifty-five inches. The city is supplied with exceptionally pure water from artesian wells, and the water works system is very complete, consisting of duplex pumping engines, which draw their supplies from reservoirs, into

which the water flows from the wells, and by which it is forced into a stand pipe twenty-six feet in diameter and 105 ft. high, located on one of the highest ridges back of the city, and which gives in the mains an average pressure of 110 lbs. per square inch. Connected with the water works system is a beautful fountain located in Court Square at the foot of Dexter Avenue. The fountain is in the center of a large artificial basin and is of bronze, twenty-five feet high and has twenty-five water jets. The decorative work consists of four female figures and four storks of life size, with a swan at the apex, riding the waves and supporting a female figure holding a child in her arms.

Dexter Avenue is the principal street of the city, and extends in an easterly direction from the fountain on a gentle slope to the crest of the highest hill in the vicinity, where is located the State Capitol, one of the most striking and symmetrical public buildings in the country. (Fig. 1.) The material is of brick covered with white plaster, giving it the appearance at a distance of marble. From the dome of the Capitol is had a fine view of the city and surrounding country and near by stands the Confederate Monument (Fig. 2) of attractive design; and

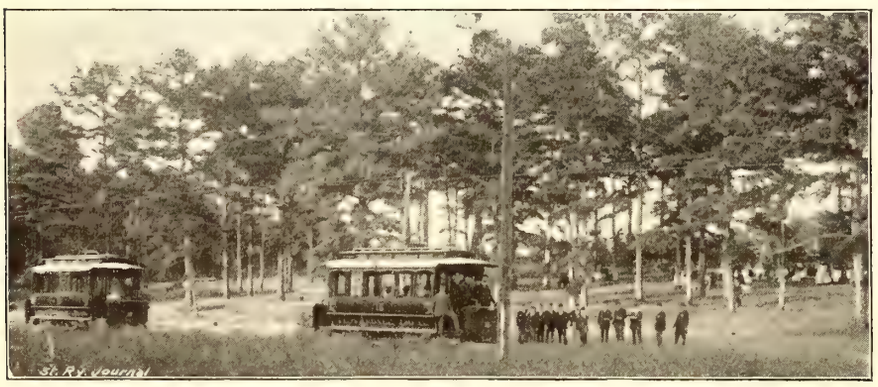


FIG. 3.—CLOVERDALE PARK—MONTGOMERY STREET RAILWAY.

on the eastern slope, which is back of the Capitol grounds, is one of the finest public school buildings of the state.

Only a portion of the business streets are paved, so that the streets become very muddy during wet weather. A scheme is on foot for increasing the area of paving, and we know of no city where it will be better appreciated.

THE STREET RAILWAY LINES

are controlled by two companies, the principal one of which is the Montgomery Street Railway, of which J. W. Dimmick is president, and Ed. L. Coolahan general manager. The cars are operated both by electricity and animal power. The work of electrifying the entire system is, however, in progress, when some of the routes now operated by animal power will be changed and the lines straightened, so as to avoid some of the troublesome curves and grades. The tracks will be extended into new territory and a much more satisfactory service than now provided. No other Southern city, in our opinion, affords better inducements for street railway development than this. Although a large proportion of the population is of the colored race, a liberal patronage is awarded the street railway lines, and in the extension of the lines the routes are being planned to accommodate the settlements of colored people in different parts of the city.

The Montgomery Street Railway is a consolidation of the Montgomery Terminal Street Railway Company and the Montgomery & Cloverdale Electric Railway Company. The electric equipment consists of seven fourteen foot motor cars built by the New Castle Car Company, mounted on McGuire trucks and provided with a double equipment of W. P. 30 Thomson-Houston motors. The electric lines operate over two routes which center at the basin, foot of Dexter Avenue, one of which extends to Cloverdale Park, on which the cars are run on an eighteen minute headway and the other to Highland Park with a headway of twenty minutes. The latter line runs for a short distance on Dexter Avenue, where the overhead construction is supported on center poles, the avenue being very wide, so that the tracks occupy a reservation in the middle of the street.

Considerable attention is given to park attractions as a means of increasing traffic, and in the summer season music is provided at the parks by the street railway company.

Preparations are being made to open a new base ball park, and an extension of one of the lines will be laid to connect with it.

The cars are run without conductors or trolley boys, fare boxes being employed, and registers which the motorman operates as the passengers board the car. At one time trolley boys were employed, but proved so inefficient that they were taken off. Frequently they would allow other boys to congregate on the rear platforms of the cars, and were generally indifferent to the interests of the passengers who seem to be quite reconciled to the use of cars without conductors. Very little trouble is experienced from the trolley wheel leaving the wire at crossings or curves, the motorman being naturally more cautious than when some one else is looking after the trolley. The cars are provided with bullseyes of different colored glass at both ends and in the middle of the side deck lights to indicate the routes. These are provided with slides of different colored glass, so that the colors can be changed when the car is transferred from one route to another.

The motormen are paid ten cents an hour, and work sixteen hours and forty minutes a day, with time off for meals. The first car starts out at six o'clock in the morning, and all are in at eleven o'clock at night, except on special occasions, when a later run is made.

Formerly the power was generated in the company's own station, which was located at Cloverdale Park, but this has been abandoned, as being too far from the city, and the generators have been transferred to the Montgomery Light Company's station in the city, where space is rented and steam for operating them is provided by the Light Company. The two engines formerly employed in the company's station are for sale. They are of 125 H. P. each, of the high speed, tandem compound type, and were manufactured by Dick & Church, at Meadville, Pa.

One line of about two miles is still operated by mule power, and for this purpose sixteen mules are now employed. The animals are very small, weighing not over 500 or 600 lbs. each, and are driven double to the cars. In connection with the re-equipping of the system for mechanical traction, the present car barns and stables, which are located on a large lot on the heights near the Capitol, will be remodeled for car storage and repairs. Pits will be provided and the barn trackage will be on a grade sufficient for running out the cars by hand in case of fire.

West End & Riverside Park Electric Railway Company.

This system, which is principally owned by Dr. Samuel D. Seelye, operates four miles of line with four cars at present. The cars were built by Brill, and are equipped with Westinghouse motors. This company has also followed the example of the Montgomery Electric Railway, and has abandoned its power station and removed its generators to the plant of the Montgomery Light Company, as it was found too expensive to operate so small a plant. The station equipment consists of one Westinghouse high speed, compound engine of 125 H. P., and a Westinghouse W. P. generator of 150 H. P.

Montgomery Light Company.

This company, which is under the supervision of W. B. Barrett, supplies both arc and incandescent lights for city purposes and power for stationary motors, and also rents space for the generators employed in furnishing power for the street railways, as noted above. The sta-

tion occupies a very plain building on the banks of the Montgomery River on the north side of the city. The power equipment of the station, besides the railway generators, consists of one Atlas-Corliss engine of 250 H. P., and one Armington & Sims high speed engine of 80 H. P. and one 90 H. P. Cummer engine, made by the Kibby

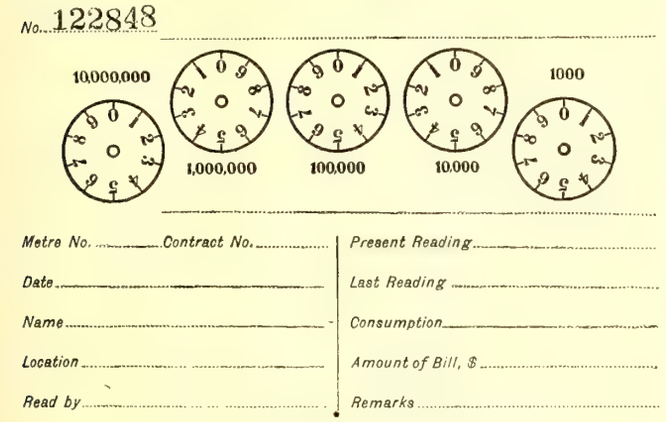


FIG. 4.—METER BLANK—MONTGOMERY LIGHT CO.

Manufacturing Company of Cleveland. There are four Thomson-Houston fifty light, arc machines, and two Westinghouse incandescent light machines, which supply power for 1,750 lights. The fuel consists of Mildale run-of-mine coal, costing $2.30 a ton delivered. The street railway companies pay a certain price per horse power hour for power, and for measuring the amount consumed



FIG. 5.—STREET SCENE—MOBILE STREET RAILWAY.

meters are provided, and a representative of the railway company takes the record of the meters twice a day, and keeps the records of the readings on blanks provided for the purpose. These blanks are printed in sets of three on perforated sheets, and are bound in book form, each blank having five meter dials printed on the face, so that in addition to the printed record the position of the register hands is indicated on the dials with pencil, thus providing a durable record. (Fig. 4.)

HOW TO REACH MONTGOMERY.

Visitors to the Atlanta Convention in October will fiud that it will amply pay them to make a trip to Montgomery over the lines of the Atlanta, West Point & Western Railway of Alabama, the distance being 175 miles. The route is through one of the most pleasant portions of the states of Georgia and Alabama, along the principal cotton belt. Many of the houses along the line fifty miles out from Atlanta are very fine, and there is a general air of prosperity superior to that found along the route of any other Southern road over which we have traveled. The line is one of the oldest railways in the country, the first section having been built in 1836; it now forms a part of the Great Trunk Line of the Richmond & Danville system, from New York to New Orleans, and is known as the model railway of the South. The roadbed is in excellent condition, and the trains are run at a high rate of speed, making the trip a most enjoyable one.

Mobile.

"Great Expectations" may be said to be the characteristic state of mind of the people of most of the Southern cities, and they have been the food on which the inhabitants have fed for a number of years. This is strikingly true of Mobile, but the indications are that these expectations regarding future greatness and prosperity are to be more quickly realized by this city than by any of her sister coast cities, for the natural advantages of her location, which give her unsurpassed inland and ocean shipping facilities, together with a healthy and delightful climate, insure her rapid growth and development. It only remains for the merchants and manufacturers of the middle West, or the great empire dominated by Kansas City, St. Louis and Cincinnati, to appreciate the importance of distributing the products of this vast region to the people of the world through this Southern port, and of receiving through this same channel foreign fruits and products for home consumption. Nature doubtless designed that Mobile should be the principal outlet for this region, as it is considerably nearer to the cities mentioned than any other Southern port, but the artificial influences of trade have heretofore diverted the products of this region to New York and the New England ports. The conditions are now changing, because the people of the South and West are acting together with a new companionship that must produce the anticipated results.

Mobile is located on the west bank of the Alabama River, about three-quarters of a mile from the head of Mobile Bay, and twenty-eight miles from the Gulf of Mexico. It is the largest city in the state of Alabama, and the only seaport in the state. Mobile Bay is about twelve miles wide, and is bounded on the east by high bluffs. There is a wide channel of sufficient depth for the largest vessel plying in the Gulf of Mexico, and this channel is now being improved by the general government, and it is expected that it will soon be open for the reception of the largest sea going vessels. The city owes its great importance to its location at the mouth of the Alabama River system, which is composed of the Alabama and three or four other rivers which enter the bay at near the same point, and which have a navigable mileage of over 1,000 miles. The location is a sandy plateau almost on a level with the water in the river, but which gradually rises and terminates in a range of hills about seven miles west of the city, which have an elevation of about 200 ft. There are six or seven miles of well improved river frontage, with sufficient depth for loading and unloading large vessels. Owing to the presence of water near the surface, as noted above, a system of surface sewers prevails. A complete underground system is about to be installed, however, when the streets will be more generally paved. The paving consists quite generally of brick and cedar blocks.

The city is bountifully supplied with almost chemic-

ally pure water, which is obtained from boiling springs in the heights about eleven miles west of the city. The Holley system of supply is employed, there being two pumps with a daily capacity of 6,000,000 gals each. A storage reservoir is located at a distance of seven and a half miles from the city, which has an elevation above the city of 208 ft. During the day the supply is direct from the pumps, but at night it is drawn from the reservoirs, and the pumps are idle.

The cotton export business has increased slowly but steadily during the last few years. There has been a large increase in lumber and coal shipments, and in the tropical fruit trade, which has been diverted from New Orleans on account of more direct shipping facilities to the interior and because of lower port charges. On the completion of the harbor improvements it is expected that the port will become a prominent coaling station for sea going vessels, as the price of steam coal delivered in the vessel's bunkers will be as low as $1.25 per ton, making it the cheapest coaling point in the world. The city is not only important from a commercial standpoint, but as a winter health resort it is taking rank with the heretofore more prominent coast cities.

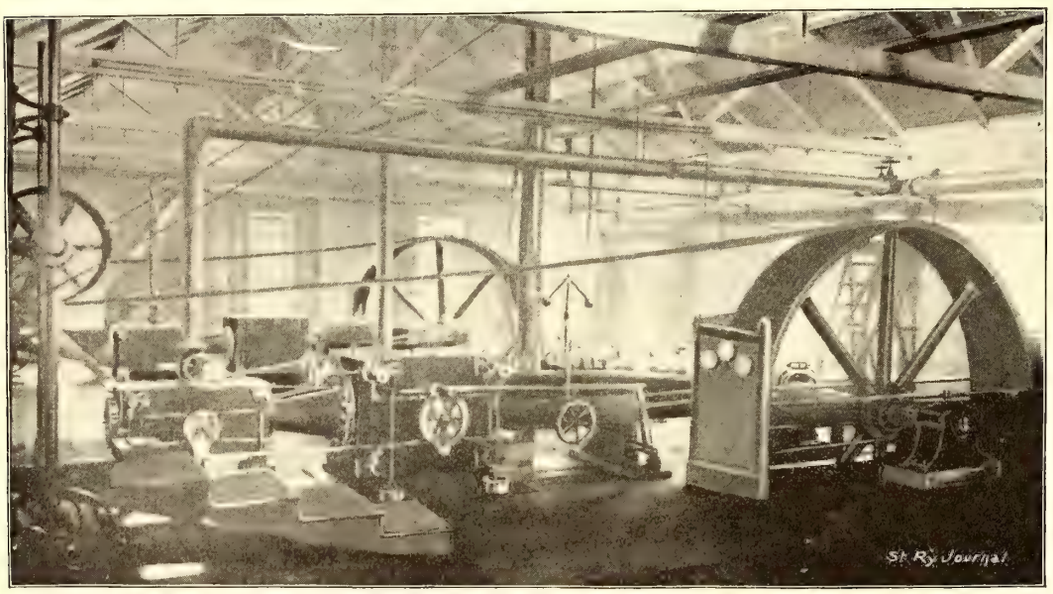


FIG. 6.—ENGINE ROOM—MOBILE LIGHT & RAILWAY CO.

It is quite natural that a stranger visiting the city should look for the first evidence of the internal growth, and we find it strikingly illustrated in her admirable system of

ELECTRIC RAILWAYS.

These are controlled by three companies, and the two principal systems are as well built and as ably managed as almost any other lines in the country.

Mobile Light & Railway Company.

This company operates one of the street railway systems and also furnishes light and power for city and house purposes. John Wilson, of Leavenworth, Kan., is president; J. H. Wilson is vice-president and general manager; A. J. Peaper is secretary. The railway system embraces eight and one-half miles of single track line, which was electrically equipped in April, 1893, and which is now being considerably extended. The rolling stock consists of thirteen motor cars and thirteen open trail cars. The average number daily run in winter is eight. The electrical equipment embraces both Thomson-Houston and Westinghouse motors, single equipments of twenty-five horse power each. The closed cars are of Brill manufacture and the open cars were made by Stephenson and Pullman and have trucks by the same makers. The cars are provided with a narrow sheet iron false dash, which is lettered to indicate the route, and which is supported across the top of the main dash by means of hooks. These adjustable signs or dashes are provided so that they can be changed when cars are transferred from one route to another. Steel wire brushes are also provided for cleaning the sand off the rails. Men are constantly employed to keep the rails free from sand.

The tracks are laid with forty-five pound T rail, and in some cases oyster shells and gravel are employed as ballast. The rails are cross bonded at every third rail and the return is grounded every 1,000 ft. The lines extend through some of the most populous districts of the city and connect with a number of parks and run in the neighborhood of the principal cemeteries. The pleasure riding in Mobile is an important factor in the street railway business and all the companies cater to this traffic to a greater or less extent. The Light & Railway Company owns Monroe Park and provides music and other attractions. One of the routes also terminates at Frascata Park, which is located on the Bay just south of the city. On the north side of the park is a base ball ground with a large grand stand. The park proper is shaded with numerous large, moss draped, live oaks, magnolias and other evergreen trees. There is a music stand, and seats are provided all about for the comfort of visitors. This park is protected on the shore side by a substantial wall, and between the wall and the river is the famous shell road which skirts the bay on the west shore for a distance of about seven miles, being shaded by venerable oaks, and is pronounced by all to be one of the loveliest drives to be found in the country. Adjoining the park is an extensive tract where is held the annual encampment of the state militia, the location being one of the most desirable parade grounds to be found anywhere. The Light & Railway Company is improving Monroe Park on the side of the bay, and during the coming season proposes to construct a new pier extending 1,200 ft. from the shore, which will be provided with pavilion and other accommodations.

POWER STATION.

The light and power stations occupy the same building, which is located just out of the business center of the city, and within a block or two from the river. The building is of brick with double gables, and the ground dimensions are 130×95 ft., with a boiler house 30×60 ft. The smokestack is of iron 100 ft. in height with an ornamental top. This is the only smokestack in the city that stood the fury of the October cyclone.

The present steam equipment consists of three Stirling boilers of 300, 200 and 150 H. P. respectively. Alabama coal is employed for fuel, but it is proposed soon to burn slab wood, which can be purchased from the neighboring saw mills at a cost of about forty-five cents per cord. The feedwater is taken from the city mains, but for condensing purposes water from three inch driven wells is employed, there being eight wells, which are from forty to fifty feet in depth, supplying 100 gals. per minute each.

The power is supplied by two compound Hamilton Corliss engines of 300 and 200 H. P., with condensing apparatus. The power is transmitted by leather belts to a countershaft, which is supported some distance above the floor by timber pedestals. Adjustable idler pulleys are employed as belt tighteners with the engine belts, which are mounted in sliding frames provided with a crank and gear mechanism for raising and lowering the pulleys.

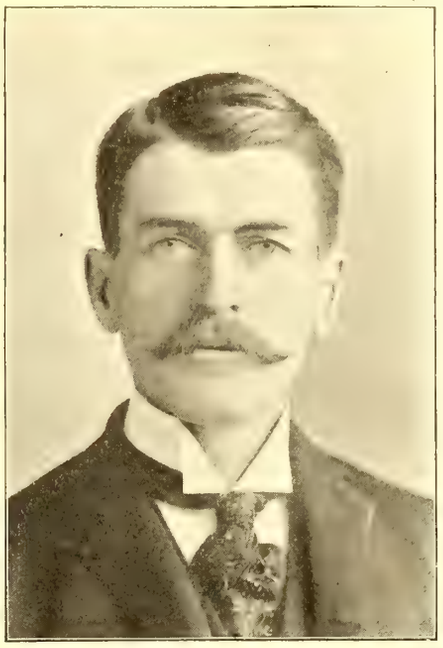
The railway and lighting generators are driven from

the countershaft. Those for the railway plant are one General Electric M. P. 100, and one Westinghouse 150 H. P. type, and the latter three Westinghouse 60 K. W. alternaters. The lighting equipment is also soon to be increased by the addition of new generators.

Employes are paid the same as the employes of the other roads described above. The fare is five cents, with twenty-two tickets for $1. School tickets are sold forty for $1, or $1 a month, which are used only on school days.



J. WILSON,
PRESIDENT MOBILE LIGHT & RAILWAY CO.



J. H. WILSON,
GEN. MAN. MOBILE LIGHT & RAILWAY CO.

The Mobile Street Railway Company,

operates twenty-one miles of track, and the system is under the management of Raphael Semmes, a gentleman well known to the street railway fraternity. Mr. Semmes is the only executive officer of the company residing in Mobile, and under his direction the lines were changed from animal to electric traction, the work having been begun in May last, and completed and put in operation on the 16th of August. The rolling stock consists of twenty closed and twenty open cars; the former were built by Stephenson, and the latter in the company's shops. The open cars are not yet electrically equipped. The closed cars are painted white, and look clean and inviting. They are mounted on Baltimore trucks, with wheels by the same makers, and are equipped with Thomson-Houston twenty-five horse power motors.

Attached to the front of the trucks are adjustable wire brushes for removing the sand from the rails. These are raised or lowered by the motorman by means of an adjustable rod, supported against the dash. The soil being exceedingly sandy, the brushes are essential as track cleaners. At some crossings and at curves on unpaved streets where the street traffic is heavy, men are employed for cleaning the sand from the rails The side steps of the open cars are hinged so that they may be turned up against the side of the car and fastened with a chain, when by putting a bar through the post hand rails the passengers are compelled to get on and off the cars on one side only, a very desirable arrangement.

The track construction on paved streets consists of the sixty pound, five inch girder rail, resting on bulb chairs with ties two and a half feet apart. Ten miles of the construction consists of forty-five pound T rail. Oyster shells and cinders are employed to a considerable extent as ballast, as is also sand and gravel, which are brought into the port as ship ballast. Cobble stones are employed to a limited extent as paving, having been brought as ballast to the port. The principal paving, however, consists of juniper blocks. Three or four squares have recently been paved with vitrified brick, as an experiment.



FIG. 8.—INTERIOR OF DYNAMO ROOM—MOBILE LIGHT & RAILWAY CO.

The turnouts on the line, as a general thing, are located at the curves, so that approaching cars can be seen in both directions. There are no grades on the line of the Mobile Street Railway Company greater then 1 per cent., and this for only a short distance. There is quite a complicated special construction at the corner of Government and Royal Streets, made necessary for passing each side of the Semmes Monument which stands at the intersection of these streets, near the City Hall. The monument is being erected to the memory of Commodore Semmes, but is yet in an unfinished condition. The overhead construction is supported on wooden poles which are of sufficient height to support a guard wire, but guard wires have not been employed to a very great extent. A movement has recently been started, however, by the city authorities to compel the railway companies to provide guard wires. It is a question, however, whether there is any advantage in their use, many cities where they have been employed having discarded them.

The car barn and power station are located at the corner of Royal and Canal Streets, just south of the business center of the city. The building is of brick, 319 × 50 ft., and the car station in the rear of the car barn is separated from it by fireproof walls and doors. The engine room is 53 × 69 ft., and the boiler room, 40 × 69 ft. The car barn is a one story building, and the power station a story and a half. The office and store room are located in a wing which extends in front of the building towards the street, and the repair shops are partitioned off from the side of the car sheds. The smokestack is of iron, six feet in diameter and seventy-five feet in height,

resting on a brick base twenty feet in height. The stack was blown over during the severe cyclone of October 2, but has been replaced and repaired. The car barn contains five storage tracks, with capacity for fifty cars. The

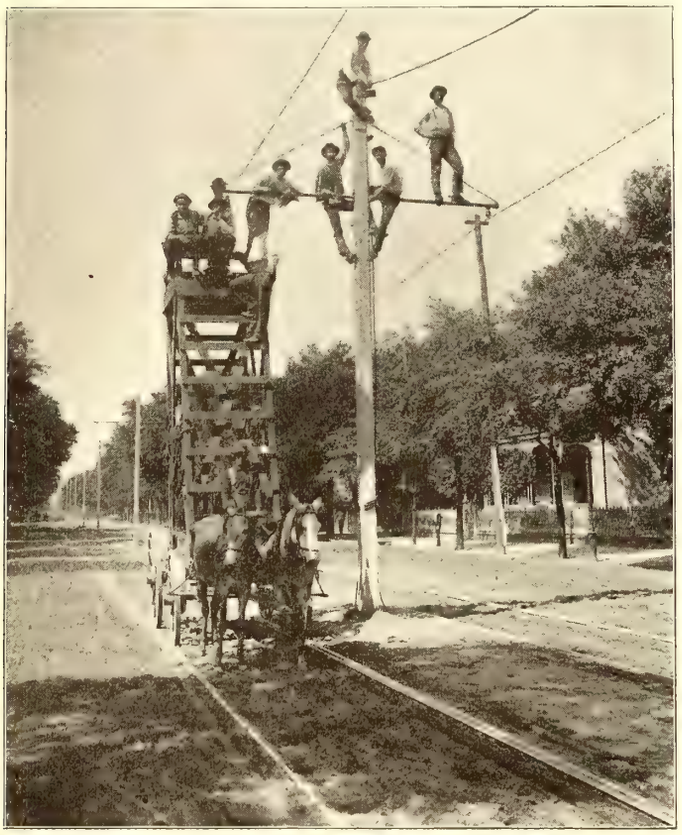


FIG. 8.—TOWER WAGON—MOBILE STREET RAILWAY.

repair pit extends across all the tracks near the front of the building, and owing to the presence of water in the soil near the surface, the walls of the pit are sealed with cypress planking and made watertight. The conductors' room is in the rear of the office, and is furnished with



FIG. 9.—POWER STATION AND CAR HOUSE—MOBILE STREET RAILWAY.

lockers and tables and chairs for the convenience of the employes. The transfer table extends across the barn at the lower end.

The engine foundations are raised to seven feet above the surface of the ground, because of the presence of water in the soil, and to provide against high water. The brick piers for supporting the engine frame rest on concrete foundations, which in turn rest on a bed of cypress timbers placed crosswise in two tiers some distance below the water line.

The power equipment consists of three 100 H. P. Ranton water tube boilers, manufactured at Auburn, N. Y. These are horizontal boilers, but have short vertical water tubes and are said to be excellent steamers. The fuel consists of run-of-mine coal, costing $2.75 per ton delivered and slack coal costing $2.25. The coal is mixed in firing during the day, but in the busy hours the better quality is employed. The evaporation is from eight to nine pounds of water to one pound of coal. Arrangements are being perfected for burning slab wood, which can be purchased from neighboring saw mills for about forty-five cents per cord. City water is employed in the boilers, but for condensing purposes water from local artesian wells is used. These wells are about 730 ft. in depth and the water rises to the surface; it being brackish and impure, however, it is not suitable for boiler purposes. The water of condensation is discharged into the street gutters, the city being provided with surface drainage only. Worthington condensers and pumps are employed.

Three 150 H. P. McIntosh & Seymour heavy type railway engines drive, each, by means of Shultz belting, an M. P., 100 K. W., Thomson-Houston generator, the shafts being twenty-six feet apart. A new switchboard composed of slate and mica has recently been substituted for one of wood as a precaution against fire.

The tools of the repair shop are operated by a vertical, eight horse power engine, and the equipment consists of an iron lathe, jig saw, a drill press, wheel press and a good equipment of small tools. A skillful master mechanic is employed to superintend the building and repairing of cars and motor repairs. Some of the assistants in the shop are colored men who are found to be quite skillful and efficient workmen. In connection with the repair shop is a fireproof vault; in fact, a regular bank vault with brick walls and double iron doors, which is utilized for the storage of paints and oils. A similar vault is also provided in the office for the safekeeping of books and records.

EMPLOYES AND FARES.

Sixty-three men are employed, and the pay is fourteen cents an hour for twelve hours' work. Car men are uniformed, except the extras. In engaging men for this service city bred men with families are preferred. The track laborers are colored men under white foremen, the pay being $1 per day. The chief engineers of the power station receive $3 and their assistants $2.25 per day.

The fare is five cents. School tickets are sold forty for $1, which are good on school days only. Transfer tickets are issued at six different points over the lines of the company. The colored people are liberal patrons of the street railways, generally riding whenever they have a nickel.

Separate parks are provided for white and colored picnic parties. The colored picnics are usually held at night, moonlight dances being the favorite amusement. The street railway company furnishes music on certain days at the parks. Saturday and Sunday are the best days for traffic. The cars are run on a reasonably short headway and are fairly well patronized, the entire population being carried about seventy-eight times a year by the united lines.

The motormen are required to signal the conductor

with two bells at all crossings and curves, as a warning to watch the trolley. The cars on all of the lines of the city are required to come to a full stop at other street railway crossings and at some of the principal driving streets. Mobile is an old French town, and as a general thing the streets are very narrow, Government Street, which is 100 ft. wide, being the principal exception. The principal line of the Mobile Street Railway Company is laid on this avenue, which is the finest residence street in the city. The car tracks occupy a reservation in the middle of the street, the overhead construction being supported by center poles. The street is shaded by beautiful live oaks and water oaks. Most of the houses are modern in their architecture, and many of them are very fine, while the lawns are shaded and ornamented by magnolias, live oaks and flowering shrubs, making the route an attractive one for pleasure riders.

Mobile & Spring Hill Railway Company.

This company operates seven miles of single track which extends from near the river wharf to Spring Hill, situated upon a high range west of the city. This was formerly a dummy line, but began running electrically in June, 1893. The steam trains are still run over the same tracks for carrying freight which consists principally of vegetables from the neighboring truck farms which abound all about Mobile. The motor cars were built by the St. Louis Car Company. There are five motors and





FIGS. 10 AND 11.—VIEWS NEAR LAKE PONTCHARTRAIN, NEW ORLEANS.

five trailers which are mounted on Peckham and St. Louis trucks, there being four of the former. The electrical equipment consists of Winkler motors, manufactured by the United Electric Columbia Company, of Kingston, N. Y.

The power for operating the lines is rented from the Electric Light Company, of Mobile, which employs General Electric generators. Wendel Goodwin is president of the railway company, Ferdinand Smith, vice-president, and J. H. Bleoo, general manager.

New Orleans.

This is the second visit that the writer has paid to New Orleans. The first was in October, 1861, when, with 500 comrades (prisoners of war from the first Bull Run battle), the city was reached after a ten days' journey from Richmond, Va. This visit covered a period of four months, during which time the writer was quartered in the east wing of the old Parish Prison at the corner of Orleans and Treme Streets, sixteen men being confined in each cell, the dimensions of which are 10 × 12 ft. But while the reception accorded at that time was more demonstrative, the second visit has been more cordial, and notwithstanding the unpleasant memories of the first visit, we have now learned to love the city and its people.

This is said to be a quaint old town, but this term is applicable to only a part of the city which includes that portion lying north of Canal Street, known as the French Section, but the newer portion of the city is not behind in many respects the more Northern cities of the country. The topography of the city conforms nearly to a great bend of the Mississippi River, in which it is embraced, giving it the cognomen "Crescent City." The shore line is about thirteen miles, and the average depth of the built up portion is one and a quarter miles, although the entire region between it and the shores of Lake Pontchartrain, five miles distant to the west, is plotted into streets and building lots. Lake Pontchartrain is really a salt water bayou, being about twenty miles in width, and forty miles in length, and connected with the Gulf of Mexico, or rather Mississippi Bay, by two narrow channels.

The city of Algiers is located opposite New Orleans, and skirts the river for a distance of about seventeen miles. New Orleans is about 110 miles from the Gulf of Mexico, and at this point the river is about 3,000 ft. wide, and has a depth of from 90 to 208 ft., the current at high tide being very swift, and the extreme variation between high and low water being about sixteen feet. The tide pulsations are about six inches at this point. The water is extremely muddy at all times, giving it a yellow color which is the characteristic color of most Southern rivers. The river is confined to its present channel by means of levees on both sides, which extend a number of miles up the river. On the river front, through the city, the levees are supplemented by wide platforms, supported on piles, which provide wharfage and storage room for the immense quantities of cotton, sugar, rice and other products which are here transferred from the river boats and railroads to seagoing vessels. A great number of vessels of all classes loading and unloading at the wharves present a picturesque scene, perhaps unequaled for variety at any other port in the world.

The level of the water in the river is at all times above the adjoining streets, the height varying from a few inches to fourteen feet. The surface of the city is almost flat, with a slope away from the river towards Lake Pontchartrain. For a few hundred feet the fall from the river is three or four inches to the 100 ft., but for the remaining distance it is only about one inch to the hundred, the lowest point being known as the basin, which is from sixteen to seventeen feet below high water. West of the basin is Metarie Ridge, which runs parallel with the lake, and which is about four feet higher than the basin, so that it becomes necessary to pump the drainage water over the ridge, from which it flows to the lake. The soil being an alluvial deposit and below the river, it is very wet, standing water being found within a few inches of the surface in all parts of the city, and all the region between the city and the lake being more or less swampy, the old fashioned method of surface drainage is employed, and there has been no material change in the drainage system for the last thirty-five or forty years. To a stranger visiting the city, the gutters filled with dirty, sluggish water present an offensive appearance, but one soon gets used to it. All the house drainage except that from the closets is direct into the gutters; from the closets it is led into cesspools, from which it is pumped and carted away in closed casks, first being deodorized. One would think from the filthy appearance and the con-

dition of the unimproved streets that the city would be unhealthy, but it ranks favorably with New York and many other Northern cities in the health reports. Surveys have recently been completed and tests made to estimate the amount of surface water to be removed, with a view of introducing an improved system of sanitary sewerage. The proposed plan is to dig drainage canals from the city to the basin with a sufficient fall to carry off the surface water, when it is to be pumped over the ridge by improved machinery, the present pumping system consisting of paddle wheels with a capacity for lifting water only three or four feet. The conditions of soil prevent the digging of wells, so that the water supply is necessarily obtained either from the river or from cisterns; the latter method prevails for household purposes, and the cisterns are usually circular wooden tanks, elevated in proportion to the height of the house, into which the water is led from the roof. There is a water works system which supplies river water for flushing and fire purposes. This is an excellent drinking water after it becomes settled. A system of filters has been tried in connection with the water works, but has not yet proved successful.

PAVING.

The business streets are generally paved, and for this purpose very large granite blocks have heretofore been employed; these are usually from twelve to sixteen inches wide and from fourteen to twenty inches long and eight inches deep. These blocks are brought from Quincy, Mass. and Rockport, Me. More recent supplies have been received from the Lithonia quarries in Georgia. These large blocks are generally laid in rows diagonally across the street with a slight crown, the spaces next to the curb line and street car tracks being filled with triangular blocks cut to fit the spaces. Notwithstanding the fact that the blocks were laid without other foundation than the natural soil, some of the pavements are still in fair condition after forty years of service without repair, but near the levees and on streets subject to heavy traffic the blocks have worn unevenly and in places settled below the grade. This type of paving is objectionable, chiefly because the blocks become smooth from wear and provide an uncertain footing for the animals. This method of paving has been discontinued by the city authorities, and the prevailing method of stone paving is the employment of the ordinary granite or Belgian blocks which are laid on a bed of concrete. Several other methods of paving are employed, depending upon the location and condition of the streets. Wood block paving has been tried, but discarded owing to the tendency of the blocks to float away when the streets became flushed from heavy rains, a not uncommon occurrence, as the annual rainfall in this locality is about sixty-four inches, and the water frequently falls in such quantities as to fill the gutters and flood the streets.

Considerable asphalt is being employed on some of the business streets and for a considerable distance on the driveways of St. Charles Avenue. It has not, however, proved durable, on account of the extreme moisture or faulty mixing of the material. Different methods of compounding the asphalt are being employed and the experiment is to be continued. Cypress planking is also being employed to a considerable extent in the residence districts, and especially on the street car lines to provide a footing for the animals. The street is planked both between the rails and tracks. Vitrified brick is also being tried, which is laid on a foundation of concrete.

The favorite paving, however, for carriage roads and residence streets is Rosetta gravel, a comparatively new material. This gravel is mined by the Rosetta Gravel Company, near Rosetta, Miss., about 140 miles from New Orleans, where it is found in great quantities in strata ninety feet in thickness. The deposit is on a line of a branch of the Illinois Central Railway, and is brought to the city on cars, where it is sold for from $2 to $2.75 per cubic yard. This gravel differs materially from other gravels in that it is composed not only of small pebbles and fragments of broken stone, but carries with it a red cement (red hematite), which causes it to form a concrete mass when exposed to the moisture and air, the materials being united by what machinists call "rust joints." In the process of laying this material the street is excavated to a sufficient depth, when the surface is covered with one inch cypress planking, upon which the gravel is placed to the depth of a foot or more, being put down in three successive layers, each layer being firmly packed by the passage of a ten ton steam roller. The cost per square yard, including the foundation, is about $1.67. The surface of the gravel streets washes considerably from heavy rains, but is readily repaired by the deposit of additional gravel. The material is being employed by the street car companies in their new construction as a foundation and ballast for the ties.

The attention of a stranger, upon reaching the city, is attracted to a series of steel towers on some of the streets, which are placed at the corners and connected by a suspension foot bridge, being designed to carry the electric wires. These towers are 125 ft. high, with the corner posts anchored at the street crossings and connected by arched girders and cross braces. Owing to the refusal of the electric companies to replace their wires on these towers, the project was abandoned after fifteen of them were constructed. The original proposition was to erect 250.

In New Orleans, excepting a place in what is called the Ridge, it is necessary to bury the dead in vaults above ground. These vaults are generally from eight to ten feet high, with an end entrance, and divided into shelves on each side just large enough to hold a single casket, which when in position is walled away from the rest of the vaults and the door sealed with a marble slab, which can be removed without disturbing the dust of the interred. These vaults are constructed, in some cases, of brick plastered over on the outside, but many of them are of granite or other building stone, and some of them are of very handsome design and finish, costing from $10,000 to $25,000. There are also in the large cemeteries what are called oven vaults, which are constructed with chambers in four or five tiers, and which close with a single slab or with brick filling. The interments in the Potter's Field and in the Jewish cemeteries are in ordinary graves.

The street railway lines of the city are controlled by five corporations, and embrace 175 miles of track. The cars are nearly all operated by animal power, there being only one system operated by electricity, and one line operated by steam dummies. All the lines terminate at, cross, or run down Canal Street. Several lines terminate at the Clay Station on Canal Street, and in this neighborhood are the starters' booths. Turntables of a primitive type are employed, and each one is operated by an attendant, assisted by the mule. Five tracks occupy the neutral strip on the level portion of Canal Street. The principal system is being equipped for electric traction, and the other companies are considering the question of adopting the same power. The companies operating by animal power employ both horses and mules, the number of the latter predominating, and in all cases the animals are driven single to bob-tail, fourteen foot closed cars. No open cars are employed in the city, except on the dummy line. The cars are equipped with fare boxes, and no conductors are employed, except on the electric and dummy lines. The street cars are well patronized, the entire population having been carried about 145 times last year.

New Orleans Traction Company,

controls the largest mileage, embracing 120 miles of track, and operates the Crescent City Railway Company and the New Orleans City & Lake Railroad, together with the new lines built under the Judah Hart franchises, but which have not yet been operated.

H. M. Littell is the resident manager of the Traction Company and is president of both the other companies. A. H. Ford is secretary and treasurer, and B. B. Gilman, superintendent. Mr. Littell is well known to the street railway fraternity, having formerly been general manager of the Cincinnati Inclined Plane Railroad, and last year a member of the Executive Committee of the American

Street Railway Association. Mr. Ford and Mr. Gilman are from Louisville, the latter having for many years been connected with the street railway lines of Louisville, Ky. The new construction is being done under the supervision



FIG. 13.—TOWERS ERECTED FOR ELECTRIC LIGHTING—NEW ORLEANS.

of G. A. Hopkins, chief engineer of the company, and B. Willard, electrician.

The work of equipping the lines for electric traction is already advanced. The Judah Hart lines have been finished and the work on Prytania and Canal Streets is well under way. In the track construction very heavy rails are employed, and the foundations are being prepared in the best manner suggested by local conditions. Three types of rails are employed. On the neutral ground which embraces about 25 per cent. of the mileage, a sixty pound T rail is used, and on about 55 per cent. of the remaining mileage a side bearing, eight and nine-sixteenths inch deep, Johnson girder rail is employed, and on the remaining 20 per cent. a center bearing rail of the same type, the weight ranging from 93 to 100 lbs. per yard. The joints are united by deep, twelve bolt fish plates, the bolts being one inch in diameter. The character of the soil and other conditions differ in many respects from those found in any other city in the country, and to meet these conditions, a peculiar method of track construction has been adopted. The location being low and the soil exceedingly wet and spongy, it cannot be relied upon to hold the ties in position. In the new construction, both on the neutral ground and in the roadways, the surface is excavated to a depth of about twenty-three inches; then as a foundation a covering of one inch cypress plank is placed in the bottom of the trench, and upon the planking is placed a layer of Rosetta gravel from six to eight inches in thickness, and on this gravel bed the ties are placed two feet centers. Cypress hewn or sawed ties 6×8 ins.×8 ft. are employed, and cost delivered about thirty-nine cents each. The rails are spiked directly to the ties, when the space between and over the ties is filled with the excavated material, except where block paving is employed. On the unimproved streets the surface between the rails and tracks is covered by two inch cypress planks laid crosswise. On the neutral ground the surface is sodded and kept in grass. The experiment is to be tried in some cases of first placing a stringer or mud sill in position on which to place the ties, after which the street material is to be returned to place.

Cypress timber, owing to its lasting qualities, is employed to a large extent in street railway construction in this locality. In the old construction some of the stringers are found in good condition after more than forty years of service. Cypress timber placed in moist ground, either as stringers, foundations or ties, or foundations for the gravel, is practically indestructible, the timber having a peculiarity of lasting if kept constantly wet or dry, but if exposed to the wind and weather it soon decays.

In the early stages of the new track work on the Judah Hart lines, a contract was made with the Duplex Rail Company for the construction of seventeen miles with the Duplex rail. After completing about eleven miles of track the contracting company failed, and although there is a large amount of material still on hand, the Traction Company will not lay any more track with this type of rail, owing to the failure of this construction on another road in the city, as will be noted later. In this duplex construction the chairs rest on ties, with a gravel foundation similar to that described above for the girder rails.

The rails are being connected with No. 0 rail bonds, with nine-sixteenths inch channel pins, the rail holes being first reamed before the bonds are applied. In the neighborhood of the power station, and on sections where excessive current will be required, double or triple bonds will be employed. No ground plates are employed, except at points where the lightning arresters are placed.

The overhead construction is supported on side poles, and in the business portion and on lower Canal Street,



FIG. 14.—VIEW ON CANAL STREET, FROM OFFICES OF NEW ORLEANS TRACTION CO.

tubular iron poles are employed, but on most of the lines wooden poles of heart pine are used. These poles are 12 × 12 ins. at the base, and are left square for the first twelve feet, but are dressed octagonal for the remaining length, and taper to 7 × 7 ins. at the top. The base of the pole, before setting, is treated with a dressing of carbo-



H. M. LITTELL,

GENERAL MANAGER NEW ORLEANS TRACTION CO.

lineum to protect the wood from the action of moisture. The wooden poles are set with a rake of two and a half feet, but are expected to assume a rake of only ten inches when span wires are in place, the soil being very yielding. The iron poles are set in a concrete foundation, and have a rake of only twelve inches. On one side of the street the poles are provided with double wooden cross arms, with two top grooved insulators for carrying the feed wires.

Instead of ending the wires on the ordinary cross arm, a special frame is made of angle iron, and firmly bolted to the top of the pole. Each feed wire is then ended and anchored to this frame by means of an eyebolt, to which is attached a steam insulator. For connecting the several wires together, a solid conductor is run near the outside edge, and a little above the iron frame, and supported by top groove insulators, to which is attached the several short cable connections which are fastened to the several feed wires. Should it be necesssary to disconnect any one wire, it can be done by disconnecting the short cable connection, and throwing out the switch corresponding to that section. The joints of the short cables are not soldered, but simply connected by means of a tee provided with set screws. Thirty foot poles of heart pine, prepared for setting, cost $4.50 each, and thirty-five foot poles cost $6.

ROLLING STOCK.

Eight wheel cars are to be chiefly employed. Those for the first equipment are all manufactured by Brill, and have twenty foot bodies, inside measurement. The cars are mounted on Brill maximum traction trucks which are equipped with Thomson Houston G. E. 800 motors, there being two equipments to each car. There will also be forty open and ten closed cars, manufactured by the St. Louis Car Company. These have a single equipment of W. P. 50 G. E. motors, and are mounted on McGuire Columbian trucks. The cars are equipped with the Crawford fender. The eight wheel cars have been adopted on the theory that they will prove less severe on the tracks, and also, in case of low joints, they will ride more smoothly than four wheel cars. The latter claim is doubtless correct, but the practice so far, on other lines, does not sustain the claim that the eight wheel cars are any easier on the tracks and joints than others. The cars have several novel features, including the use of electric push buttons which are placed on the inside of each post, by means of which passengers can signal the conductor when they wish to have him stop the car. The window blinds are also of special design, and the doors are double. The contrast between the bob-tail cars at present employed and the new equipment is very striking.

A new car barn has been erected at the corner of Arabella and Magazine Streets, on the south side of the city, near Audubon Park. The ground dimensions of the structure are 240 × 260 ft., and the monitor roof is sixty-five feet high. The posts are sixty feet apart in the width, and twenty feet apart in the length. One tier of posts running across the barn in the line of the transfer track is omitted, the roof being supported at this point by plate girders which span the track space about twenty feet above the rails. The structure is of steel, with corrugated sheeting, and covered with improved composition ready roofing, manufactured by I. D. Fletcher & Company, of New York, and was designed by L. W. Brown, city engineer of New Orleans, and built by the Youngstown Bridge Company. There are nineteen storage tracks, aggregating about a mile, with capacity for 190 cars. The transfer car crosses near the back end, communicating with each of the tracks. Five tracks are provided with repair pits, the sides of which are supported by cypress planking, tongued, grooved, treated with carbolineum, and made watertight to prevent the water from draining into the pit. The side posts of the pits are anchored by braces to mud sills which extend two or three feet beyond the line of the pits. The repair shop occupies a large space on one side of the building, and will be equipped with working tools.

The power will be rented from the Louisiana Electric Light Company, on the basis of a car mile rate, whose plant will be described later on, by the addition of four M. P. generators, manufactured by the General Electric Company.

PRESENT OPERATIONS.

The two systems controlled by the Traction Company are at present operated by animal and steam power, for which purposes 2,343 head of mules and horses are employed. The system embraces eleven routes, nearly all of which run on streets parallel with the river. The steam dummy line, however, enters the city on Canal Street and extends past the principal cemeteries and athletic grounds to West End, a popular summer resort on Lake Pontchartrain, seven miles west of the city. The route beyond the city proper is along the bank of the new basin and ship canal, which connects the city with the lake. The buildings at West End consist of a hotel, pavilions and club houses with a large platform, which is built partly over the water and partly on a wide levee which shuts out the water of the lake from the city. A portion of the levee has been transformed into a pleasure ground, and is ornamented by a rustic fountain, shade trees, palms, yuccas and other tropical plants, together with a labyrinth formed by the intertwining branches of an evergreen shrub. There are numerous small houses and rustic seats provided all about for the accommodation of pleasure seekers, and on one side is a shell road, making a very smooth carriage way. Music is provided on all pleasant evenings, and there is boating and the usual attractions of a summer resort. The location is reached from the depot and carriage road by two drawbridges which span the canal and basin. The temperature is said to be about 10 degs. lower at the lake than in the city. Old Spanish Fort, another popular resort on the lake, is located a few miles east of West End, and is reached by steam line and carriage road. The dummy cars, which now communicate with West End, will soon be operated by electrically propelled cars.



A. H FORD,

SECRETARY NEW ORLEANS CITY & LAKE AND CRESCENT CITY RAILWAYS.

Several of the

lines extend to Aubudon Park, and one passes across it and beyond. This park was the site of the New Orleans Exposition held in 1884–5. This tract has been donated to the city as a public park. The only remaining building of the Exposition is Horticultural Hall in which are still preserved the palms, plants, trees and shrubs which composed the exhibit in this department. The grounds are unimproved except there is a fine gravel driveway. Near the river are avenues of fine old live oak trees covered with Spanish moss, whose overhanging branches form a perfect arch and now and then there is an isolated tree whose leaves cover a circular space nearly 300 ft. in diameter. On the back part of the tract are forty acres devoted to an experimental sugar plantation, where young men go to study the art of growing and making sugar. The buildings are equipped with the latest and most approved machinery for refining sugar and preparing it for the market. The station is in charge of Professor W. C. Stubbs, an expert in sugar making.

STABLES.

The 1343 mules are housed in seven stables which are each in charge of a foreman, and all are under the direction of E. H. Starks, assistant superintendent. The stables are of one story structure with ample ventilation and ground yard, in which the animals are quartered during the night in hot weather. Wide stalls are provided and the stables are kept in an exceptionally clean condition, the animals being all trained to attend to nature's calls at certain times and at a certain place provided in the yards.

The feed consists of Arkansas prairie hay, costing $8.50 per ton, which is fed long, and dry oats and corn which are unground. The daily ration consists of twelve and a half pounds of hay and fifteen pounds of grain. The water for the use of the animals is obtained in most cases from artesian wells, which are from 700 to 900 ft. in depth, and the water flows naturally into tanks from which it is led to the watering troughs. The average daily mileage of the animals is eighteen, long and short trips being made on alternate days. The tracks of the old construction are composed of tram rails laid on wooden stringers, 5×10 ins. At the present time they are in rather bad condition, repairs having been neglected on account of the proposed reconstruction.

EMPLOYES AND FARES.

Drivers are paid $1.65 for a twelve hour day; conductors on the dummy line receive $2.50 per day. Engineers and firemen $75 and $45 per month respectively. On the dummy lines the conductors use the Beadle bell punch, and all the other cars are provided with Beadle and Slawson fare boxes of the old type. The fare is five cents, except on the dummy line to West End, where it is ten cents, with a round trip ticket for fifteen cents, and on the owl cars, where it is ten cents after 12 o'clock midnight. Tickets are sold to mail carriers for four and a half cents each. Employes are provided with tickets with which they ride when on duty.

COUNTING RECEIPTS.

The fare boxes are stripped daily, and returns are carried in bags to the receiving station which occupies the third floor of the Germania National Bank Building, where are also the company's offices. Here a force of clerks is employed for counting the money and putting up change in envelopes for the use of drivers. This department is in charge of Joseph Bein, and all details of the work are carefully systematized. To save time in counting the nickels, of which about $2,000 worth are received daily, a pair of specially constructed Fairbanks scales is provided on which the nickels are weighed, the scales being so constructed that a proper allowance is made for the worn coin.

Strippers are provided with canvas bags numbered to correspond with the car to the number of 219, the usual number run; into this the contents of the fare boxes are emptied when they are taken to the receivers' station, the hour for stripping the boxes being 12:30 P. M. to 5:30 P. M. each day. The work of counting the receipts is begun in the morning and is conducted by three persons. The contents of the bags are emptied upon the table, when the silver pieces are selected out and counted, and the amount of silver called out to a lady clerk who records the same opposite the car number in a book ruled for the purpose. The employes' tickets are also selected when the nickels are transferred to the hopper of the scales, which is provided with weights and also a beam register. The amount in dollars and cents is then reported to the clerk, and is recorded opposite the car number; the footings of the daily receipts are then reported to the secretary. The entire amount is usually counted by two persons in about an hour, the total receipts being from $2,500 to $3,000 a day. Formerly, before the present method of weighing the nickels was adopted, it took over five hours to count the daily receipts.

The nickels are then again weighed and placed in small wooden boxes in amounts of $100 each, and are then given to lady clerks who place them in change envelopes in sums of fifty, twenty-five and ten cents. Change envelopes are provided and the nickels are placed in them in echelon and the envelope is folded twice and sealed, making a solid packet. Some of the young ladies become very expert in putting up change in envelopes, frequently putting up $50 in twenty-five cent packets and tying them in bundles of $5 each in about eighteen minutes. A tally is kept of the amounts delivered to the packers, and when the bundles are completed and returned to the receiver they are checked up so that a careful tally is kept on each step of the operation. The bundles are then enclosed in bags of $50 each and placed in the receiver's office, which is fenced off from the main office by a high wire screen. The bundles are then sold to the starters who come to the receiver's office for them who in turn sell them to the drivers, each driver being required to carry $10 in change, which is carried in a belt provided for the purpose. The entire amount of nickels received each day is returned to the drivers as change packets.

PAY WAGON.

For paying the employes a pay wagon is employed, which is an ordinary one horse, covered express wagon, the cover being supported by a wire frame, which is enclosed front and rear and provided with a safe. These wagons are driven to the different pay stations, and as the employe receives his wages he stands upon a rear step and signs a receipt on a shelf provided for the purpose.

C. B. F.

(*To be Continued.*)

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

New York, March 9, 1894.

Editors Street Railway Journal:

In your February number we find an article, entitled "An Excellent Cable Record," which, as it stands, seems to indicate a high degree of perfection in the work turned out by the English manufacturers named. The beautiful illustration makes one feel real sorry for the cable railway which threw away so perfect a cable prematurely. It may be, however that portions of the cable were in a very bad condition; would it not have been better to have shown samples of worn cable, as it is easy to find plenty of good samples carefully prepared on an emery wheel? Apparently, the article casts discredit on the cables of American manufacture, and probably it was intended to do this, otherwise, cables of the same manufacture which lasted less than half the time of the one good one in the same place, might have been mentioned in the article. Records of American made cables, showing services of 485, 550, 579, 602, 679 and 1,258 days, each on different railways, can be mentioned and referred to and pointed out as being of extraordinary quality and perfection. These records are all of them very high; at the same time, the elements of chance and good luck had much to do with their long life. Under conditions in which cables are

worn out in from thirty to ninety-eight days, quality plays a secondary part, and freedom from accidents the principal part. Taken as a whole, the records of foreign made cables used here are a very ridiculous affair, and it requires considerable assurance to claim great things on one chance record. As practically the entire revenue of street railways is derived from citizens of the United States, it would seem proper that they should have preference as to trade. Experience and records will certainly show that American made cables are far superior to any foreign ones.

Respectfully submitted by
An American Manufacturer.

TWIN CITY RAPID TRANSIT COMPANY.

AUDITING DEPARTMENT.

Minneapolis, Minn., March 22, 1894.

Editors Steret Railway Journal:

Though often said, yet true: "No knowledge is more indispensable to the successful management of any business than a thorough and concise system of accounts." It is related of Talleyrand that he has defined the science of language to be "for the purpose of concealing one's thoughts and opinions," and the same idea is often carried out in the application of the principles of book-keeping—to bewilder, to confuse and obscure the financial conditions of a business or corporation. While it is true that "figures won't lie," yet there are those individuals and corporations who, either through ignorance or for a purpose, make certain combinations of figures or statements that are misleading and false.

From my personal experience and observation I am fairly of the opinion that there is no business where the opportunities are so diversified, and chances for leakage so great, as in the operation of an electrical street railway, and this condition is greatly aggravated where transfers are issued. I might state, without fear of contradiction, that there is no class of business, to-day, where the system of records is so crude and unsatisfactory as that now in vogue in very many of our street railway systems. This existing condition is accounted for as follows:

1. Many roads have tried to adapt the "old horse car methods" to the accounting of an electric system, and without success.

2. The transition from a horse car system to an electric system has been so recent that the mechanical transformation and development has been, so far, the prime and only consideration.

3. The conditions are so diversified and intricate that the installation of an economical, accurate and harmonious system is imperative; such a system, however, has not been found, and if found, not successfully installed.

Now that the mechanical principles of our electrical street railway systems are fairly well settled, the time has arrived for the careful consideration of all those conditions that lead to an economical management and a fair remuneration to those who have invested their money. These conditions can only be arrived at through a concise and practical system of accounting and record.

The American Street Railway Association will accomplish a great deal of good by taking some definite action toward adopting a uniform standard of accounts. By the adoption of such a standard the management of the various roads throughout the country could make comparisons of the cost of operation, which would be mutually beneficial. The adoption of a standard system would also be of great benefit and security to the investor, as he could then tell something, from the statements rendered, about the condition of the various companies.

For the mutual benefit of all concerned, and with your kind permission, I should like to introduce or have introduced by others more competent than I, in the subsequent issues of your valuable journal, for general discussion and mutual benefit, a few specific ideas on those fundamental principles which could be generally adopted by all electric street railways. Yours truly,

J. H. Calderwood.

Cleveland, March 24, 1894.

Editors Street Railway Journal:

I wish to make a suggestion to the American Street Railway Association through the columns of your valuable journal with reference to the yearly conventions, to remedy in the future what has, in my judgment, been an error in the past. It has been the custom heretofore to throw the doors of the exhibition hall open to everyone and anyone, and the halls have been crowded to their utmost capacity, usually with the residents of the city, and the fair sex have been represented to a great extent (to which I, of course, have no objection). As I have been connected with street railway work for a great many years before my interest in the manufacturing business, I am inclined to look on both sides of the question, and by doing so I am enabled to arrive at a fair conclusion. It is my belief that the conventions have been made interesting and successful largely from the fact that the supply men have turned out so liberally and spent a great deal of time and money in preparing their exhibits. The men in charge of the exhibits have been obliged to remain at their posts some fourteen or fifteen hours a day during the three days that the convention is in session, and are usually busily engaged in explaining their various devices to those who make inquiry; very frequently after spending a long time and a great deal of patience with some gentleman who appears to be thoroughly interested, he will find when he comes to go with the usual "many thanks for your courtesy," that the gentleman is running a dry goods store or a shoe store on the same street a few blocks away. I would suggest that the Association adopt a resolution setting aside one day, or even half a day if thought best, when all the members present may meet at the convention parlors and from these visit the exhibition hall in a body, and at this time the doors be closed against every one excepting the street railway men and their friends and the supply men. This would afford them an opportunity to examine the exhibits which the supply men have taken such pains to prepare, and would also be a cue to the supply man that the gentleman with whom he is talking to is directly interested in street railway work. After the street railway men had made a tour of the exhibition hall the doors could again be thrown open to the public, and the supply men would not then be obliged to keep so constantly at their posts.

I do not wish to convey the idea that I am at all dissatisfied with the treatment I have received at the street railway conventions that I have had the pleasure of attending; on the other hand, it has been one of the greatest pleasures of the whole year to me to be present at the American Street Railway conventions, and it has encouraged me not a little in getting up a nice line of exhibits of new and improved devices, and I trust that we shall be represented at a great many conventions yet to come.

I hope this suggestion will be received by the Association in the spirit in which it is intended, and that it will receive their favorable consideration.

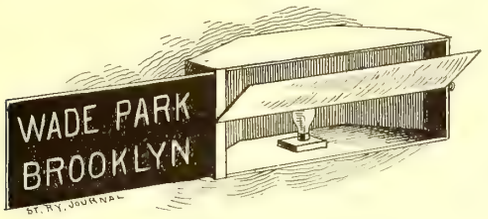
Yours truly,
W. E. Haycox, President and Manager,
The Fulton Truck & Foundry Company.

Illuminated Car Sign.

The illuminated sign here illustrated has recently been put into use on a number of the cars of the Cleveland Electric Railway, and seems to possess the advantage of being easily read at considerable distances, as well as being simple in construction and comparatively inexpensive. This sign was designed by John J. Stanley, general superintendent of the company, and those in use have been made at the company's shops.

The sign is intended to be attached to the dash of the vestibule, and consists of a galvanized iron box twenty-one inches long, eleven inches wide and four inches deep. The back is beveled off toward the ends as shown, to allow space for the hooks whereby it is attached to the dash,

and at the same time increase the reflective effect on the sign, which forms the front. The front is furnished with a glass slide which bears the name of the line. A double sign may be used and a folding tin cover attached to the



ILLUMINATED CAR SIGN.

front of the box that may be folded either up or down, thus exhibiting the destination of the car. The illumination is furnished by a single incandescent lamp.

These signs may be readily and cheaply constructed at any well equipped car shop, and have been shown by practice to be readable at a distance of from 200 to 300 ft. If desired, the front slide of the box may be constructed of tin with perforations for the letters.

An Electric Brake.

An ingenious electric brake, for which a number of advantages are claimed, has recently been invented by E. B. Skinner, of the Ogden City Street Railway, of Ogden, Utah. An important feature of the invention is that to set the brake the electric current is only used

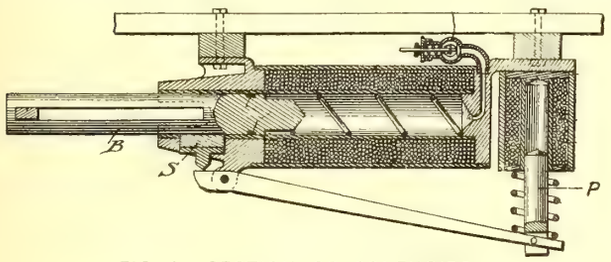


FIG. 1.—SECTION OF SOLENOIDS.

momentarily, instead of continuously, as in most devices of this character.

Fig. 1 shows a section of the electrical portion of the device. The horizontal plunger, B, which is so connected o the brake beams that a movement to the left sets the brake shoes, moves inside of a solenoid wound on a brass or copper tube with heads of the same material. Within this solenoid is a spring which normally holds the plunger outside the solenoid. A smaller, vertical solenoid, with plunger, is also provided, as shown. The end of this plunger is directly connected to a long lever operating or pressing against a shoe, shown at S, which bears against the plunger, N, with such force as to hold it rigidly in

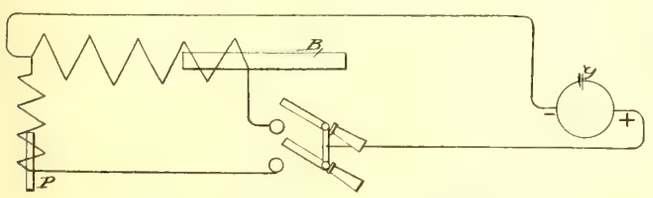


FIG. 2.—DIAGRAM OF CONNECTIONS.

place when there is no current passing through the vertical coil.

The method of electrical connection of the brake apparatus will be seen from the diagram (Fig. 2). The dynamo is shown at y, and the outgoing circuit leads to two switches, shown in the diagram, controlled by one lever. These are so arranged that the movement of the lever first closes the lower switch, and afterwards the upper switch.

The action of the brake is then as follows: In its normal position the horizontal plunger, B, is extended, and kept so by the pressure of the brake shoe operated by the vertical plunger, P, which itself is kept extended from its solenoid by the action of the spring shown. The result of moving the double lever is first to close the lower contact (Fig. 2) so as to pass the current through the vertical solenoid, drawing in plunger, P, and causing the shoe to drop away from plunger, B. The upper contact, or that making the circuit through the horizontal solenoid, is then made, drawing the horizontal plunger into its solenoid, and setting the brakes. The switch is then thrown open, stopping the electric current from passing through the release coil, when the plunger, B, is held in position by means of the shoe. Then the current may be stopped from passing through the horizontal coil, and the pressure of S against B will hold the brake shoes tight. To release the brake, the current is passed through the release coil, thereby releasing plunger, B, from the pressure of the shoe, when it will be pushed out by its spring.

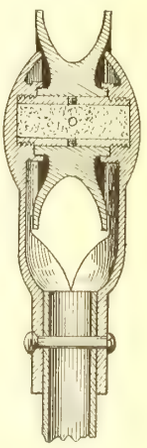
To guard against any sudden action or jar when the brake is released, an air valve, as shown, is provided at the back end of the horizontal cylinder. When plunger, B, moves into its cylinder, the air will be forced through this valve, but when the brakes are released, B will be held back against the action of its spring, sufficiently to prevent jar by the partial vacuum formed as it moves out of the tube. The vacuum can be controlled by the air valve, allowing more or less air to re-enter.

By an ingenious arrangement the brake is made adaptable to train use, so that not only can all the brakes be set from one point, but in case the train should break in two, the brakes on each portion would be automatically set. The device does not interfere with the ordinary hand brake attachment, so that that can be used, if, in the case of a trolley car, there should be a failure of current for any cause.

A Simple Trolley Head.

A trolley head, consisting of but four parts, has recently been invented by I. B. Walker, superintendent of the Sioux City Railway Company, Sioux City, Ia. The device has been in operation for some time on that road, and seems to give good satisfaction. The chief claim for this device is its simplicity, there being no cotter pins, nuts, springs, rivets or other loose parts. The four pieces comprise the pin, wheel and the two sides of the harp. The engraving herewith shows the method of construction.

The head is perfectly self-contained, and needs no attention whatever from the time it is put on until it is worn out. The wheel can be made of any durable metal, such as copper, bronze, aluminum or cast iron. The harp can also be made of any suitable metal, aluminum, brass, and malleable iron having been employed. The latter is the cheapest, and the aluminum weighs about one-fourth that of the brass harp. Owing to the peculiar shape of the harp there is no wear upon it, while the shape allows the greatest possible strength.



TROLLEY HEAD.

The pin is made of steel and case hardened, and during the five months' use of this device on the Sioux City Railway no pins have yet worn out. The pin is secured into bosses on the harp, and is filled with dry lubricating graphite, sold by the Graphite Lubricating Company, of Bound Brook, N. J. It has a three-quarter inch hole through its entire length, and four and one-eighth inch holes are bored into the pin in its center. The graphite can escape only through these holes, and as graphite is a conductor there is perfect lubrication, while the wheel runs perfectly cool. There is no need for side springs, as the one-inch pin gives more surface than is really needed for carrying off the current.

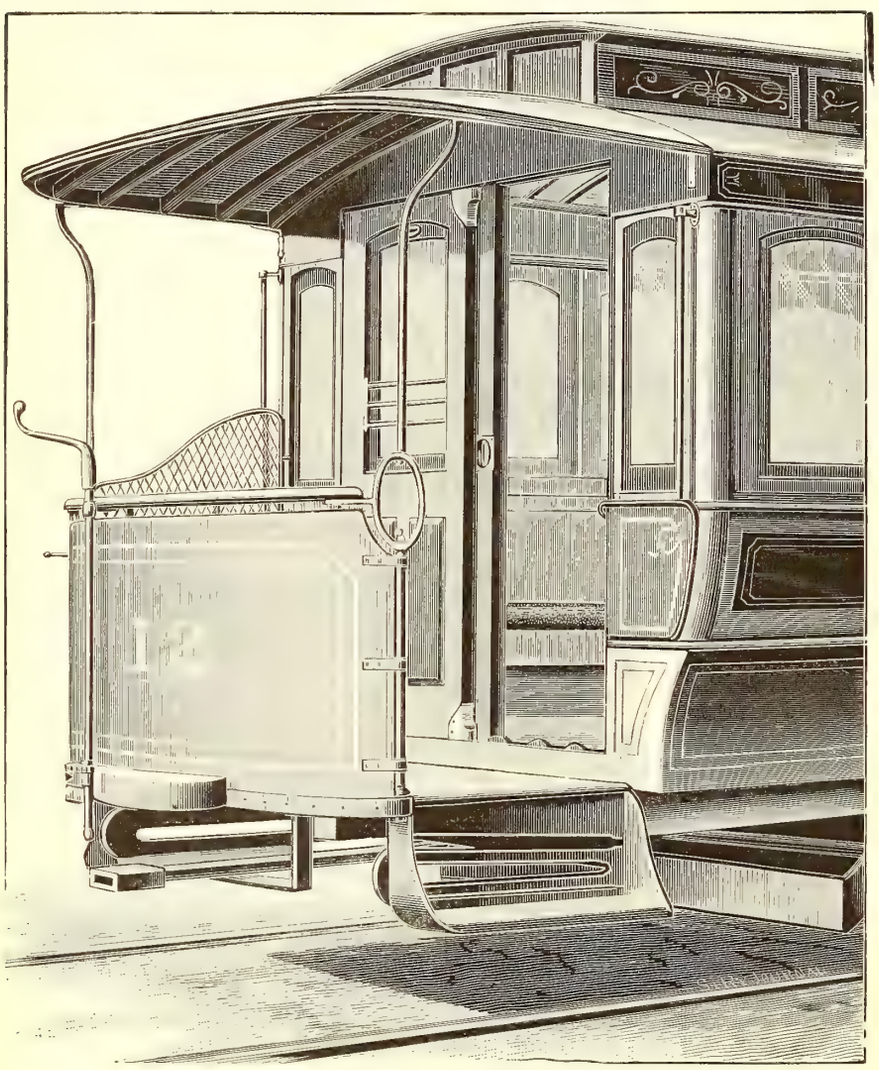
In another form of head, graphite in the form of paste is used, and this is fed to the bearing by a screw fitting into the end of the pin which is set up as required.

New Easy Exit Car.

Since the advent of electricity and cable as motive powers for street railways, and the consequent increase of passengers carried, it has been found that the old method of constructing street cars must be improved on, and passengers handled easily and rapidly.

The crowding of platforms, and consequent difficulty of entering and leaving a car, has troubled many managers. A new type of car, the invention of Wm. Sutton, president of the American Car Company, of St. Louis, has been put upon the market with the object of overcoming the above difficulty. It is shown in the accompanying engraving.

The car is provided with double doors, one of which is of the ordinary sliding type, but made to move from one side of the opening to the other. The other is pivoted in the center of the opening, swings out towards the platform, and is made to close and lock on either side of the opening. This pivoted door is only used at the end of the route, when changing from one track to the other, and is locked on the side of the platform closed by the gate. This arrangement makes the pivoted door tight, and prevents rattling, and allows three-fourths of the platform for passengers to stand on, without interfering with those getting in and out.



NEW EASY EXIT CAR.

One seat at the entrance is sacrificed, and this is made adjustable, the motion being the opposite of a theatre seat, turning in instead of up when the sliding door is used, and utilized on the side that the pivoted door is locked. This invention has only recently been patented.

The American Car Company built a trial order of this type of car, the results of which were so satisfactory that it is now completing an order for ten more.

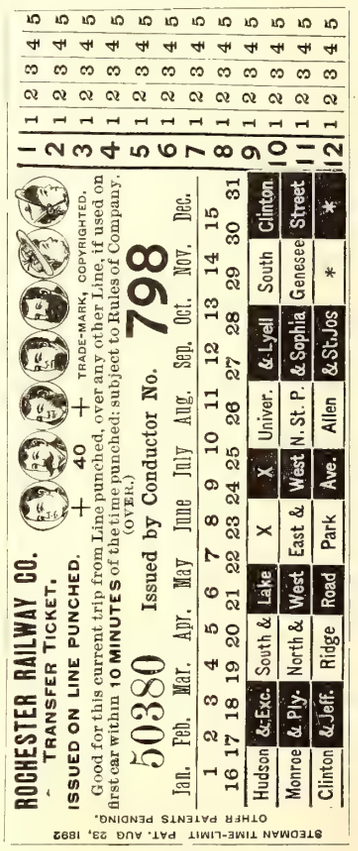
An electric railway, sixteen miles in length, will be built at Klampenborg, Denmark.

New Transfer Ticket.

We present herewith a reproduction of a new transfer ticket, designed by J. H. Stedman, of Rochester, N. Y., and embodying the Stedman system now used by over eighty street railways. The protection from abuse by passengers, and the prevention of frauds of conductors is the vital point of this system, and it has proved highly efficient.

The ticket shown illustrates a new method devised to confine the use of the transfer ticket to the original passenger. Besides showing the route, direction, time and date of issue, the conductor indicates on the ticket the appearance of the person to whom the ticket is issued. This is done by indicating that likeness making up the trade mark which most resembles the original holder. This ticket need be put into use only once in a while and intermittently, perhaps, but it will prevent, it is thought, much of the fraudulent use of the transfer, as its moral influence will be considerable.

As will be seen, the ticket is most compact and convenient for punching.



The back can be used for advertisements if desired. Among the cities in which the Stedman tickets are in use are New York City, Indianapolis, St. Louis, Brooklyn, Baltimore, Buffalo, Rochester, Milwaukee, Pittsburgh, Newark, Hoboken, etc.

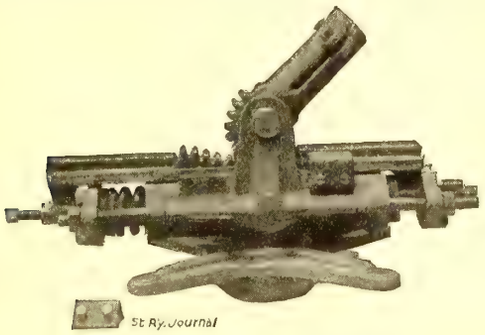
The Union Traction Company, of Providence, has purchased the mortgage of the Attleboro, North Attleboro & Wrentham Street Railroad. It is stated that the road will be in operation by April 1. It stopped doing business last fall after the burning of the power house in North Attleboro.

The Fair Haven & Westville Horse Railroad Company, of New Haven, Conn., signed a contract last month with the Westinghouse Electric & Manufacturing Company, of Pittsburgh, to electrically equip its road.

Clay, Moore & Company, of Philadelphia, have purchased the New Haven & Centerville Horse Railroad from Cornelius Pierpont for a syndicate of that city. The price agreed upon, it is said, was $225,000. The road will be electrically equipped.

A New Type of Trolley.

The illustration shown herewith gives a view of a new trolley, the invention of J. R. Griffiths, of Chicago, and sold by the Yeats Engineering Company, Monadnock Block, that city. The important claims made for this trolley are its simplicity and durable construction.



A NEW TYPE OF TROLLEY.

One of its special features is its few parts, which are all interchangeable. Any part can be removed in a very few minutes and a new part replaced.

This trolley is claimed to be especially good for bridge work, as it has a low base, and as no chains or side springs are used, can be carried down level with the top of the car. It has only one spiral spring encased in a cast iron frame, making it very firm and rigid, and as the pole works on sprockets in conjunction with a half sprocket wheel attached to the spiral spring, it will be seen that the tension must be even, and the pressure on the wire is the same whether the pole is at an angle of 40 degs. or at 2 degs. The trolley swivels on its base and pulls in both directions. The bearing surfaces are all designed for strength and durability, with provision for taking up the wear.

The trolleys are now doing service on the Calumet Electric Street Railway, where they are giving excellent satisfaction.

Smoking cars are to be tried by the Philadelphia Traction Company on the 13th and 15th Streets electric line.

The Foster Fender.

The accompanying illustrations display a new safety guard for trolley and cable cars now placed on the market by the Foster Automatic Safety Guard Company of 150 Broadway, New York. A test of this fender on human beings has been made on the Hillside division of the North Hudson County Railway Company with gratifying results.

The advantages claimed for this safety guard over other types are as follows:

The front fender in its normal position can be made to run over the roadbed at a height above the track of three inches or less, according to the condition of the roadbed. The fender is attached to the truck of the car in such a manner that it can be made to run flush with the dashboard, thereby making it possible to trail cars without any delay or inconvenience. The safety guard when struck automatically releases a cradle which instantaneously drops from beneath the platform of the car and runs forward on wheels on the crown of the track, three feet in front of the car, and prevents any possibility of the crushing or maiming of the person struck.

This fender is also claimed to be the only one which is capable of running three inches or less above the ground where the forward wheels of the truck are more than seven feet in the rear of the bumper.

The general arrangement of the fender can be seen from the engravings shown herewith.

The front fenders are attached to rails extending from the truck of the car, thereby avoiding all oscillation.

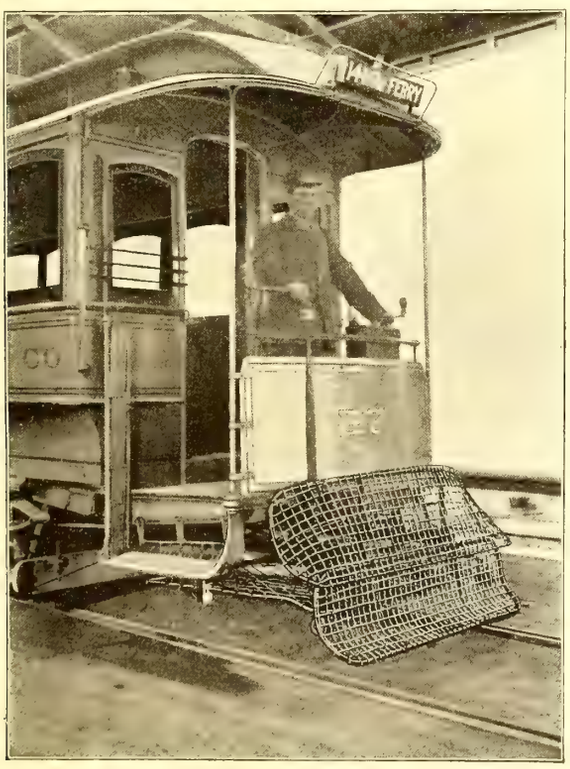


FIG. 1.—THE FOSTER FENDER READY FOR OPERATION.

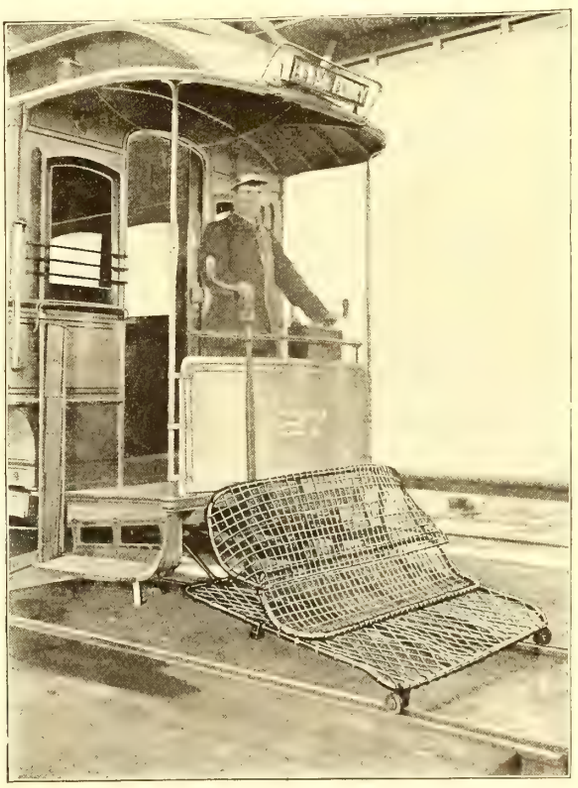


FIG. 2.—THE FOSTER FENDER IN OPERATION.

The cradle is suspended from beneath the platform of the car and is held in position by two arms, and is actuated by the impact of any collision with the fender, and runs out from its position beneath the car.

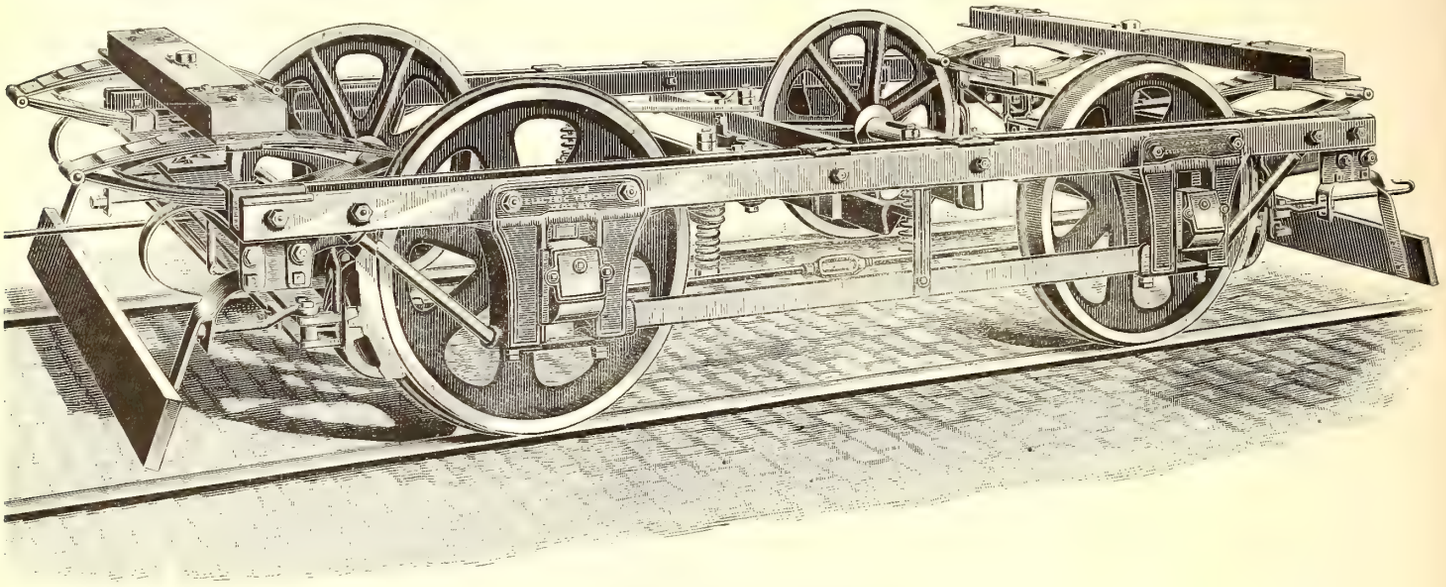
The cradle can also be locked from the platform, and prevented from acting by the motorman in order to avoid the destruction of the safety guard in case of any collision with vehicles.

The line of the Brooklyn City Railway of Brooklyn, N. Y., has been extended to Newtown and Corona. Before long cars will be running to Bowery Bay Beach and Flushing.

Electric Motor Trucks.

The wear upon the running equipment of an electric street railway is certainly equal to, if not greater than, that upon a steam railway. The constant stopping and starting of an electric car on tracks covered with snow, slush, mud and dust alternately, the strain in rounding short curves, &c., all sum up a total of wear, which the more rapid speed of the steam railway does not counterbalance.

That this independent truck frame accomplishes more than one result is evident. The car body is not depended on to keep the frame square, and does not receive the tremendous racking and straining inevitable when the frame of the truck is bolted to side sills of the car body. Then again the axles can be made and held parallel to each other in the Taylor construction, and as a result uneven wear on the flanges of wheels is unknown, while the motor and truck journals are worn evenly and truly. The Taylor Electric Truck Company is convinced from its past experience, and from the facts as presented above,



TAYLOR ELECTRIC MOTOR TRUCK.

That these facts are recognized by practical men is evidenced by the adoption by electric street railways as basic principles, the ones tried and found true by steam railways.

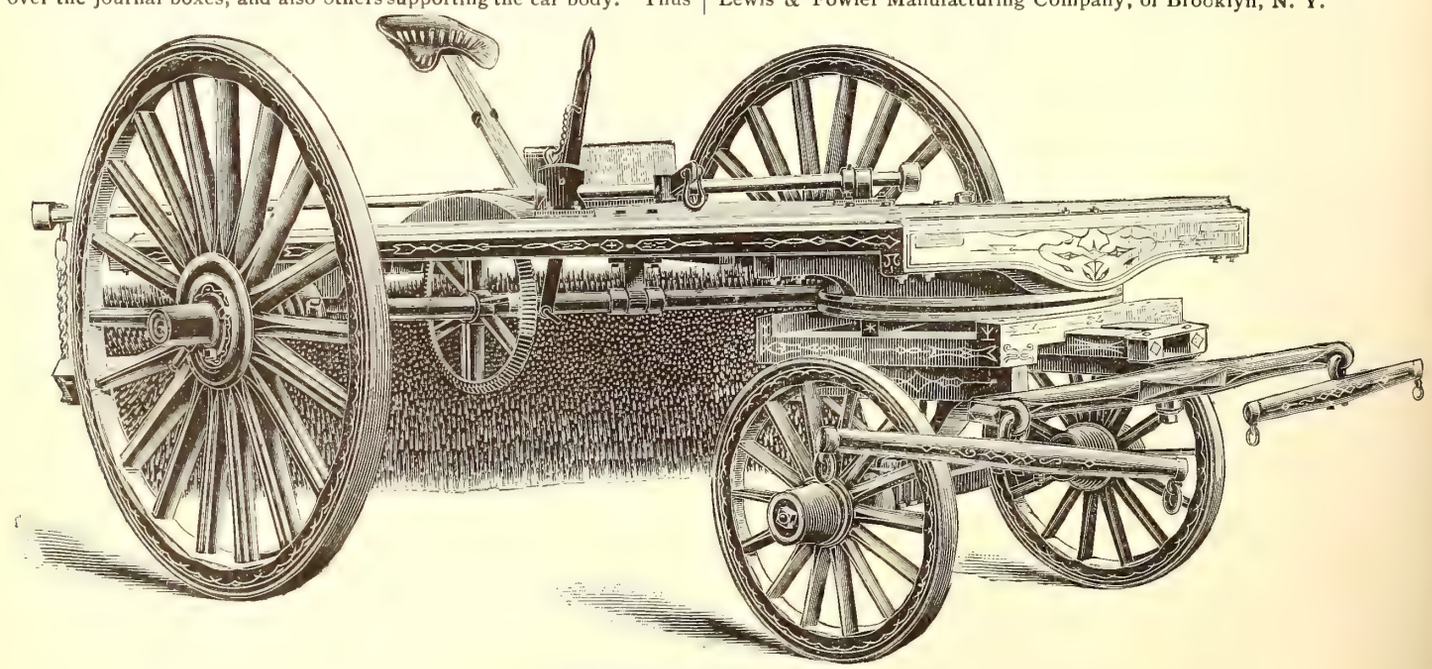
The Taylor Electric Truck Company believes that practical experience should prevail in motor truck construction; and acting on this belief, has incorporated in its trucks the fact long ago found out in governing steam railway construction, that the elliptic spring was the only form with elastic and easy action, suitable for use under passenger coaches.

The Taylor Electric Truck Company makes a strong point on the use of the elliptic springs in its construction. The latest pattern single truck made by the company, as shown in the cut, has elliptic springs over the journal boxes, and also others supporting the car body. Thus the car body is entirely supported on elliptic springs, which by their elastic action carry it with the ease of a Pullman or Wagner palace car. The frame of the truck is in the form of a simple truss, so strong and substantial that it is able to support the utmost weight that can be placed on it, without having recourse to coil springs placed intermediate to the supporting elliptic springs. An interesting experiment proving the strength of the side frame of a Taylor improved electric truck was made recently, when a single side frame supported at the journal boxes was loaded with 10,260 lbs. at each end without distortion. The Taylor trucks, both single and double, are designed so that each truck is an independent and complete construction, and is connected to the car body by king bolts, precisely as in steam railway construction.

that it is working in the right direction as regards the proper motor truck construction, and feels assured that a cordial recognition of the validity of the claims made will be accorded.

The Eureka Street Sweeper.

It is universally admitted that a well cleaned track means a great saving of power. Sweepers, therefore, are economy producers, and the better the sweeper the greater the saving. The accompanying engraving shows the improved Eureka sweeper, manufactured by the Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y.

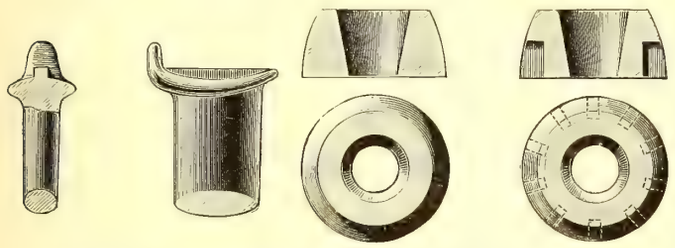


THE EUREKA STREET SWEEPER.

One especially desirable feature of this sweeper is the patent box hub. This encloses the axle and effectually protects all the working parts from dust and dirt, preventing clogging and insuring constant and free working. By means of a triple ratchet the axle is always held in the direct center and is prevented from wobbling and damage. This sweeper, it is claimed, lasts longer, performs better work in less time than any other sweeper, and is less wearing upon horses. The Eureka is made of the best material, and is so simple that inexperienced hands can operate it successfully from the start without damage to any part, it simply being required that the oil wells be filled once a week. Another and very important feature of this machine is that the broom can be thrown in and out of action while in motion.

Wrought Iron Wheel Centers.

The use of forged, wrought iron center, steel tired wheels in street railway practice is comparatively unknown in this country, the one-piece, cast iron, chilled wheel being the standard. European tramway practice is different, however, in this respect, the forged center, steel tired wheel being used almost entirely. The possibilities of building up a market for the forged center wheel was brought to the attention of M. Pierre Arbel, of the Arbel Establishments, Rive-de-Gier (Loire), France, while at the Columbian Exposition. Believing the wheel manufactured by that company to have a future in the American street railway world, it has been decided to establish an American office for the sale of the wrought iron, forged wheel centers manufactured under the Arbel process. This, as already mentioned in this publication, is in the Havemeyer Building, New York, and is in charge of Wm. Hazleton 3d.



FIGS. 1 AND 2.—SECTIONS OF SPOKES AND HUBS.

In the great developement which has taken place in the manufacture of all varieties of street railway equipment, the wheels have not been appreciably altered except by increasing the weight from the old style used on the first horse cars, although with the large and heavy cars and the equipments used now on many street railway lines the wheel load is considerably heavier than that allowed in steam railway service. It is a well known fact, also, that cable and electric traction is much more severe on wheels than steam road service, the former having to operate on the surface where the rails are often covered with a coating of mud or dirt. Besides this, the wheels are subjected to much more frequent and severe brake action than on steam roads. Surface roads must also follow the lines of streets, necessitating many sharp curves and heavy grades.

The severity of this service upon the life of wheels is well known, and the average cast iron, chilled rim wheel is not guaranteed for over 40,000 miles of service. Numerous experiments have been made with compound, or built up wheels; that is, wheels having a cast or wrought iron steel center and steel tire, which, however, have not led to the adoption of this class of wheel to any extent. Cast steel wheels have also been tried experimentally and have been found to be superior to cast iron wheels in that they are lighter, wear less from the action of the track and brake, and give better traction and quicker brake action; the cost of steel castings, however, is quite high. With the wrought iron center, steel tired wheel, the advantages of the steel tread are all retained with the ability to replace the steel tire when worn, at a slight

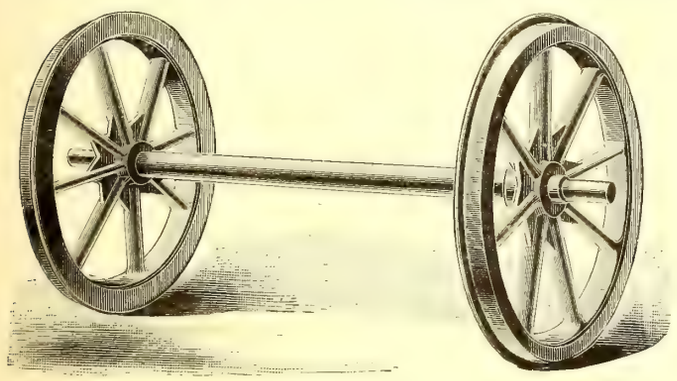


FIG. 3.—PAIR OF ARBEL WHEELS.

expense. This pattern of wheel, it is also claimed, makes less noise while running and wears the rails very much less than the cast iron wheel.

The Couzon Works of the Arbel Company are located at Rive-de-Gier, France, and have been established since 1870, being the largest works of their kind in Europe for the manufacture of wheels for street railway use. The process of manufacture has been steadily improved since starting the factory, and as the result of a number of special processes employed, they claim superior excellence for their product, which claim is borne out by a large number of awards received at different National Expositions.

The manufacture of wrought iron wheels as carried on at the Arbel Works is divided into three processes; first, preparation of the different parts of the wheel; second, mounting or assembling; third, forging. The rims, which are made from flat bar iron of special section, are rolled into circular form by a special machine and welded at the ends. The rim is then grooved to receive the spokes; the spokes are elliptic in section and are drop forged at their outer ends to the shape shown in Fig. 1, to facilitate welding to the rim. The hub is composed of two halves of the form shown in Fig. 2, each half being forged from a bar of rectangular section, bent around a mandrel. The grooves receive the inner ends of the spokes and are formed by dies under a steam hammer. The different parts are then assembled into the form of a complete wheel, their construction being such as to let the wheel thus set up be transferred to the heating furnaces without falling apart. In this state the wheel has a greater dish to the spokes than in its completed form, the extra amount of metal being necessary to obtain perfect welds.

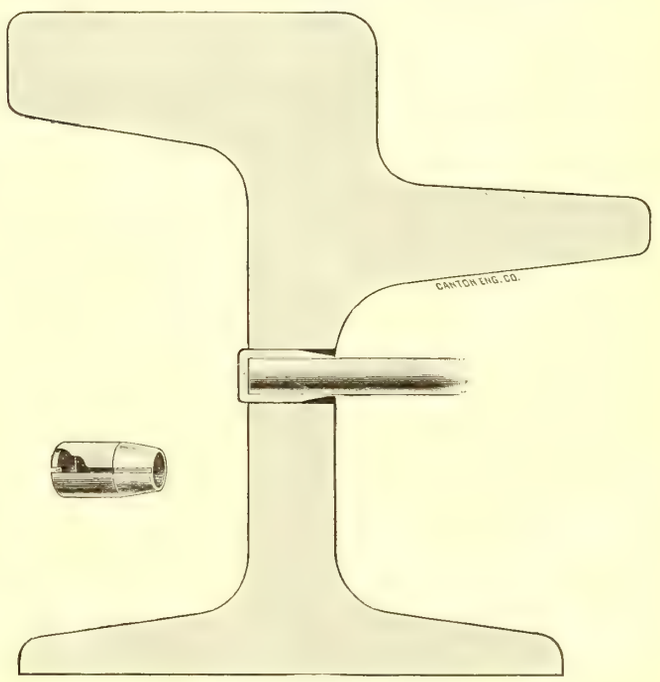
The heating is done in reverberatory furnaces of special form, so constructed that the maximum intensity of the heat comes at the hub of the wheel where the metal is heaviest, gradually decreasing to the rim, which is much lighter. After the whole wheel has reached a white heat it is placed between two dies on the anvil of a steam hammer, one die being fastened to the anvil and the other to the hammer. A few blows of a fifteen ton steam hammer are sufficient to weld all the parts perfectly into one homogeneous whole. The webs uniting the spokes, shown in Fig. 3, are formed by this last process. The wheels are then finished, hubs bored and rims turned and are ready to be placed on the axles and receive the steel tires.

Owing to the facility with which steel tires of standard street railway sizes may be obtained in this country, the Arbel Company is only importing at present its forged wheel centers, but is prepared, upon the receipt of large orders, to manufacture the wheels complete at its French establishment, in accordance with any desired specification. So far as the question of durability is concerned, there seems to be no doubt but that the steel tired wheel is superior to the standard cast iron wheel, leaving out of the question the facility with which new tires can be placed upon the wrought iron centers as fast as worn out. In railway service, steel tired wheels have made over 500,000 miles, and should, in street railway service, make at least 200,000 miles, or practically equivalent to five years' maximum service. The forged centers are guaranteed for five years' service, but are practically indestructible.

The Arbel Company has large numbers of its wheels in use on all the principal tramway lines throughout Europe, and has a number of flattering testimonials testifying to the satisfaction given during the periods of service, covering, in several cases, as much as seven years.

Steel Bonding Caps.

The accompanying cut shows views of the new track bonding device recently brought out by the Ohio Brass Company, of Mansfield, O. The steel bonding cap, as its name signifies, is a steel cap which fits snugly over the end of the bonding wire and into the web or flange of the rail. The method of bonding tracks with this device is as follows: The end of the wire is passed through the hole in the rail



RAIL WITH BONDING CAP.

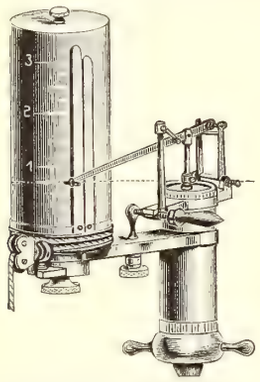
which is drilled one thirty-second of an inch smaller than the outside diameter of the cap. The cap is then placed on the bonding wire and entered into the rail. A few blows from a hammer fasten it in place. The crimp, extending the full length of the cap, allows the shell to compress firmly over the wire and into the rail, making a perfect air and moisture proof joint.

It can be used equally well with iron or copper wires of different sizes. The facility and quickness of bonding combined with the low selling price will no doubt bring it into speedy favor.

AT a recent meeting of the stockholders of the Northampton (Mass.) Street Railway Company, it was voted to increase the capital stock to pay for ten miles of track extension, enlarge the power house, and increase the equipments.

The Robertson-Thompson Indicator.

Our illustration shows a new form of indicator manufacted by the New York Indicator & Specialty Company. This indicator has been but recently put on the market, and seems to contain a number of valuable features. The parallel motion employed is of a new design, and is secured by a controlling lever attached to the pencil arm governing it direct. By this arrangement any wear on the pivots that should appear in course of continued use, only affects the accuracy of the pencil movement an amount equal to the wear, and does not multiply the error, as in some other forms of parallel motions.

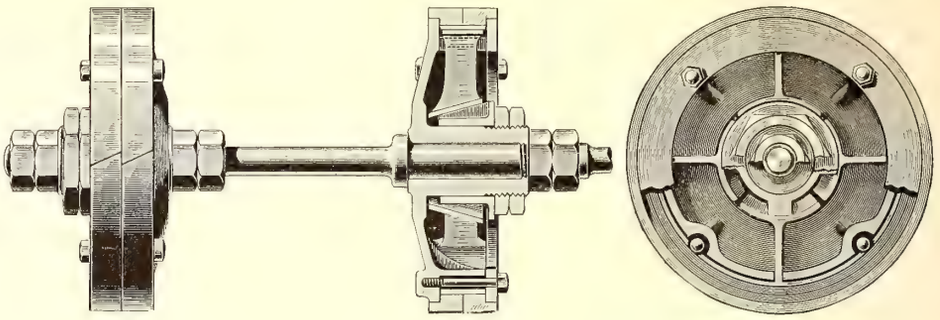


THE ROBERTSON-THOMPSON INDICATOR.

It will be noticed by reference to the cut that the two links are parallel with each other at all points of the stroke, and that the lower pivots are always in a straight line with the pencil point. This arrangement does not depend on the piston rod for a guide, and gives a very exact pantograph effect. The indicator is made almost entirely of brass heavily nickeled, but for use on ammonia machines it may be constructed entirely of steel. The piston rod is of steel, hollow and threaded on the inside, permitting the adjustment of the pencil point to any height on the drum. The drum is one and three-quarters inches in diameter and is provided with a bearing one a half inches long at the bottom and half an inch long at the top, as well as cone bearings to take up the end play. The guide pulley admits of the cord being led in every possible direction without the use of carrying pulleys. The indicator can be readily adjusted for either right or left hand use, and on account of its light moving parts is especially adapted for high speed service.

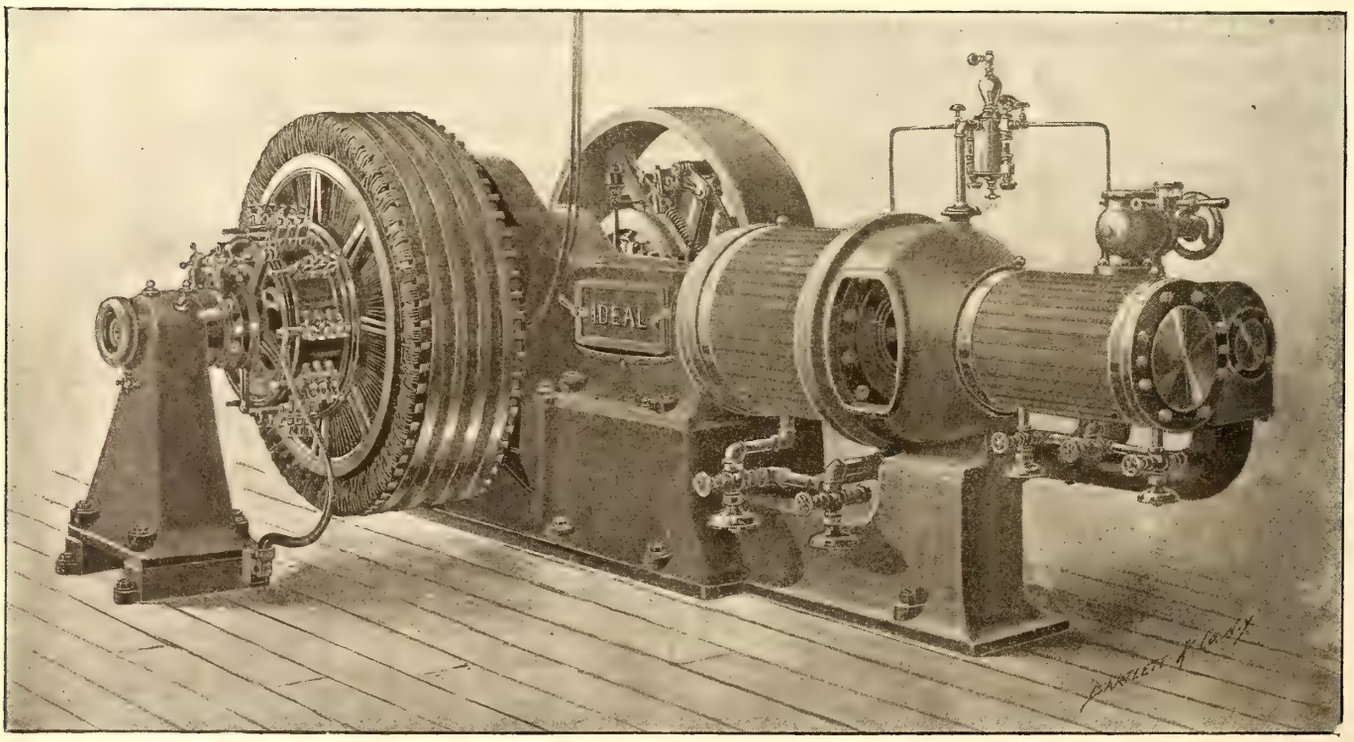
Direct Connected "Ideal" Engines.

The direct connected combination of engine and dynamo of to-day is demonstrating, by an increasing number of plants, its practicability, efficiency and sound principles. We illustrate one of the latest of these combinations. This comprises a multipolar dynamo of the Waddell-Entz type, driven by a Harrisburg tandem compound, Ideal, self-oiling engine. The dynamo is 80 K. W. capacity, and the Ideal engine, cylinders 10 and 17 × 22 ins., is built for running, in this instance, non-condensing. The speed of the combination is 260 revolutions per minute, and it operates under a pressure of 115 to 125 lbs.



DIFFERENTIAL EXPANSION PISTON VALVE—IDEAL ENGINE.

The Ideal engine has several strong points of improvement. The self-oiling feature is shown to be a highly efficient device, all the bearing surfaces being by its use supplied with continuous streams of oil, by which the following very apparent advantages are obtained: First, perfect circulation of oil without the care and attention dependent on drop feed and other devices for oiling. Second, important bearing surfaces are dustproof. Third, there is freedom from all splashing and unsightly dripping of oil on the floor and dynamos. In direct connected work of this character, it is extremely important that the dynamos should be kept as free from oil as possible, for it has been proved that short circuits of dynamos are most frequently traced to the throwing or conveying of oil from the engine to the dynamo.



IDEAL ENGINE DIRECTLY CONNECTED TO DYNAMO.

Another point is the improved adjustable piston valve shown. In this valve the sectional spider that governs the pressure of the packing rings is made of composition metal or brass, having a greater ratio of expansion than the metal in the valve proper or its seat. The adjustment is made when the engine is tested at the works, steam being let in between the flanges of the valve, and the adjustment made while hot; when the parts cool, the greater contraction of the brass spider releases the rings, thus preventing sticking and consequent damage to the surfaces when the engine is started after a period of rest. As soon as the valve becomes heated the adjustment of the rings perfects itself.

These engines are remarkable for the simplicity and heaviness of their design, the method of support under the cylinders being original.

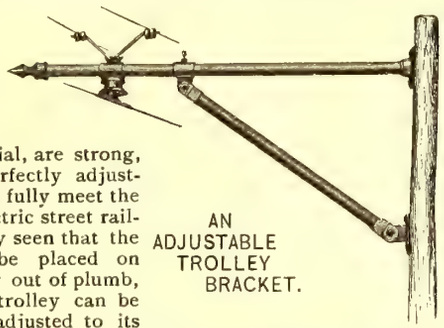
Stern & Silverman, railway contractors, of Philadelphia, Pa., have taken the contract for the reconstructing of the Brigantine (N. J.) Beach Electric Railway. This road was built a year ago, directly upon the sand, and was swept away during the storm of October, 1893. It is to be rebuilt upon trestle construction, and bulkheads and jetties projecting into the ocean. The road is to be in operation June 1.

The economy of this combination is quite remarkable, since a water consumption is obtained in service of twenty-three pounds per horse power non-condensing.

The Ideal engine illustrated was manufactured by the Harrisburg Foundry & Machine Works, of Harrisburg, Pa., and was installed at the Bridgeport Copper Company, of Bridgeport, Conn., by the manufacturer's representatives for New York and Boston, W. R. Fleming & Company, 203 Broadway, New York, and 620 Atlantic Avenue, Boston.

Adjustable Trolley Wire Brackets.

The use of adjustable trolley wire brackets is often most convenient, and they have proved most popular with line contractors and constructors. We show herewith a convenient bracket of this kind which is manufactured under the patents of the Burnham & Duggan Railway Appliance Company, of Boston, Mass.



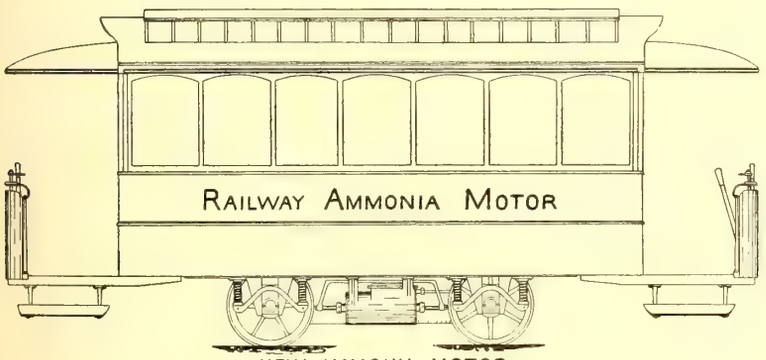
AN ADJUSTABLE TROLLEY BRACKET.

The brackets are made of first class material, are strong, neat in appearance, perfectly adjustable, and, it is claimed, fully meet the requirements of the electric street railways. It can be readily seen that the Duggan brackets can be placed on poles that are crooked or out of plumb, and when required the trolley can be quickly and accurately adjusted to its proper position. All of this can be accomplished without disturbing the pole or the fastenings of the bracket to the pole.

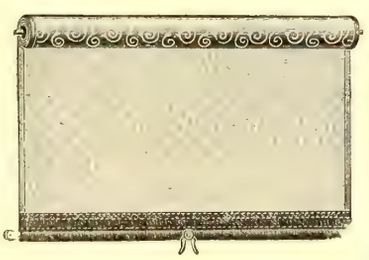
Duggan brackets are extensively used on the principal railways of this country, and in some cases have been substituted for rigid brackets, where experience has shown that adjustable brackets are not only necessary in use but economical in maintenance of line.

The Railway Ammonia Motor.

Our readers will remember that some months ago we published an engraving and description of an ammonia motor that was operated on the 28th Street line, New York City. The motor, as its name implies, was operated by ammoniacal gas, which was used to work a small engine placed under the car. The motor was withdrawn from service some time ago, and its manufacturers, the Railway Ammonia Motor Company, have made some changes in its mechanical construction. Two motors of an improved type are now in course of construction at the works of the De La Vergne Refrigerating Machine Company, 138th Street, New York, the large manufacturers of artificial ice machinery. One of these motors will be ready for exhibition on a New York line about the middle of April.



NEW AMMONIA MOTOR.



The motor car body was built by the John Stephenson Company, Ltd., of New York. The motor is of fifty horse power, and the reservoir can be charged in two minutes to run a distance of thirty miles. The motor is designed to attain a speed of twenty miles per hour, and can climb a grade of 8 per cent. at a speed of six miles, hauling two trailers loaded, or a weight of nine tons.

The principle upon which the ammonia motor operates is the expansion of anhydrous ammonia gas. Anhydrous ammonia can only be kept in a liquid form under atmospheric pressure at 40 degs. below zero, or under greater pressure corresponding with the increased temperature. At about 60 degs. F. it will evaporate with sufficient force to give a pressure of 100 lbs. per square inch on the cylinder of an engine; at 80 degs. F. it gives 150 lbs., and at 115 degs. F., 225 lbs. pressure.

The anhydrous ammonia is charged into a sort of tubular boiler, and surrounding this is an outer tank filled with water at a temperature of 80 degs. This gives an initial pressure of 150 lbs. of ammonia gas, which is passed through the engines shown. The exhaust gas from the engine is discharged into the water tank and is completely absorbed, water being able to absorb 727 times its volume of ammonia gas. The union of these elements also increases the temperature of the water, and consequently the pressure.

Anhydrous ammonia is a cheap product, and is obtained by distilling aqua ammonia. One cent's worth of coal is sufficient to produce six gallons of ammonia, or all that is required, it is said, to operate a car for two miles. As none of the ammonia is allowed to escape, but all is absorbed by the water in the outer tank of the motor car, the material can be used over again practically indefinitely, the only process required being the redistilling, as described above.

The question has often been asked if there is any liability of explosion or ignition of ammonia gas, and has been settled by the best authority that it is not ignitible, and under the conditions in which it is used in the ammonia motor there is no possibility of explosion.

Large Consolidation at Allentown, Pa.

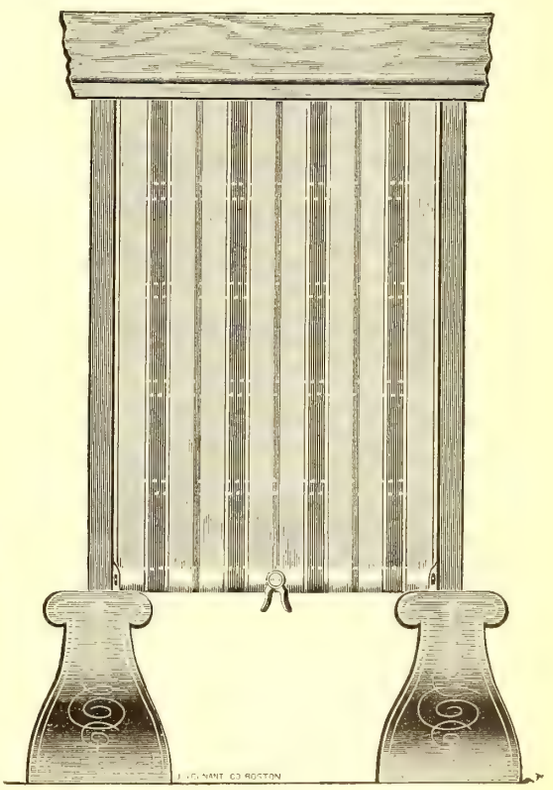
A consolidation of the street railway interests of Allentown Pa., was made last month by a number of capitalists, among which were A. L. Johnson, of Cleveland, and R. T. Wilson, of New York.

The old company was known as the Rapid Transit Company, and was largely owned by the Industrial Improvement Company, of Boston. In addition to this property, the syndicate has secured a baseball ground, shooting park, picnic grounds, etc., as well as the common stock of the Allentown Power Company, which had a contract for lighting Allentown. A. L. Johnson has been elected president of the new company.

Curtains for Street Cars.

The substitution of curtains for wooden blinds, which is a noticeable feature on many of the new steam and street cars, has been brought about in the interests of health, convenience and economy. The space for receiving lowered blinds in street cars is a receptacle for all sorts of filth. Hence, the employment of blinds has many opponents. On the other hand curtains can be dusted or washed, the cloth can be cheaply replaced, using the same old fixtures, and the convenience in use is beyond comparison. A curtain that will run easily, stop at any point, which cannot be run up on the fly when released, is strong, durable, cheap and convenient, is greatly to be desired. By a new process, open car shades are rendered mildewproof and waterproof, thus lasting much longer.

Two styles of curtains, manufactured by the Davis Car Shade Company, of Portland, Me., are shown herewith. The holding device employed with these shades has been described in former issues. Among the recent orders closed by this company is one for shades for 250 cars with the People's Traction Company, Philadelphia.



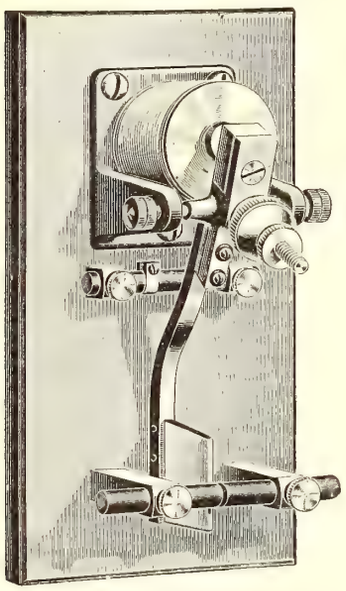
CURTAINS FOR STREET CARS.

THE Newburgh (N. Y.) Electric Railway Company was incorporated February 28; capital, $150,000. Directors: George L. Nichols, George M. Huyett, William M. Tobias, Henry R. Newkirk, of Brooklyn; Harry C. Norton, of Newburgh, and others.

A New Lightning Arrester.

The W. S. Hill Electric Company, of Boston, has put upon the market a new lightning arrester, known as the Doane arrester, which we illustrate herewith. This arrester possesses several ingenious features which should draw the attention of station managers. In it the short circuit is made through a non-inductive resistance sufficient to limit the current that will follow the lightning discharge to an amount that can do no injury. In a 500 volt circuit with a non-inductive resistance of 100 ohms in series with the arc, only five amperes can follow the discharge.

In this instrument the arcing points are carbon rods, shown in the cut, the resistance being placed in series with the line. The cutting of the arc is made by a slate block, on the end of the movable lever, and raised between the carbon points by the action of the coil, shown in the cut. No current can pass through any of the movable parts of this arrester, and as only a limited amount passes through the carbons they are practically indestructible.

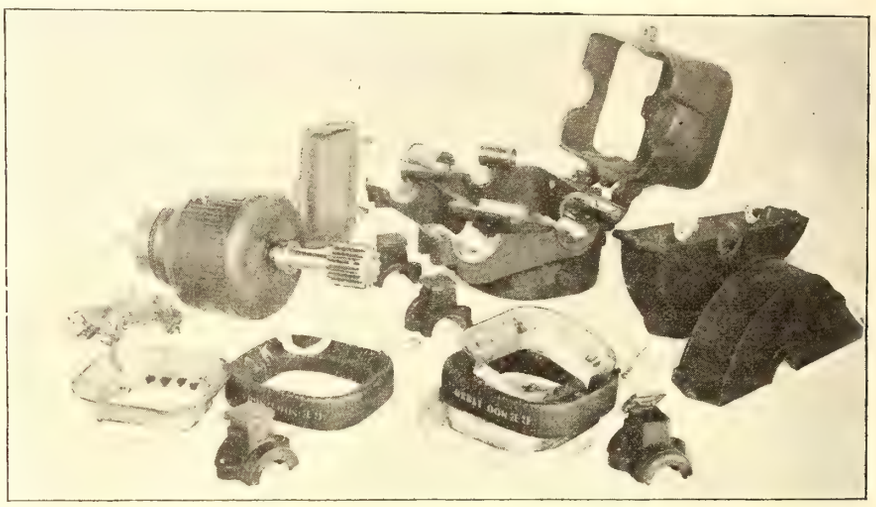


A NEW LIGHTNING ARRESTER.

A Dissected G. E. 800 Motor.

The G. E. 800 motor has gained for itself numerous testimonials from practical railway men for excellent qualities. Its light weight, in particular, appeals to the economical manager, who finds that by its use the wear on his track is necessarily reduced. The cost of the maintenance of the motor has been found very low. Some have been run for nearly a year without entailing a penny of expense for repairs.

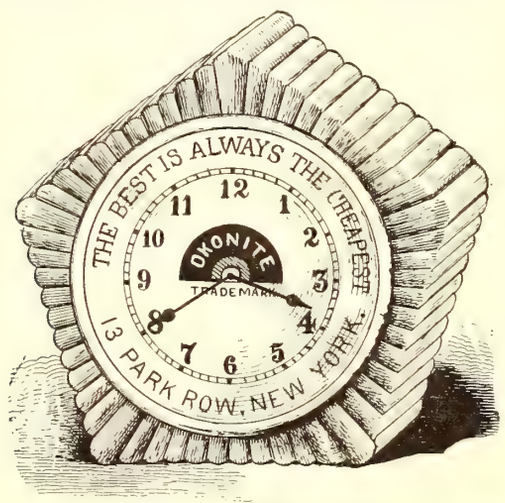
The cut shows the method of construction of this motor. The armature is of the iron clad type with embedded winding. The spools are wound and set in cup shaped field pieces, which are bolted to the upper and lower frames. The bearings are lined with the best quality anti-friction babbit, and the small door in the top frame of the motor allows of ready access to the brushes. When the motor is closed, and mounted on the car it is absolutely water and dust proof, and under the control of the equally well known type "K" controller, forms with it an excellent pair.



A DISSECTED G. E. 800 MOTOR.

A Tasteful Paper Weight.

The Okonite Company, of New York, which has the reputation of doing things up in a very handsome manner, has recently sent us a very novel and tasteful paper weight. This is of glass, in the form of a pentagonal prism, and contains a small clock which is a first rate time keeper. The face of the clock bears the familiar trade mark of the Okonite Company, and the motto of the company, "The best is always the cheapest."



A TASTEFUL PAPER WEIGHT.

The Geneva & Waterloo (N. Y.) Electric Railway enterprise has been revived again. It is averred that the road will be built this year. The right of way has been mostly secured, it is said.

The City Council of Akron, O., has passed the ordinance granting the Akron & Cuyahoga Falls Street Railway Company permission to extend its lines into the city.

New Type of Car Seat.

The accompanying engraving shows a novel type of car seat, built by the Gilbert Car Manufacturing Company, and placed in ten Kentucky and Indiana cars constructed by that company. It differs from other car seats of its kind in that the back does not turn over when reversing, but simply moves from side to side. It is claimed that in this way the seats can be placed much nearer together, and can be more easily and quickly reversed at the same time, as fast as the conductor can walk through the car. It has the tilting seat, as in all steam railway car seats, and when the back is moved in one direction the seat travels in the opposite direction, raising the front. Ends of arms are not used, so as to make the seat more convenient for entering or leaving.

Mr. Anger, of the Gilbert Company, has also devised a center lock, not shown in the engraving, for locking the back of this style of seat, and which can be used if required.



NEW TYPE OF CAR SEAT.

A Complete Line of Overhead Material.

A collection of overhead parts sold by the New York Electrical Works is shown herewith. The engraving is from a photograph taken last month of one side of this company's New York office.

The section insulator of which two views (side and bottom) are shown, has, in common with the full line of crossings and switches, the horizontal run for the trolley wheel. The further advantage claimed is the carrying the current from each end to the center by strips of metal on opposite sides of the central running piece of wood. This is an advantage in many ways and is very fully covered by the patent. There is no point on the line from which current cannot be taken by the wheel, and yet there is no possibility of a burnout. The car lights do not go out in passing over it, and it avoids shock to the motor, especially on heavy grades.

The rigid right angle crossing and the diagonal, which is adjustable to any angle, have a horizontal run for the trolley wheel. There being no dip, the sparking is greatly reduced and the tendency for the wheel to jump off the wire, so noticeable at crossings, especially when taken at any speed, is claimed to be overcome. The method of holding the wire down is by a key or wedge which is forced down on the wire by a cap screw, as shown in the cuts of crossings, switches and section insulators. The method of clamping the trolley wire in the switches to hold it against the horizontal strain or pull of the wire is similar, using a cap nut and key which bends the wire into a depression left in the body of the switch, or over a hump or projection.

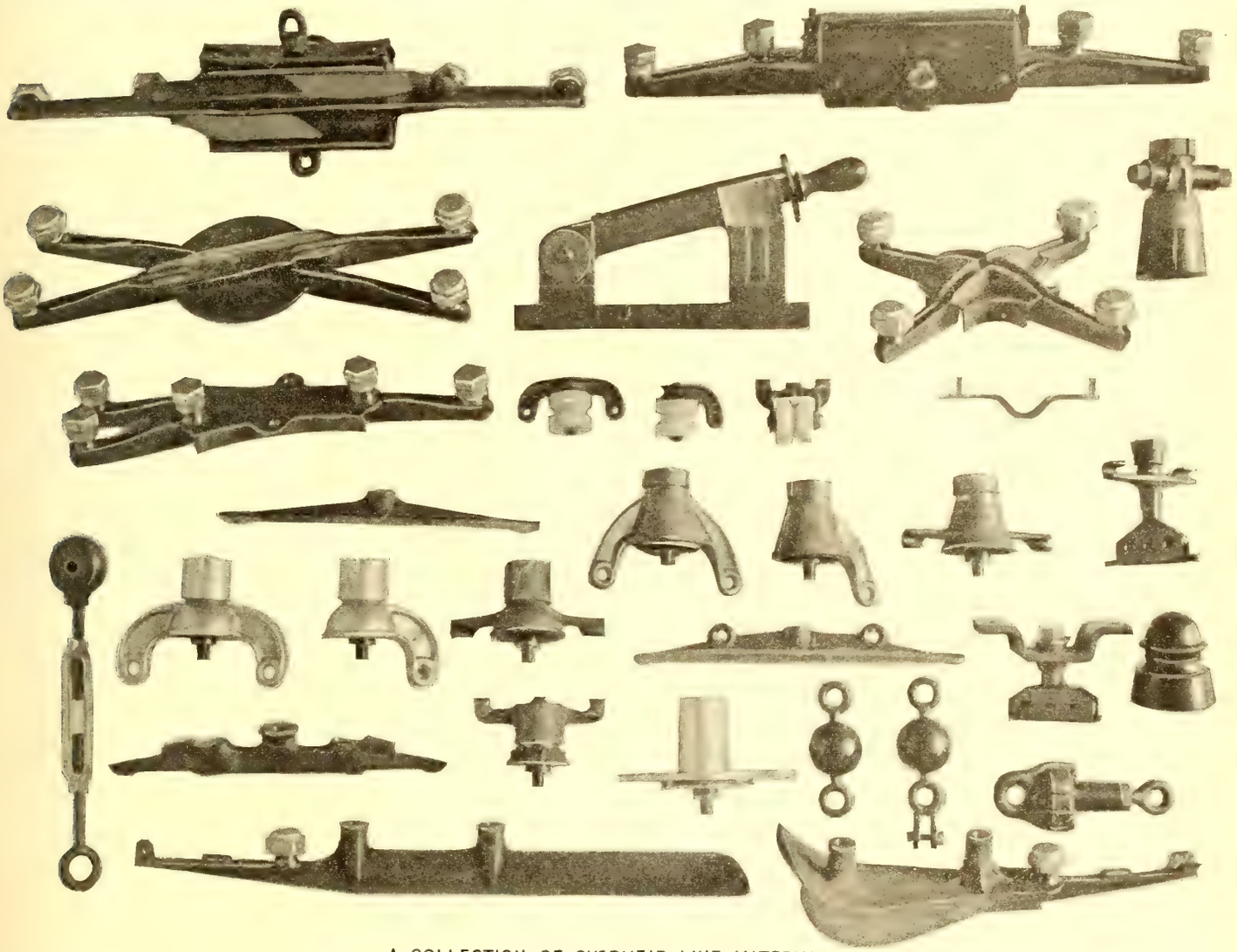
There are several kinds of straight line hangers, pull-offs, solder ears, splicing ears, anchor or strain ears, and mechanical clips also shown, as also a spring hanger for bridge work or under elevated roads, and a very simple and neat car house hanger.

The insulated turnbuckle shown in the cut is one that was tested in a Riehle testing machine, and gave way at the opposite end from the insulation at a strain of 6,085 lbs.

The mechanical clip is giving great satisfaction wherever used, and is especially valuable for emergency work.

While this company makes solder ears and material of all kinds to use with solder, its especial attention is given to mechanical devices obviating the use of solder, and it has a full line of such material.

The insulating compound used in its devices has shown wonderfully high resistance in a series of tests made at one of our foremost institutions of learning. Of a lot of hangers submitted to a breakdown test, none broke through at less than 5,000 volts, and some ran up to over 20,000.



A COLLECTION OF OVERHEAD LINE MATERIAL.

General Electric Exhibit at the Midwinter Fair, San Francisco, Cal.

The building officially called the Palace of Mechanical Arts is the one containing most of the electrical exhibits. The exhibit of the General Electric Company occupies a space less prominent in location and smaller in size in proportion than that occupied by the same firm in Electricity Building in Chicago. At present the electric field on the Pacific Coast lies chiefly in the way of transmitting power, and its employment for the propulsion of street cars, mining work, etc., owing partly to the high price of coal, and on the other hand to the abundance of water power in the higher altitudes. For this reason evidently the General Electric Company made a specialty of its mining and power transmission apparatus. The standard car equipment is also shown, consisting of a Bemis truck, having mounted upon it two G. E. 800, single reduction, iron clad motors, fitted up with the new style of suspension, allowing the larger part of the weight of the motors to be carried on springs, instead of being thrown on the axles.

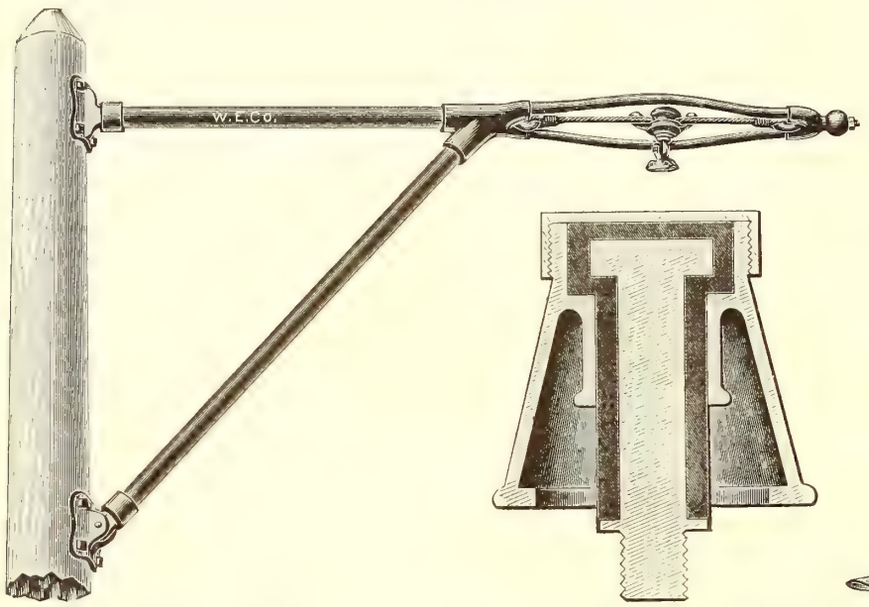
There is also exhibited a complete power transmitting plant with three-phase current. The generator is of thirty-five kilowatt capacity, and is driven by means of a thirty-five kilowatt motor. The current of the generator is led to a switchboard containing the usual set of instruments, such as indicators, recording wattmeters, switches and fuses, and the regulator for the field winding of the motor. From this switchboard the "line" is carried on oil insulators, after having been transformed in the step-up transformers from a potential of 300 volts. to one of 6,000 volts, to the switchboard of the receiving station. Step-down transformers are employed there, reducing the voltage to 300, under which pressure the current is delivered to a ten horse power, three-phase motor. This is belted to a "drill" generator, or dynamo having rotary bushes, such as required for the operation of the percussion drill. The drill exhibited is of the General Electric type. Connection is made by means of a cable armored for its better protection in usage in the mines. A ten horse power mining locomotive, portable mining outfits consisting of a diamond drill and hoist operated by the same motor, motor and pump, sinking pump, etc., are also shown.

A board filled in exposition style with railway supplies, etc., a few fan motors which attempt to make things lively by means of colored ribbons attached to their frames and floating in the air currents produced; a search light, twenty-four inch projector, four large ball clusters on poles, contaning each forty sixteen candle power lamps and two cubes of fifty-four sixteen candle power each, complete the exhibit so far as the Exposition space proper is concerned.

A 200 K. W. railway generator furnishes current for cornice lighting, the lamps being connected five in series, also for the motor of the tower elevators, and is driven by a double piston valve engine of the Joshua Hendy Machine Works, of San Francisco, cylinders 14 × 18 ins., belt connected. The cylinders are oiled by the Acme light drop lubricant. This dynamo is on the opposite side of Machinery Hall, near the boiler house, where also are found eight arc light machines of Thomson-Houston make, each of fifty light output. They are driven, four each, from a countershaft, which in turn are belted, one to a Buckeye automatic cut-off, slide valve engine of 200 H. P., 140 revolutions; cylinders 14 × 24 ins., the other one to a 150 H. P. Russell engine of 190 revolutions, cylinders 13 × 20 ins., and fitted with the Russell automatic cut-off slide valve and flywheel governor.

Combination Pole Bracket.

Superintendents and managers of electric roads have long felt the want of an improvement in bracket suspension. Among a number of new devices for bracket construction which have been placed on the market within the last few months, Wood's combination bracket stands out as one embodying all of the improvements which tend to make it a practical, simple and durable device. The pole bracket illustrated herewith was designed to overcome all of the difficulties experienced in bracket suspension, and it can be thoroughly depended upon either in single or double track work. The principal objection to bracket suspension is the rigid construction and the continual hammering effect received from the trolley wheel, which is not only detrimental to the trolley, trolley wheel and line, but tends to loosen the bracket and increase the arcing and burning.



COMBINATION POLE BRACKET.

This device entirely obviates this trouble. By reference to the above cut it will be seen that a straight line hanger is to be used for supporting the trolley wire instead of the ordinary bracket hanger. The hanger is held in place by a piece of one-quarter or five-sixteenths inch span wire about three feet long, which affords a *flexible* support for the insulator. This bracket is similar in construction to the ordinary bracket now in use, differing only in the fact that two curved arms which support the span wire extend over the brace casting. The span wire is easily adjusted by means of an eye bolt at the extreme end of the bracket. All objections to rigid construction have been overcome by the use of this bracket, and the liability of breakage is reduced to a minimum. This bracket is being placed in the market by the Wallace Electric Company, Chicago, and was designed by M. M. Wood, the company's electrical engineer.

Under the caption of "Anti-Friction Materials" *Cassier's Magazine* for March publishes an article by K. Hedges, M. Inst. C. E. The use of oil as a lubricant, says Mr. Hedges, is to separate the rubbing parts of machinery and to diminish the friction of metal upon metal by an intervening film of oil. If the oil is supplied in sufficient quantity to cause the entire separation of the metals, the friction is reduced to the measure of the viscidity of the oil. Where an insufficient quantity of oil, or a poor quality, is used, friction is caused by the interlocking of the metals forming the revolving and stationary parts of the bearings. For if the bearings are examined under a strong magnifying glass their roughness is very apparent, and the oil used, under such conditions, carries along with it particles of metal that are gradually torn from either the revolving shaft or the bearing, and these particles aid greatly in increasing the friction and causing further wear and cutting. It is a well known fact that heavy lubricants effect a better separation of the metal, and with less wear and tear, than lubricants that are more limpid. Of all the various materials tried, graphite, especially flake graphite, is proving quite successful in reducing friction and curing hot bearings. The conditions of success, so far as lubrication with graphite is concerned, are: The graphite must be soft and yielding, absolutely pure, free from grit, and the flake of uniform size.

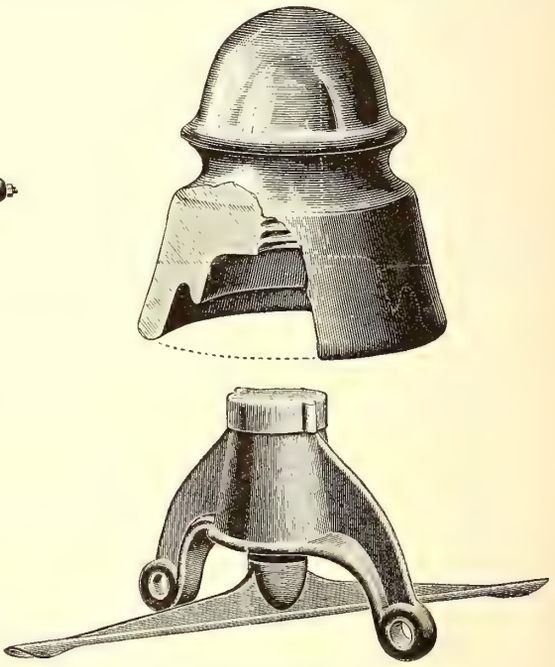
Large Motor Equipment for Brooklyn.

The Curtis Electric Manufacturing Company, of Jersey City, announces that it has closed with the Brooklyn City Railroad Company for 120 electric car equipments. The motors furnished will be its well known 30 H. P. "Box" type. These motors have been in use on the lines of the Brooklyn City Railroad Company for the past two winters, running in competition with those of the two largest electric companies. The fact that this large order went to the Curtis Company shows how highly its apparatus is esteemed by the officers of the road.

New Types of Line Appliances.

The accompanying illustrations show some line appliances sold by the Lynn Manufacturing Company, of Boston, Mass. The construction of the appliances can be easily seen from the sectional and other engravings shown herewith.

Each piece of line material supplied by this company is made of bronze or metal castings which have been thoroughly tested before leaving the factory, and is insulated with "Sinew Compound" which has achieved a reputation for its insulating qualities, toughness and durability.



SOME NEW LINE APPLIANCES IN SECTION AND READY FOR USE.

The Lynn Manufacturing Company has issued an attractive catalogue giving descriptions and illustrations of its special line and overhead electric railway material.

Improvement in Paneled Switchboards.

The disastrous results usually incident to short circuits in power stations are too well known to, and have been too vividly impressed upon, street railway managers to need further description here. A precautionary device, which could always be relied upon to give complete and independent control of each section into which the system is divided, has for years past been a real necessity in every complete station equipment. This section control is needed to avoid the disablement of the entire system by trouble on any one section which may arise from a variety of causes. Furthermore, a proper system of feeder distribution and section control serves another useful purpose, for if a short circuit on one section cut off all the current, a severe mechanical strain is placed upon the station machinery, and still another strain occurs if the load on all the sections is thrown on simultaneously. A suitable division of the system into sections, each of which is controlled at the station, is therefore desirable for every electric railway.

In order to provide for this convenient and necessary control, the General Electric Company has still further projected its feeder panels, which are made for different numbers of feeder circuits; that known as from "C" adapted for two circuits, being shown in the illustration. It is fitted with a circuit breaker, two ammeters, and two single pole switches for each feeder.

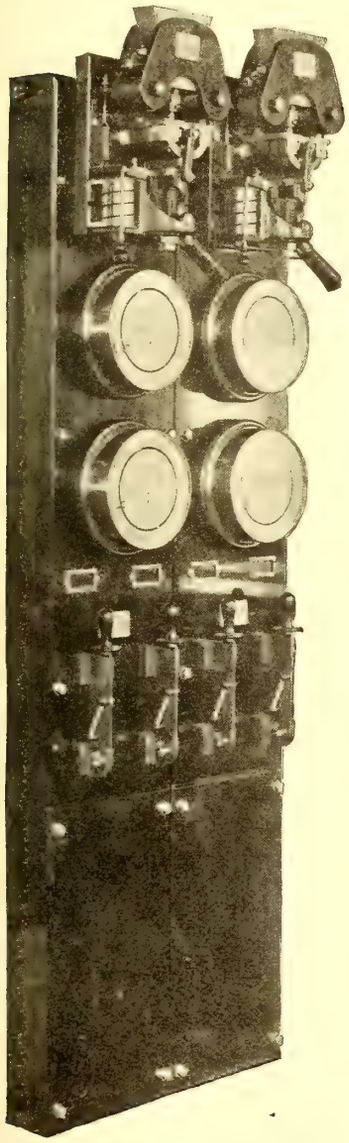
The automatic circuit breaker is known as form K, and is of the latest and most improved design. It will interrupt repeated short circuits without damage to itself, and can be instantly reset. The magnetizing coils will carry 1,200 amperes continuously, and can be adjusted to 1,800 amperes for temporary overloads. The fuses are of excellent design and can be cheaply and quickly replaced. They are of copper and are coiled to secure some electric magnetic effect and diminish the flashing when melting from overload. The terminals are made with a view to avoid the damage from any ordinary short circuit.

These panels are designed to be bolted side by side with the gen-

erator panels, and are supported by vertical angle irons, which can readily be bolted to the angle irons furnished with the generator panels. The bus bar is of the same height, so that the feeder panels can be connected in circuit, by simply extending the line bus bar of the generator panels.

Some of the forms of these panels are equipped with circuit breakers and some with fuses. The circuit breaker acts more quickly in opening the circuit and can be more quickly closed. The fuse acts more slowly, but when blown cannot be replaced as quickly as the circuit breaker can be closed; and although the first cost is less, the cost of renewing fuses is greater than that of maintaining the circuit breaker.

Feeder panels thus made will prove valuable acquisitions to every station switchboard. They have already demonstrated their indispensability and are now being made in large numbers to meet a rapidly increasing demand.



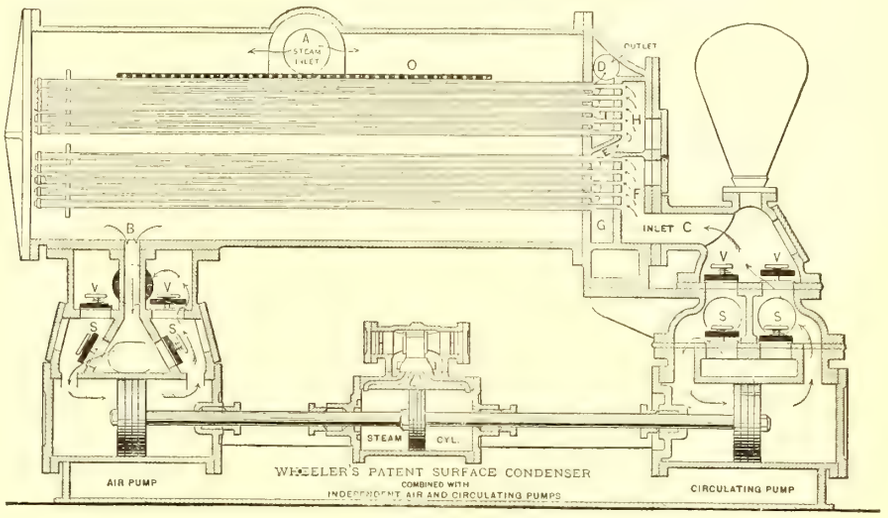
FEEDER PANEL FOR SWITCHBOARD.

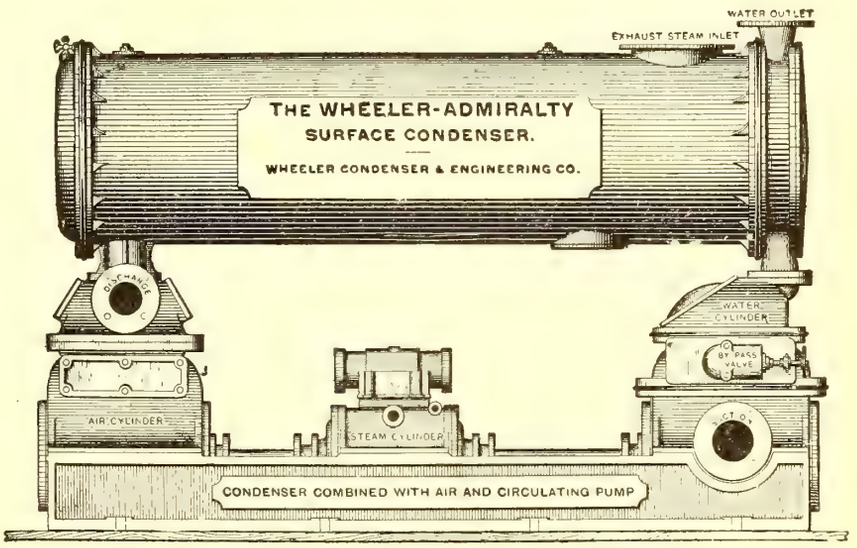
Wheeler Surface Condensers.

The use of Wheeler surface condensers is extending so rapidly in electric and cable railway power houses that an explanation of their peculiar features and method of operation will be both interesting and instructive.

The Wheeler condenser is the result of extensive and wide experience in condensing steam. The principle on which it is constructed is that of exposing as much surface as possible of the cooling medium to the exhaust steam, and producing a uniform temperature in the condenser, making one portion as efficient as another. The tubes are arranged so that they are free to expand and contract, without the use of packings of any kind. The tubes are also so arranged as to be easily removed, so that the condenser can be cleaned and kept in working order without serious delays or stoppages.

Referring to Fig. 1, the exhaust steam enters the inlet nozzle, A, and is distributed evenly throughout the chamber by the baffle plate, O. After being condensed it passes, with the vapors, to the air pump through the outlet, B. As will be noticed, there is ample room in the bottom of the condenser for the water of condensation, so that it cannot accumulate and come in contact with the lower tubes and become chilled. The cooling water enters the condenser from the circulating pump through the inlet, C, and passes into the chamber, F. From this point it enters a series of small tubes which extend inside of larger tubes to a point near the back end of the latter. In returning through the larger tubes, the water passes through the annular space between the two tubes. It is thus spread out, giving a high velocity to the inner skin or surface of the large tube, which sweeps away very rapidly the heat of the steam on the outer surface of the latter tubes. From G, the water passes to H, is again subjected to the same operation as before, and leaves the condenser through the passage nozzle, D.





FIGS. 1 AND 2.—WHEELER SURFACE CONDENSERS.

Fig. 2 shows an external view of the Wheeler "Admiralty" type of condenser, which is not only used extensively in marine service, but is very popular in connection with stationary engines. The tubes of this condenser are of the plain, single type, secured with patent brass screw gland ferules, etc. Either type of condenser can be mounted upon the air and circulating pumps, as shown in both cuts, or is furnished separately to be operated by centrifugal pumps belted to the main engine.

For railway power stations and electric light plants the surface condenser is rapidly taking the place of the jet condenser, owing to the safety and security which it adds to the engine, in addition to the value of the vacuum and the usual advantages gained by the addition of any condenser. In localities where water is unsuited for boiler purposes the surface condenser is of special value, because the water of condensation does not come in contact with the circulating water, and consequently is returned to the boiler in a pure and distilled state.

The Wheeler Condenser & Engineering Company has offices at 39 and 41 Cortlandt Street, New York, and its works at Carteret, N. J., where are the best facilities in the line of special tools, etc., for making condensers of every description.

The Philadelphia Electric Elevated Street Railway Company was incorporated on March 13, with a capital stock of $200,000. The president of the company is Wm. D. Marks. Others interested are D. S. Lindsay, Wm. J. Hamilton and Joseph Blair, all of Philadelphia.

The Washington, Burnt Mills & Sandy Spring Railway Company has been incorporated by George W. Cissell, Ralph L. Galt, of the District, and Asa M. Stabler, John Miller, of Maryland, and others.

The Manufacture of Veneer for Car Seats and Ceilings at Newport, Vt.



W. P. SEGUINE.

Those conversant with the manufacture of veneer are aware that there are several ways in which it is cut. For the information of those unacquainted with the several processes, the following description is given of the method of rotary cutting as practised every week day in the year at the mills of the Frost Veneer Seating Company in Newport, Vt., and Antigo, Wis. The other methods of cutting logs for the manufacture of veneer are by sawing and slicing, each of which has its advantages.

At Newport, Vt., the Frost Company has a mill 40×85 ft., three stories high, and with a saw room on the lake side 24 ft. square. This building is all occupied for the manufacture of veneer, and in connection with this building is a factory 40×100 ft., where the veneer is made up into many different forms, such as chair seats, car ceilings, settees and many other articles too numerous to mention.

But the present article has only to do with the cutting of the veneer, beginning with the logs in Canada ninety miles from the mill. These logs are shipped over the Quebec Central Railroad to Newport, in the winter time, and unloaded on top of the ice, which, for the benefit of those unacquainted with the winters of that neighborhood, it should be said, is often three feet thick. Those logs that are not cut up go to the bottom of the lake, which inside of the boom is from four to twelve feet deep. It is very essential that veneer logs be kept under water during the summer season to prevent season checking and sap stain. The logs are taken from the lake by two men in a heavy boat. This boat is provided with a windlass, and the logs are raised from the bottom with a pair of tongs. Four are attached on either side of the boat, when with the windlass the boat is pulled to the foot of the slip. Here a bull chain is attached to two or three of the logs and they are pulled into the saw room by steam power.

In the saw room the logs are cut in blocks, from four to six feet long, by means of a patent saw machine, shown in Fig. 3, and which well performs the work for which it is designed. About 2,500 ft. of logs are cut up daily and put in the steam tank, where they are steamed from six to ten hours. As there are two tanks, one is being filled while the other is being emptied. From the tank the logs are rolled to the cutting room, and the bark taken off; this process in veneer parlance is termed "rossing." They are then centered, which means that a hole is bored in each end about one-half inch deep. With a crane they are then swung into the machine illustrated in Fig. 2.

The log rotates toward the knife which is slowly but surely creeping up to the log at a rate, which can be gauged by the operator, so as to cut veneer so thin that it will take sixty layers to make an inch, or by giving it a more rapid rate, so thick that it will require only four of these sheets to make an inch. In other words, the machine can be gauged so as to cut veneer any thickness from one-sixtieth to one-fourth of an inch. After the log is rounded up it is possible to take the sheets off in a continuous piece to the core, which is six inches in diameter, but at Newport the sheets are usually pulled on to a table twenty feet long, and are broken up, running layer upon layer. Two men at the far end of the table then cut the sheets in squares, as desired for use. By the aid of little knives, called "spurs," set at right angles to the log, the veneer can be cut any desired width. The widest veneer which can be put on the machine shown is six feet, but the bulk of the veneer is cut in widths of from fourteen to twenty-one inches. It requires four men to operate the machine, two to cut the veneer at the end of the table, one to take off the bark, and two to cut up the logs and put them in the tank.

From the cutting room the veneer is taken on an elevator to the dry rooms, where girls place two sheets at a time in racks made for the purpose. The rolls are taken to another dry room, and spread out, stood on edge, or built in pyramids, as the case may be. The dry veneer is taken out by one man, and carried to the sorting room, where it is graded for the different uses to which it is best adapted. From this room it is taken to the glue room, but as the object of this article is only to describe the manufacture of veneer, we will leave the subject with one or two casual remarks.

A person standing by the veneer machine with a perfect log about twenty to twenty-six inches in diameter, and seeing the veneer roll off, is led to exclaim, what a mine of wealth there must be in cutting veneer. But reverse the thing, and get a poor log in the machine, and see armful after armful go into the fire room. The exclamation will be of a very different character. Many apparently good logs are found to be nearly worthless when cut in veneer. The logs principally used are birch, although some elm and bass are used in the work.

More might be said on the subject, but the principal points have been described and it only remains to give a short sketch of W. P. Seguine, general manager of the railroad department of the Frost Veneer Seating Company, whose portrait appears on this page.

Mr. Seguine was one of the earliest pioneers in perforated seats and veneers. While in the service of the late firm of Gardner & Company, he put into use the first veneer seating ever used by a public conveyance. This was in the old steamer "Shady Side," a trifle over twenty years ago. In this test veneer gained public favor and also began for Mr. Seguine a record as a railroad supply man. At the building of the Third Avenue L road, New York, he seated all the stations from the South Ferry to Harlem. Following this came the building of the West Shore Railroad, and he furnished all stations with seats and settees from New York to Buffalo. He has also done work for the Pennsylvania Railroad system for twenty years, and his veneers are now in all parts of the world.

Mr. Seguine is a thorough mechanic and understands his business from the log up, finding himself at home in the veneer mill, in the factory or at the setting up of his work.



FIG. 1.—FROST VENEER SEATING CO.'S FACTORY—NEWPORT, VT.

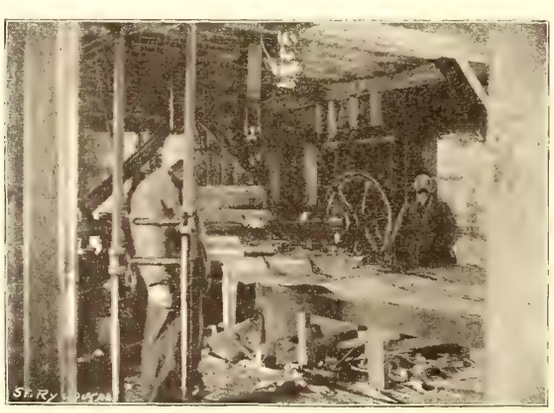


FIG. 2.—CUTTING ROOM—VENEER FACTORY, NEWPORT, VT.

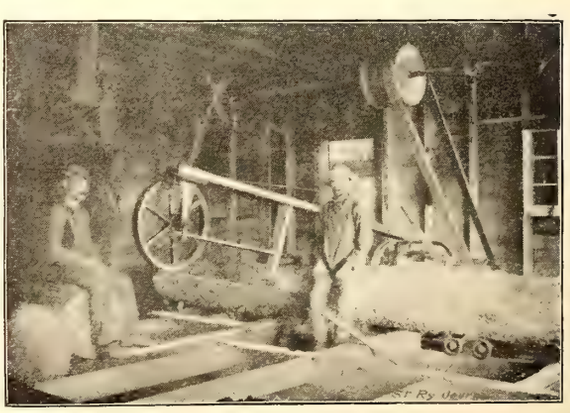
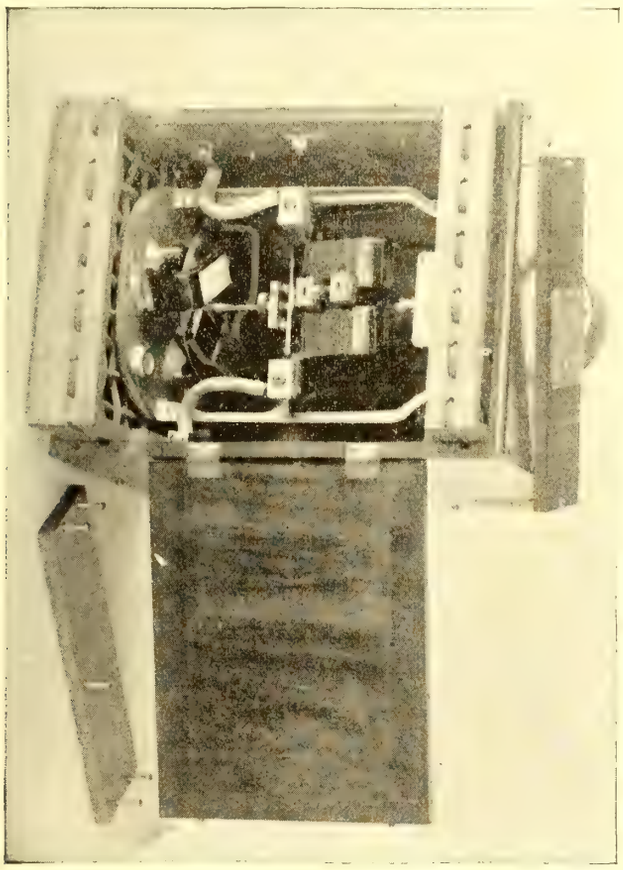


FIG. 3.—SAWING ROOM—VENEER FACTORY, NEWPORT, VT.

Portable Thomson Recording Wattmeter for Street Car Testing.

It is frequently necessary in electric street railway practice to test the power consumption of the cars, and heretofore the General Electric Company has furnished a 500 voltmeter mounted rigidly within a mahogany box for this purpose. This was, however, found not to be without faults. The mechanism being rigidly mounted, the meter was subjected to violent jars which frequently interfered with its accuracy, shortened its life and rendered it unsatisfactory. Experiments have been going on for some time past to evolve a satisfactory portable recording meter for the purpose named, and the General Electric Company now announces one which will satisfy the many requirements of street railway service.

The meter in question consists of a Thomson recording meter mounted on a skeleton metal frame, and having a capacity of twenty-five amperes at 500 volts. It is mounted within a polished wood carrying case about two-thirds the size of the former type. Instead of



PORTABLE RECORDING WATTMETER.

being rigidly mounted in the case, the meter is suspended between two networks of interlaced rubber cord, or, as it were, between two rubber hammocks. This method of suspension saves the meter from violent agitation or shocks, and renders its accuracy reliable. It is the first time that this system has been applied to the recording meter, and it is a feature that will recommend it to all street railway men. The meter may be used placed upon the floor of the car with absolute safety and convenience, and gives perfectly accurate readings.

This portable meter is normally rated at twenty-five amperes. In testing cars, however, the current will frequently, for short intervals, very greatly exceed this, as when starting, or upon heavy grades, but this meter is so constructed as to record these sudden bursts of current accurately, and enormous overloads may be carried through the meter for short intervals without detriment to the instrument or impairment of its accuracy.

The meter has been subjected to careful and severe tests with absolutely satisfactory results.

An Electric Signaling System for Cable Roads.

An electric signaling system whereby the necessary signals may be transmitted from any point on the road to the power house, has been recently put in operation on the Third Avenue cable road in this city. This system is the invention of Frederick Pearce, of New York. The signals consist of a certain number of strokes on a gong, and are sounded and registered at all the power houses. Any arbitrary arrangement of signals may be used. As employed on the Third Avenue road, one stroke of the gong means "Stop the cable"; two, "Go easy"; three, "Go ahead, O. K.", and four, "Fire." There are two gongs in each power house, the larger one of which rings for signals relating to the cables operated from the 65th Street power house, and the smaller to those operated from the Bayard Street power house. There is also an annunciator connected with the gong which shows whether the up or down cable is in trouble.

The signaling apparatus consists of devices called automatics. These are contained in small boxes covered by manholes at certain points along the line. The manholes are placed as nearly as possible on the north side of every other cross street, and where the streets are numbered, on those bearing even numbers. The boxes are also numbered, where practicable, to correspond with the number of streets they are nearest to. Every signal received at the power house is printed upon a tape and the time of receipt recorded automatically. Whenever a stop signal is received, a wrecking wagon from the nearest repair station is sent to the point from which the signal is sent. There being five of these stations along the line of the road, it can be readily seen that assistance can be rendered at any point in a very short time.

The automatic or signaling apparatus consists of a bronze cylinder nine inches long and three and a half inches in diameter, closed at one end by a diaphragm, and at the other by a solid cap. In the interior of this cylinder is the mechanism for automatically transmitting the number of the box. This mechanism is attached rigidly to the framework of the manhole and the box has a slight play about it, governed by the flexible diaphragm at one end. At the closed end of the box is attached a handle that may be swung into a vertical position, by which the box may be raised to send the signals.

When it becomes necessary to send a signal, the conductor of the car proceeds to the nearest manhole, raises the corner and lifts the handle of the automatic to a vertical position, then by raising the automatic, an electrical circuit is broken, and signals sent to the power house according to the number of times the automatic is raised. The general signal used is one stroke of the gong, meaning to stop the cable. The lifting of the automatic to send the first signal winds the interior mechanism, whereby the number of the box is transmitted. When the conductor replaces the manhole cover to return to his car the handle is pressed down against a diaphragm on the top of the box, thereby releasing the mechanism and transmitting the box number. The handle may also be depressed by hand if necessary. Electrical connections may be made at each manhole and telephones attached to communicate with the power house if required.

The automatics are by their construction air and moisture proof, and there is nothing to get out of order. As this apparatus operates on a closed circuit, any defects in the line are at once noted at the power house, and may be repaired.

Work at the Factory of the Barney & Smith Company.

This large and progressive company is more than satisfied with its advent into the street railway field. Its managers report an excellent trade. A trip through the extensive shops of the company was recently made by a representative of this paper, who saw evidences of great activity. He noticed under construction seven open cars for the Mt. Adams & Eden Park Incline Railway of Cincinnati, six of which are grip cars, with seven reversible and one stationary seats, and one trailer, with seven reversible and two stationary seats, one on the outside. These cars are all built with one bulkhead, as they are to run on a loop. They are twenty-five feet six inches over all.

The company is also building for the Mt. Adams & Eden Park Incline Railway eight open, electric motor cars, thirty feet long, with seven reversible and two stationary seat, and no seats on the platforms. These cars are built with bulkheads on both ends, and when completed will certainly present an elegant appearance.

But the pride of the shop is the lot of forty cars now under construction for the Cincinnati Street Railway Company, of Cincinnati. Part of these have been delivered, and reflect great credit upon the company. They are being built twenty-seven feet over all, and eighteen feet on the inside, and have detachable vestibules on one end. The side windows are four in number, and consequently very large, being 48×30 ins., of French plate, bevel edge glass, very highly polished. The end doors are double hung, patent rollers. The interior is finished in cherry, highly polished, and elaborately carved. The ceiling is in birdseye maple handsomely decorated with variegated leaf. The thick windows are glazed with three-sixteenths inch, polished, bevel edge plate glass, with chipped center. The strap rails are of solid bronze tubes, instead of the old-fashioned wooden rail ordinarily used. The seats are upholstered, and are covered with crimson plush. Burrowes curtains, forty-eight inches in width, are used. The Cincinnati Street Railway Company is to be congratulated on the elegant appearance of these cars.

Also complete and ready for shipment is a full equipment for the Capitol Street Railway Company, of Frankfort, Ky. These cars are all mounted on Barney & Smith new improved trucks, are sixteen feet long (inside), and make a very stylish showing. One of the cars is a twenty-two foot body, mounted on a pair of Barney & Smith's double trucks, and is intended for hauling freight. It is equipped with four twenty-five horse power motors, and will be expected to draw freight cars to and from factories located on a belt line of this road. At the factory are also ten cars for the Philadelphia Traction Company, all of which are to be open, twenty-seven feet long, with six reversible and two stationary seats. These cars will have bulkheads on each end.

The Barney & Smith Car Company has also an order from the Canton & Massillon Street Railway Company for nine open cars, twenty-six feet over platforms, with seats all reversible, and vestibules on both ends, seven of which will be mounted on Barney & Smith's new improved trucks.

Eighth Annual Meeting of the International Street Railway Association.

(From Our Special Correspondent.)

The programme for the eighth annual meeting of the International Street Railway Association, which will occur at Cologne, next August, is as follows:

1. TRACK CROSSINGS.

The subject of crossings appeared in the programme of the general meeting of 1893. The following request was then made: "State what proportion of the expense of the installation and maintenance of grade crossings between steam and street railway lines, such as gate-houses, gates, signals, etc., is borne by the steam railway company and by the street railway company.

Have you any new information to furnish or new observations to present in regard to this question?

2. LUBRICATION.

The programme of the general assembly of 1893 contained the following questions: "What lubricants are employed on your locomotives and cars? State the cost of lubrication per axle kilometer." Have you any new information upon this subject? What, according to your knowledge, are any local conditions which should affect the selection of lubricants? What effect does quality have?

3. SHOEING.

Have you made any trial of strap-shoes? What manner of using them did you adopt? What are the results in respect to the work and condition of the horse? What is the expense compared with the cost of the ordinary shoe?

4. RAILS.

Describe the type of rail you use. What have been the faults which you have found with it? What has been the wear, and for how long a time has the rail been in service? What is the amount of traffic on the line and what is the vehicular wear? How do the joints stand up and how do the rails keep to gauge? Is your track sufficiently solid to enable it to stand up in case a system of electric or mechanical traction should be substituted for animal power? State to what type of rail you would give the preference in a pavement of macadam, Belgian block, wood, asphalt, etc.

5. ELECTRIC TRACTION. INSTALLATION.

Describe the system of electric traction which you have adopted. What is the length of line equipped, and what is the topography of the route, especially the grades on the lines?

What is the maximum radius of your curves? Do any curves occur on the grades?

What is the horse power of your central station?

What is the number of motor cars composing your rolling stock, and what is the seating capacity of the cars.

Do you think that the ordinary type of horse car is suitable for electric traction? Do you think that the employment of double decked cars is to be recommended for this service.

What has been the total cost of the installation? Per kilometer for track? Per kilometer for overhead line? Per motor car?

What was the expense of changing over or rebuilding the roadbed.

OPERATION.

What in ordinary service is the current and voltage which you use on the line? What are the same required for maximum service?

What is the average speed of your cars per hour?

What is the average number of cars in operation and the average number of kilometers run daily by the cars? Give this information for motor cars and for trail cars.

State the maximum number of cars which you can put in operation at the same time and the total maximum daily mileage of the cars.

Give this information for motor cars and for trail cars.

State the expenses of operation per motor car kilometer. N. B.—the expense of operation should include the cost of producing the motive power, the wages of employes, and the depreciation of the plant.

State what accidents have occurred in your operation by electricity. What have been the cost and the results of these?

6. HEATING OF CARS.

Have you had any experience in the heating of your cars, and what have been the results?

What system do you employ, and what are its advantages and disadvantages? What was the original cost per car and what is the cost of maintenance per car day?

7. FEEDING HORSES.

What composes the normal rations of your horses? Especially what were the conditions that determined you to employ a greater or less quantity of hay, straw (as food), barley and corn?

From economical or local considerations should the choice of food be made to depend in any way upon climatic conditions?

Application is to be made for a charter for the Berks & Dauphin (Pa.) Traction Company, the incorporators being D. B. King, C. J. Lewis, H. G. Culp, C. Q. Guldin, S. R. Miner, H. M. Brownback and G. Reuntrow Seidel. This is understood to be the first move in the project of building a chain of trolley roads from Harrisburg to Philadelphia, via Reading and Lebanon.

The Cost of Producing Electricity.

At the meeting of the National Electric Light Association, at Washington, February 27, 28 and March 1, the Committee on Data, consisting of H. M. Swetland, T. Carpenter Smith, E. F. Peck, G. G.

TABULATED STATEMENT OF DATA.
(Where there are blanks in the table, details were not given.)

Hours.	Amperes.	Volts.	Watt-hours	Pounds Coal.	Kind.	Watt hours per lb. coal.
24	583	115	1,609,070	10,800	slack	150
15½	101	120	187,860	2,940	.....	64
14	....	....	386,385	3,755	slack	103
.....	....	....	10,989,870	64,155	slack	171
6	25 inc. / 18 arc.	1,000 / 1,500	312,000	4,200	.....	72
6	800 inc. / 6.8	52 / 2,750	361,800	8,000	slack	45
9½	20	1,100	2 090,000	39,750	Ind. block	53
24	10	117	259,600	16,420	Ind. block	166
22	879½	1,180				
7	4¼	2,000	59,500	2,000	soft	30
10	225	110	247,500	4,400	slack	56
14½	20	1,046	381,023	7,300	soft	52
7	6.8	1,632				
6	7	2,640	110,880	1,000	pea	110
14.6	....	....	315,360	6,930	slack	46
6.5	....	....	401,249	5,469	slack	73
24	39	1,050	982,800	30,852	slack	42
8⅔	9.6	2,068	172,058			
24	296	500	355,200			
15	150	120	270,000	5,925	slack	46
13	400	113	587,600	7,000	Pekay	95
10	10	810	81,000			
6	300 / 10	120 / 1,050	279,000	4,000	.....	70
8	19	1,000	152,000	1,404	slack	108
8	113⅓	110	99,550	1,584	.....	79
7	6¾	560	26,460			
24	4,409	122.1	12,920,136	70,352	screenings	183
inc. 24	84	1,100	2,217,600	38,220	hard sc'gs	208
arc. 24	80	2,000	3,840,000			
pwr. 24	145	550	1,914,000			
.....	200 inc. / 24 arc. / .. pwr.	125 / 1,500 /	375,000 / 421,600 / 46,000	7,942	Cumberland and sc'gs.	106
15	234	50	189,100	6,000	.....	31½
4	6.8	500				
7	285	51¾	283,820	5,450	Pittsbg. nut and slack	52
12⅔	268	52				
inc. 24	369	110	974,160	12,267	soft	186
pwr. 18	80	500	586.740			
arc ..	....	....	720,000			
6	200 inc. / 10 arc.	110 inc. / 50 arc.	132,000 / 3,000	2,000	bit. slack	67
6	141	108	91,368	1,400	Lehigh pea	65
14½	26	1,000	377,000	4,200	buckwheat	90
15 inc.	108	1,135	1,838,700	18,600	.....	132
18 pwr.	65	525	614,250			
15	60	1,100	990,000	8,960	ant. bkwt.	110
inc. 11	20	1,000	272,250	3,257	Ygy. lump.	83
arc. 5½	9½	1,000				
12	28	1,000	336,000	3,500	Pardee soft	96
inc. 13	400	52	552,550	6,000	ant. bkwt.	92
arc. 11	9½	2,700				
16	46	1,070	787,520	6,500	bituminous	121
pwr. 12	160	203	389.760	27,366	Y'ghiogheny	104
inc. 24	775	132	2,455 20			
inc. 8	240	110	211,200	3,000	bituminous	98
arc. 7	8½	1.375	81,812			
inc. 15½	230	104	370,760	3,360	slack and nut	111
arc. 6	8	45	2,160			
inc. 15½	15	52	12,090	6,100	bituminous	88
arc. 13	10	4,050	526,500			
inc. 14⅓	20	1,000	290.000	6,048	buckwheat	126
arc. 14	10	3,400	476,000			
15	1,600	52	1,248,000	6,500	buckwheat	192
24	373	112	1,002.624	8,190	Pittsburg	122
14	22⅓	1,000	312,666	2 880	Leh. V. pea	109
7½	310	115	267,375	3,500	bituminous	76
inc. 6½	156	120	121,680	1,681	Cumberland	85
arc. 6	30	120	21,6 0			
inc. 24	500	112	1,344,000	16,000	hard rice	152
arc. 8	100	9.6	7,680			
pwr. 24	200	225	1,080,0 0	4,805	buckwheat	114
16.3	33.56	1,000	547.028	4,800	bituminous	71
inc. 12	25	1,000	300,000			
arc. 5	8½	1,000	42.500	7,380	slack	68
inc. 15	26	1,000	390,000			
arc. 7	350	45	110,250	6,760	Sidney	46
inc. 7	180	110	138,600			
arc. 12	9.5	2,700	307,800	4,300	buckwheat	170
inc. 18	30	1,100	594,000			
arc. 12	6½	1,800	140,400	1,400	bit. slack	62
6½	122	110	87 230	2,000	pea	143
8	inc. 19.25 / arc. 9.6	1,100 / 1,500	284,600	55,420	soft coal	68
25	1,200	125	3,750,000	2,100	coal	117
10	220	112	246.400	5,320	lump	46
10	217.7	113	246,001	1,800	.....	112
6	inc. 22 / arc. 6.8	1,060 / 1,500	201,120	1,800	slack	40
5	120	112	72,800	2,400	bituminous	56
9	120	125	135,000	16,053	good lignite	73
10.46	....	....	1,180,306	12,000	slack	40
14	200	110	308,000			
11	10	1,500	165,000	3,200	McAl. lump	76
11	20	1,100	242,000	3,640	Iowa slack	47
7⅓	203	115	171,197	7,500	buckwheat	67
14	inc. 30⅓ / arc. 52	1,000 / 102	501,256	3,200	coal	25
inc. 7½	14	54	5,670			
arc. 7½	10	1,000	75,000			
			Average watt-hours per lb. coal,			91.7

H. Blaxter, C. E. Scott, presented the preceding table as the result of their efforts to procure data on the consumption of coal in generating electricity. This information was obtained by correspondence, and does not compare favorably, the committee states, with the results secured in generating power for manufacturing purposes. Attention is also called to the great saving in operating in large units and running continuously, as shown by the report, which shows 208 watt hours per pound of hard screenings, where about 8,000,000 watts were generated, running full twenty-four hours, as against the report, which claims only thirty watt hours per pound of soft coal, the total output being less than 60,000 watts and the service being furnished only seven hours.

In order to facilitate comparisons, a table has been prepared on the basis of 90 per cent. engine efficiency, with same dynamo efficiency.

Coal per hour per I. H. P.				Watt hours per lb. of coal.
1.5	lbs.	should	produce	402.84
2	"	"	"	302.13
3	"	"	"	201.42
4	"	"	"	151.06
5	"	"	"	120.85
6	"	"	"	100.71
7	"	"	"	86.32
8	"	"	"	75.53
9	"	"	"	67.14
10	"	"	"	60.43
11	"	"	"	54.93
12	"	"	"	50.35
15	"	"	"	40 28
18	"	"	"	33 57
20	"	"	"	30.22

Discussions on Street Railway Practice.

M. K. Bowen, superintendent of the Chicago City Railway Company, has introduced an excellent method on that railway of improving the service in the operating departments of the road, which recommends itself and has shown excellent results in practice. This consists in the holding of regular meetings attended by heads of operating departments, at which some paper relating to street railway practice is read, after which a general discussion follows. These meetings are held once in two weeks, and the resulting effect of exchanging ideas has been found most beneficial.

At a recent meeting one of the papers read was by W. C. Carter, foreman of the 61st Street car house. Mr. Carter said in part:

Dirty Cars.—The condition of cars depends largely, as far as cleanliness is concerned, on the class of travel. The laboring element that patronizes some of our lines night and morning, will litter a car up more in one trip than the rest of travel will in an entire day. The washing and cleaning of cars at the barn is an important item; to get the best results from the labor employed requires some attention.

A good rustler in charge of the wash crew is an absolute necessity. I think that as a general thing cars are washed too much, especially on the inside. By wiping the windows on the inside, removing the slats and washing them, where there are portable slats, cars can be kept in very good condition.

Water should not be turned on the inside of the car oftener than once a week, and in clean, dry weather once every two weeks. Cars are slow to dry on the inside, especially in winter, and by turning water in two or three times a week the floor and bottom tends to become water-soaked. It soon commences to decay, and causes a sour and musty smell in the car. In clean and dry weather once a week washing cars on the outside, platforms and slats is sufficient. Use a soft brush on the car body very lightly, as too much rubbing soon destroys the lustre of the varnish.

After the crew has washed all the cars, have them devote their time to the windows. Dry wiping of the windows every other night soon puts a lustre on the glass that can not possibly be obtained with water. After the windows have taken on a polish they are very easy to keep clean. Of course, in stormy weather this course cannot be pursued.

Abnormal Breakage of Car Parts.—The largest breakage of car parts seems to be in brake rods. This, I think, can be attributed largely to the suddenness with which brakes are applied by gripmen. If a gripman would take more time to stop his car, and would apply his brake more gradually, the breakage of brakes and rods would be greatly reduced. You can not depend on defects of cars being reported by the train crew, especially on cable lines; hence, a night inspector is a necessity. He should inspect each car after it is in the barn, fix what he can, and mark all cars that are in an unsafe condition for the day repair gang.

All repair work, excepting finished work, should be done at the barns. All work such as finished work on car bodies, etc., should be centralized, as a concentration of forces can be more satisfactorily worked than to have the gangs scattered under half a dozen or more heads.

The "Dragon" fountain brush, manufactured by the General Agency Company, New York, is a device which is claimed to fill a long felt want on street railways, in the washing of cars. It is attached to a hydrant by hose; the water is sprayed over the top of and through the brush, thus making it unnecessary to carry water back and forth in pails. It is a labor saver, and performs the work more satisfactorily and quicker than by old methods. A large number of railways are now using them, and the General Agency Company reports a rapidly increasing business.

Street Railway News.

Extensions and Improvements.

Altoona, Pa.—The Altoona & Logan Valley Electric Railway Company has let the contract for an extension of its lines from Altoona to Bellwood, a distance of seven miles; also a contract for a second track from Altoona to Lakemont Park.

Boston, Mass.—The Laconia Car Company has contracted with the West End Street Railway Company to build for it 150 of its electric car trucks.

Flushing, L. I., N. Y.—The Highway Commissioners have decided to grant the franchise applied for by the Brooklyn City Railroad Company, which desires to extend its tracks over Strong's Causeway into the village. It is said that the road will be in running order by May next.

Milwaukee, Wis.—An ordinance has been introduced in the Common Council, granting the Milwaukee Street Railway Company the right to extend its electric service to Lake Park.

Mount Vernon, N. Y.—Work has been recommenced on the tracks of the Union Railway Company from Mount Vernon to the terminus at West Farms.

New Haven, Conn.—The Fair Haven & Westville Street Railway Company has contracted with the Westinghouse Electric & Manufacturing Company for the electrical equipment of the road.

The Winchester Avenue road will be extended from the West Haven terminus to Merwin's Point at Woodmont. The extension will be complete by June 1.

Niles, O.—It is reported that the Niles & Warren Electric Street Railway Company will extend its line to Girard.

Philadelphia, Pa.

The Hestonville, Mantua & Fairmount Railway Company, will begin immediately to electrically equip its lines.

The Common Council of Philadelphia has concurred in Select Council ordinances granting permission to the Philadelphia, Cheltenham & Jenkintown Passenger Railway Company to lay tracks, erect poles, overhead wires, etc., on Old York Road.

Pottstown, Pa.—The Pottstown Passenger Railway Company contemplates a number of improvements in order to make its line and park more attractive during the coming season.

Worcester, Mass.—The bill to extend the Millbury & Worcester electric railway has been passed to a third reading by the legislature.

New Roads.

Adamstown, Pa.—The Mohnsville & Adamstown Electric Railway Company was incorporated on March 6, 1894, for the purpose of constructing and operating an electric railway in Berks and Lancaster Counties. The president of the company is L. T. Custer, of Adamstown. Others interested are Esaias E. Billingfelt, Elmer E. Billingfelt, and S. W. Miller.

Albion, N. Y.—Emmons, Dwyer & Company, of Syracuse, have offered to build an electric railroad from Batavia through Albion to Lake Ontario.

Allegheny, Pa.—At a recent special meeting of the Select Council, the Millvale, Etna & Sharpsburg Street Railway Company was granted right of way along Liberty and East Ohio Streets.

Allentown, Pa.—Negotiations are on foot for the merging of the two electric railroads of the city of Bethlehem and Catasauqua under one management.

Boston, Mass.—The petition of Reynolds T. White and others for leave to build, equip and operate an elevated electric road in Boston and its suburbs was heard before the Committee on Transit lately. Mr. White proposes to construct a double track belt line of three and a half miles around the city. Mr. White is the inventor of the system to be adopted.

Bridgeton, N. J.—The City Council has passed the ordinance of the Bridgeton, Cedarville & Port Norris trolley road. Work will be begun at once.

Charlottesville, Va.—The Piedmont Construction & Improvement Company, T. O. Troy, president, expects to have an electric railway system in use here by the middle of June. Material has been purchased and contracts let.

Chesterfield, Va.—A bill is in the legislature to incorporate the Chesterfield Transit Company.

Chicago, Ill.—The City Council has passed the ordinance granting a franchise to the North Chicago Electric Railway Company to operate an electric street railroad on Lincoln Avenue, between Wrightwood Avenue and North 59th Street, and on Milwaukee Avenue, between Armitage and Lawrence Avenues.

Clayton, Mo.—The Clayton & Creve Cœur Railway Company has applied to the County Court for a franchise to construct and operate an electric railroad line from Clayton to Creve Cœur Lake.

Cleveland, O.—There has just been incorporated the Ohio Interurban Railroad Company, with a capital stock of $200,000, for the purpose of building and operating street railways. The incorporators are James L. Mauldin, James B. Crist, Clayton Chapman, Cecil L. Saunders, Frank J. Lewis and William C. Scover.

Detroit, Mich.—The Township Board of Springwells has granted a franchise to a Detroit corporation called the City & Suburban Traction Company, headed by Ellwood T. Hance, to run an electric street railway on Michigan Avenue from the city limits to the Dearborn line.

Galt, Ont.—The contract for the equipment of the Galt & Preston Street Railway has been given to Messrs. Ahearn & Soper, of the Westinghouse Company, of Ottawa.

Gettysburg, Pa.—Work on the Gettysburg Electric Railway has been resumed, the creditors who filed a bill in equity having been paid their claims.

Hamilton, Ont.—The contract has been let for the power house of the Hamilton, Grimsby & Beamsville Radial Railway, and it must be finished by June 1st.

Hampden, Me.—The Hampden & Winterport Electric Railway & Light Company was incorporated at the last session of the legislature, the incorporators being J. Manchester Haynes, George E. Macomber, of Augusta; Henry W. Mayo, of Hampden; Fred Atwood, of Winterport, and others. The Company is to construct a railway from the terminus of the Bangor Street Railway, at the Hampden town line, to Stockton Springs.

Hartford, Conn.—A meeting of the incorporators of the Hartford, Manchester & Rockville Tramway Company was lately held to take up subscriptions to the capital stock, which has been placed at $150,000. It is the intention of the company to extend the lines as far as Manchester during the coming summer.

Holyoke, Mass.—The Aldermen have granted the People's Street Railway Company a franchise to lay its tracks on the largest part of the city.

Hopewell, Pa.—The charter has been secured, and capital to the extent of $175,000 subscribed, for an electric line, to run from Roaring Spring, Blair County, to Hopewell, Bedford County, by way of Woodbury and Loysburg.

Indianapolis, Ind.—The Farmers' & Broad Ripple Street Railway Company, of Indianapolis, lately incorporated, proposes to operate an electric line from Indianapolis to Broad Ripple, and also may extend it to Noblesville. The capital is $100,000. The board of directors is composed of W. R. Myers, Secretary of State; John C. Green, A. N. Fisher, Henry Malpas and Oliver C. Myers.

Kansas City, Mo.—President A. A. Pearson, of the Merriam Park, Rosedale & Kansas City Electric Railway Company has filed a petition with the Board of County Commissioners of Wyandotte County, asking a franchise for the operation of the company's proposed electric street railway line.

Kenosha, Wis.—The City Council has passed an ordinance granting a franchise for a street railway to F. M. Kringle. The work must begin within sixty days, and must be finished within one year.

Marion, O.—It is said that a stock company of local capitalists has been organized to build an electric railway.

Moore, Pa.—It is reported that a franchise has been asked for for an electric railway here. The names of the applicants have not been divulged.

New Bedford, Mass.—The contract for building the Dartmouth & Westport Electric Railroad has been awarded to Arthur Hodges, of Boston. The road is to be completed by June 20.

Newport, Ky.—The building of the Newport & Evergreen Electric Street Railway will be begun shortly.

Niagara Falls, Ont.—A scheme is mooted by the Niagara Falls Park & River Railway Company to construct a bridge from the Canadian side of Niagara River to Navy Island, and thence to the Canadian shore. The company is also considering the extension of its line about two miles further up the river.

Norton, Va.—A bill is in the legislature to incorporate the Norton Street Railway Company.

Ogden, Utah.—The Ogden & Brigham City Railroad Company has been incorporated. The company will at once commence the extension of the motor line, now built as far north from Ogden as the Utah Hot Springs, to Brigham City. The following are the officers: James P. Sprunt, president; Edward Reed, vice-president; George F. Phillips, secretary.

Outrement, Que.—An electric railway is the latest possibility in this town.

Philadelphia, Pa.—The Philadelphia Elevated Electric Railway Company was incorporated on March 3, 1894, with a capital stock of $42,000. The president of this company is Walter N. Boyer, of Philadelphia. Others interested are Radcliffe B. Mills, John R. Bannan and Samuel R. Russell.

Portland, Ore.—The Portland Traction Company has been incorporated in San Francisco to build and operate all kinds of street railroads in Portland, Ore. The capital stock is placed at $400,000. The directors are Isaac Hecht, S. Prentiss Smith, Frank L. Brown, S. Schwabacher and Thomas N. Strong.

Pottstown, Pa.—The contract for the construction of the roadbed, track laying and overhead work of the Ringing Rocks Railway Company, has been awarded to Hugh E Crilly, of Allentown.

Reading, Pa.—The Reading & Womelsdorf Electric Railway Company was incorporated on March 10, with a capital stock of $30,000, for the purpose of constructing and operating an electric railway in Berks County. The president of the company is John A. Rigg. Others interested are Richmond L. Jones, Samuel E. Jones, and Samuel E. Rigg, all of Reading.

Skaneateles, N. Y.—It is reported that H. V. S. Lord, of Auburn, secretary of the Auburn Business Men's Association, is furthering a scheme for an electric railroad from Auburn to Skaneateles, a distance of eight miles.

Springfield, Mass.—A meeting of the projectors of a proposed electric street railway between this city and East Longmeadow, was held lately. G. M. Merrill, C. S. Roberson and C. M. Kirkham were appointed a committee on the matter.

Toledo, O.—The right of way from Monroe, Mich., and Detroit has been secured for the proposed electric railroad between Toledo and Detroit. The Toledo parties interested in the road claim that it will be in operation before the first of July next.

Washington, D. C.—A bill has been introduced to incorporate the Union Passenger Railway Company, of the District of Columbia. The incorporators are J. G. Slater, Anson S. Taylor, Henry K. Simpson, George W. Linkins and others, all of the District. The bill authorizes the company to operate a street railway in the streets of the city.

West Chester, Pa.—T. L. Eyre, J. H. Baldwin, Thomas Pennypacker and others have sold their charter for the West Chester & Downingtown Electric Railway to L. G. McCauley, H. B. Buckwalter, James McGraw and J. M. Baker, all of this place. The new owners promise to have the road in operation before next fall.

West Deptford, N. J.—The Camden, Gloucester & Woodbury Electric Railway Company has applied for a faanchise through this place.

West Richfield, O.—A meeting of the citizens of Royalton, Copley, Bath, Richfield, Brecksville, Parma and other townships in Summit and Cuyahoga Counties was held at the town hall in West Richfield recently to discuss the matter of an electric road from Akron to Cleveland. E. Hawkins, R. C. Ellsworth and Peter Bomgardner, of Richfield; S. E. Edgerton and Horace Edgerton, of Royalton; S. E. Witcraft, M. J. Sprankle, of Bath, and others are a committee on the matter.

The White-Crosby Company.

This is the title of a new corporation which will commence business May 1, as contracting engineers. The president of the new company will be O. T. Crosby, who has resigned his position as manager of the railway department of the General Electric Company, taking with him the best wishes of his associates for his success in his new venture. The vice-president and general manager of the new company will be J. G. White, of J. G. White & Company, the well known electrical engineers, and the secretary and treasurer of the company will be G. H. Walbridge, who has been associated with Mr. White for a long time.

The main offices of the company will be at Baltimore, and branch offices will be located in New York and Chicago. The former will be in charge of A. G. Greenburg, now of the insulated wire department of Washburn & Moen, while the Chicago representative of the company will be J. F. Easterbrook. The low rents and cheap markets of Baltimore will allow the company ample room for storing cars, wagons, equipment, etc., together with the best facilities for shipping to all parts of the country such material as is likely to be needed in carrying out contracts.

Mr. White has during the last two years closed contracts in Baltimore alone, amounting in all to about $800,000, of which over $500 000 has been for overhead construction alone, including material and labor. In addition, he has carried on a large business in other sections of the country, to the satisfaction of the principals. Mr. White has now in course of completion, or about to be taken. some additional contracts in Baltimore and elsewhere, which will be completed by the new company.

The manager of the supply department of the company will be H. H. Harrison, and the company will be prepared to supply all kinds of electric railway material promptly.

Personal.

Mr. W. H. Bone, of the Walker Manufacturing Company, was in New York last month on a business trip.

Mr. John H. Stewart, former president of the Ohio State Tramway Association, is about making his permanent residence in Chicago.

Major George W. McNulty, under whose direction as chief engineer of the Metropolitan Traction Company, the Broadway Cable Railway was built, has resigned from that office, and will be located at 45 Broadway, New York.

Mr. H. W. Brinckerhoff, late chief assistant engineer of the Metropolitan Traction Company, has resumed his practice as consulting mechanical and civil engineer, and will be associated with Major George W. McNulty at 45 Broadway, New York.

Mr. F. J. Pearson has been appointed chief engineer, and Mr. L. J. Hirt assistant engineer, of the Metropolitan Traction Company, of New York. Messrs. Pearson and Hirt were formerly connected with the West End Street Railway, of Boston. Mr. F. L. Hart will remain operating engineer of the Broadway road.

Mr. W. W. Hess, former editor of *The Car*, of Philadelphia, has severed his connection with that paper, and is now general manager of the Car Equipment Company, of Philadelphia. Mr. Hess's company has secured the agency, for the Middle and South Atlantic States and

Ohio, for the Graham truck, Johnson portable power house hoist, Johnson oil insulation, Ajax metal trolley wheel, Allen Electrical & Supply Company, etc. Mr. Hess is well qualified for the business in which he is now engaged, and we feel confident will make it a success.

Obituary.

HOADLEY B. IVES, president of the Fair Haven & Westville Railroad Company, of New Haven, Conn., died March 18. Mr. Ives had been president of the Fair Haven & Westville Railroad Company for many years, and was the possessor of considerable property.

HIRAM R. RHOADS, president of the Pennsylvania Street Railway Association, and of the Williamsport (Pa.) Street Railway Company, died, February 17, at his home in Williamsport. Mr. Rhodes, who was born in Philadelphia forty-nine years ago, was one of the early telephone workers, and opened the second exchange in Philadelphia. In 1880 he organized a telephone supply company, and in 1890 purchased the Williamsport Street Railway. At the time of his death he was also interested in several other street railway and lighting properties.

JACOB LIVINGSTONE BARCLAY, of Chicago, Western manager of the sales department of the Walker Manufacturing Company, died March 26, of appendicitis, at Pittsfield, Mass., where he had gone on some electrical business. The usual operation was performed by Dr. Bull, of New York, the famous specialist who was sent for.

Mr. Barclay was well known in electrical and street railway circles. He was born in Glasgow, Scotland, about thirty-six years ago. His first connection with electrical affairs was with Holmes, Booth & Haydens, with whom he remained for a considerable time. Later he was appointed Chicago representative of the Sprague Electric Railway & Motor Company. In this capacity he was most successful, and closed a large number of contracts for electric railway apparatus. Upon the consolidation of the Sprague and Edison companies, Mr. Barclay became connected with the Westinghouse Electric & Manufacturing Company, as its first Chicago electric railway representative, and did much to advance the Western interests of that company. Mr. Barclay has been Western representative of the Walker Manufacturing Company since November last. He leaves a widow and two children.

New Publications.

The Electrical and Street Railway Reporter. Vol. 1. No. 1. Published by the American Electrical Publishing Company, of New York.

This is the title of a new monthly which, as its name imports, aims to follow the development in the electrical and street railway fields. The first number contains a report of the proceedings of the National Electric Light Association, at Washington, as well as other interesting articles.

Illustrated Catalogue No. 1. Published by the Laclede Car Company, of St Louis, Mo.

This catalogue gives views of some twenty of the latest types of cars manufactured by the Laclede Car Company. They include open and closed electric and cable cars, cars with single and double trucks, combination cars, etc. The principal dimensions of each type are also given. The Laclede maximum traction truck, four wheeled truck, and the Robinson sand box are all illustrated.

Catalogue of Electric Trucks, Manufactured by the Taylor Electric Truck Company, of Troy, N. Y.

This catalogue gives a full description of the Taylor improved electric truck, describing in detail the principal features of the truck, as well as its advantages in service. These trucks have shown an economy and durability in service, together with easy riding and non-teetering qualities, which has made them extremely popular. A description is also given of the company's Empire State radial truck.

Catalogue A of the Wallace Electric Company, Chicago.

The first catalogue of the Wallace Electric Company has been entitled by them Catalogue A, and is most complete in the list of electric appliances which it illustrates and tabulates. The officers of this company are well known to the trade, and are well fitted by practical experience to serve it. The company itself, though a new one in the field, has already secured, we understand, a considerable trade, and promises to make a great success of the electrical supply business. The company, on May 1, will remove from 104 Michigan Avenue to 307 Dearborn Street.

Catalogue of Berlin Iron Bridge Company, East Berlin, Conn.

A handsome catalogue of 318 pages has recently been issued by the Berlin Iron Bridge Company, of East Berlin, Conn. This company, as is well known, is engineer, architect and builder in iron and steel. The company not only supplies bridges, as its name implies, but entire buildings, roofs, beams, girders, columns, etc. The catalogue gives views of the most important installations made by this company, with a short description of each. We notice among these views, engravings of a large number of installations made for street railway companies, showing that the excellence of the work of the Berlin Iron Bridge Company is recognized in this industry.

A Text Book on Electro-Magnetism and the Construction of Dynamos. Vol. 1. By Dugald C. Jackson, professor of electrical engineering in the University of Wisconsin, etc. MacMillan & Company, New York. 290 pp.

Professor Jackson is a well known authority on electrical subjects, and his qualifications for writing on the subject of dynamos are excellent. The book before us was developed by the author from a series of lectures given by him to students in electrical engineering at the University of Wisconsin, and is admirably adapted for a text book at colleges or scientific schools, as well as for its use as a reference book by practical engineers. The theory of electro-magnetism and the magnetic properties of iron are taken up from the primary definitions, in a logical and thorough manner, to a study of constant potential, direct current machines. The subject of series arc lighting and alternating current dynamos is reserved for another volume.

Equipment Notes.

The Jewell Belting Company, of Hartford, Conn., has sent us a very handsome card case made up in seal leather, and forming one of the souvenirs of this company at the Electric Light Convention, at Washington, D. C.

H. L. Stillman, of Kenyon, R. I., agent for the Stillman railway system, has recently devised a restraining bolt for use on his system of rails, which, it is claimed, gives a great deal of additional strength to the construction.

The Peckham Motor Truck & Wheel Company, of Kingston, N. Y., has opened a Boston office at Room 315, 53 State Street, that city. A. W. Field, the popular vice-president of this concern, will be its New England representative.

The Gleason & Bailey Manufacturing Company, New York City, has recently purchased a controlling interest in a well established chemical fire extinguisher, and hereafter hand extinguishers and chemical engines will be added to its extensive line of fire apparatus.

The Manhattan General Construction Company, whose offices are at No. 50 Broadway, New York, and Equitable Building, Baltimore, Md., has been appointed by the Buckeye Electric Company its sole agent for New York and vicinity, and Baltimore and vicinity.

The J. W. Fowler Car Company has moved its main office from the Havemeyer Building, Cortlandt Street, New York, to Elizabethport, N. J. The company has fitted up handsome quarters in its new factory building, a description of which appeared in a recent issue of the STREET RAILWAY JOURNAL.

The American Fuel Economizer & Engineering Company, of New York, has issued a very handsome circular, descriptive of its fuel economizer system, of which George H. Burpee is the patentee. This system has been carefully worked out in all its details, and is giving good results in a number of plants.

The Sterling Supply & Manufacturing Company of New York, has moved into new and commodious offices in the Ross Building, Corner of Hudson and Bank Streets. Its shops are also in the same building, which will enable the members of the company to give prompt and personal supervision to all orders.

Johnson & Merritt have been appointed general sales agent for the Boston Incandescent Lamp Company. This firm has but recently organized. Elliott O. Johnson is well and favorably known in electrical circles and Matt. M. Merritt has a large acquaintance. The result of this happy "combination" should be mutual beneficial.

The Standard Glass Insulator Company, the manufacturers of Gray's patent process glass insulators, located at 120 Tremont Street, Boston, Mass., makes a very handsome display of its various kinds and designs of insulators. This company is probably the largest glass insulator manufacturer in New England. It manufactures insulators specially designed for street railway work.

The McKay Curtain Company, of Wilmington, Del., which is already well known in the railway world as a manufacturer of car window curtains of all kinds, as well as lambrequins, draperies, furnishings, etc., is giving special attention to street car work. This company makes a specialty in hair cloth for seat covering; a new style of goods, claimed to be better and cheaper than rattan.

John A. Roebling's Sons Company, of Trenton, N. J., will supply a large amount of the wire and the copper which will be used in the new Bennett-Mackay ocean cable now being manufactured by the Siemens Company. None of the wire was passed at less than 99 per cent. of Dr. Matthiessen's standard, while the aggregate of all the wire actually shipped was 99.873 per cent.

The National Water Tube Boiler Company, of New Brunswick, N. J., owing to the increase of its business, has found it necessary to have more extensive facilities in its New York office. The company has therefore secured commodious quarters at No. 74 Cortlandt Street, where the New York manager, Mr. Loretz, will be pleased to see the company's customers and friends.

The Davis Car Shade Company, of Portland, Me., has established an agency in Chicago with J. M. Denniston as representative. Mr. Denniston's office will be at No. 911 Monadnock Building. Among the orders recently closed by this company is one for the 250 new cars of the People's Traction Company, Philadelphia, which will be equipped with the Davis automatic curtains.

The Pettingell-Andrews Company, at present located at 192—202 Summer Street, Boston, has made arrangements to move to more spacious quarters on Federal Street. This company has recently branched out into the railway field, and means to make a determined effort to make this department as successful as its general supply department. There is every reason to believe that it will succeed.

The Babcock & Wilcox Company, of New York, has moved its main offices to 29 Cortlandt Street, New York, corner of Church Street, diagonally opposite the home of the STREET RAILWAY JOURNAL. This company in announcing its removal, has sent us a handsomely printed leaflet giving views of its different offices in the principal cities of the country, and these show the extent of the business of this company.

A. Groetzinger & Sons, of Allegheny, Pa., sole manufacturers of "Dermaglutine," improved process rawhide for electric street car service and mechanical purposes, etc., are experiencing a great improvement in their business right along; orders for "Dermaglutine" pinions are coming in freely on all sides, from new as well as old customers. From the general outlook this firm confidently anticipates a much larger trade this year than ever before.

The Tripp Metallic Packing, manufactured by Wm. B. Merrill & Company, of Boston, is to be applied throughout to the new engines about to be erected by the Philadelphia Traction Company, of Philadelphia. The Quincy Street Railroad, during the last month, has also placed an order for the "Tripp," and the continued increased demand for this packing throughout the country denotes a very general satisfaction with the results derived from its use.

The John Stephenson Company, Limited, of New York, has recently been awarded an order for 100 open cars by the Metropolitan Traction Company. The style of car selected is a most tasteful one, and will certainly prove a most attractive addition to the company's rolling stock. The Stephenson Company has also a number of other orders on hand, and supplied all the rolling stock for the Mobile Street Railway Company, described in another connection.

The Graphite Lubricating Company, of Bound Brook, N. J., has recently issued an interesting pamphlet descriptive of its graphite and bronze bushings, bearings, washers, &c. References are given to the principal users of this material, and among this company's customers are numbered many of the prominent manufacturing companies in the country. The material has been employed with success for electric railway service, including its use for trolley bushings.

T. E. Crossman, of Brooklyn, announces that he is now located in the Franklin Trust Building, 166 Montague Street, that city, and is ready at all times to perform stenographic work of every description. Mr. Crossman, as is well known, is the official reporter of the American Street Railway Association, the Electric Light Association, the American Water Works Association and others. The excellence of Mr. Crossman's work is recognized by all who have any acquaintance with it.

The Fulton Foundry & Machine Works, of 21 Furman Street, Brooklyn, N. Y., is doing a good business and is prepared to accept all orders for first class castings. E. B. Willcox has reorganized this department of the work, putting all labor on a piece work basis, and writes us that he proposes to keep his works running every day. The long reputation of this concern for first class work, extending over some thirty years, is a guarantee of the quality of the castings turned out.

The Jackson & Sharp Company, of Wilmington, Del., has no difficulty to fill its factory with orders. The demand for cars on the new street car department of this company is great, and orders are coming in in a rapid fashion from different sections of the country. Among those lately received is an order from the Hartford Light & Power Company, of Hartford, Conn., for sixteen open, and four closed cars. The Jackson & Sharpe Company tells us that these cars will be exceptionally fine and tasteful in finish.

The Goubert Manufacturing Company has removed from 32 Cortlandt Street, New York City, where it has been located for many years, and now occupies more commodious headquarters at 14-16 Church Street, corner of Cortlandt. The new offices are attractive in appearance, and in their arrangement and furnishing offer every convenience for taking care of the large business done by the company in the "Goubert" feedwater heater and "Stratton" steam separator, of which this company is the sole manufacturer.

Westinghouse, Church, Kerr & Company, whose ten years of successful business career has made them well known in all branches of the engineering trade, have removed their New York offices from 17 Cortlandt Street to the Havemeyer Building, 26 Cortlandt Street. As a convenience to the technical press, and for the information of their numerous friends, they have gotten out a circular letter giving much interesting information as to the details and principles that have led to the development of their well earned and deserved business success.

The Ball Engine Company, of Erie, Pa., among recent shipments and orders mentions the following made to public buildings in different parts of the country: Two 100 H. P. engines to the Criminal Court building, Chicago; one 100 H. P. engine to the House of Correction, Chicago; one 60 H. P. engine to the Illinois State Reformatory, Pontiac, Ill.; one 100 H. P. engine to the Industrial Home for the Blind, Chicago; two 100 H. P. engines to the State Asylum for Chronic Insane, Wernersville, Pa.; one 135 H. P. engine to the Willard State Hospital, Willard, N. Y.

The Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., reports activity in all the departments of its extensive factory. This company has recently greatly extended its brass founding department, and has now what are claimed to be the best facilities in the country for turning out car trimmings and other brass castings. The company has recently put upon the market a street sweeper which is illustrated and described elsewhere in this issue, also a car jack which is certainly very simple in construction, and should prove most convenient in repair shops, car houses, and for emergencies.

E. F. De Witt & Company, of Lansingburgh, N. Y., report a a large and increased demand for the De Witt Common Sense sand box. The general testimony of those street railway managers who have seen this box has been that it has solved the problem. One of Mr. De Witt's customers, the Cayadutta Electric Railroad Company, of Gloversville, N. Y., has been using the boxes under very severe conditions of service and grades, and in a recent letter to the manufacturers expresses itself as follows: "We are very much pleased with your sand boxes, and have used them to good advantage. T. C. FRENYEAR, general manager."

The Peckham Motor Truck & Wheel Company, of New York, tells us that it is pushing its works to their full capacity on orders for the following named companies: Brooklyn Heights Railroad Company, and Coney Island & Brooklyn Railroad Company, of Brooklyn, N. Y.; Consolidated Traction Company, of Jersey City, N. J.; North Hudson Company, of Hoboken, N. J.; Third Avenue Cable Road, of New York; People's Traction Company, of Philadelphia, Pa.; Cincinnati Consolidated Railway Company, of Cincinnati, O.; Leavenworth Electric Railway Company, of Leavenworth, Kan.; Yonkers Railway Company, of Yonkers, N. Y.

The New Castle Car Manufacturing Company, of New Castle, Pa., has issued a new circular showing views of a number of recent cars turned out of its shops. These engravings show a wide range in the style of cars, and the fact that a very fine line is being constructed by the company. Some of the cars shown are those in operation on the Braddock & Turtle Creek Street Railway Company, Beaver Valley Traction Company, Punxsutawney Street Passenger Railway Company, Bridgeport, Bellaire & Martin's Ferry Street Railroad Company, Warren Street Railway Company, Buffalo & Williamsville Street Railway Company, Youngstown Street Railway Company, and other lines.

The Breese & Mansfield Company, of Philadelphia, Pa., is a new corporation to which has been awarded the agency of the Walker Manufacturing Company for the States of Pennsylvania, Maryland and Delaware, and for the District of Columbia. The company is named after C. B. Breese and Frank Mansfield, both of whom are well known in electrical circles. Mr. Breese was connected for a long time with the Hall Signal Company, of New York, and Mr. Mansfield has had long experience in electric construction through his connection with the Sprague Electric Railway & Motor Company, and other corporations. The headquarters of the company will be at 120 Betz Building, Philadelphia.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., closed contracts last month for the complete equipment of all the cars of the Williamsport Passenger Railway Company, of Williamsport, and all the cars of the Citizens' Electric Traction Company, of Pittsburgh, with its patent automatic safety appliances. Other lines which are equipping their cars with the Crawford safety appliances are the following: Philadelphia Traction Company; Citizens' Street Railway Company, Indianapolis; New Orleans Traction Company; Central Traction Company, Pittsburgh; Duquesne Traction Company, Pittsburgh; Pittsburgh Traction Company; Pittsburgh & Birmingham Traction Company.

Westinghouse, Church, Kerr & Company, represented in leading cities of the United States, have recently undertaken the manufacture of ice making machines, and have met with a spontaneous demand for the same from electric lighting stations, who find that the addition of an ice plant can be very conveniently run, without very materially increasing the present steam plant. The advantages obtained are that the product is obtained with almost no increase of cost for superintendence, office force or labor account, and but little for fuel, and the market is made by the popular demand for pure ice. Southern street railway managers will find it would mean a source of profit to add to their equipment an ice plant.

The R. Woodman Manufacturing & Supply Company, 63 Oliver Street, Boston, Mass., has recently issued what is termed a "Pocket Catalogue." This neat and attractive little pamphlet contains illustrations and descriptions and prices of this company's punches, which are shown in many styles, intended for all kinds of service in connection with street railroad business. Woodman's "baby punch" is intended to be worn as a watch charm, at the same time it is perfect in every detail and is sold for $5. In glancing over the list of street railways now using the Woodman punches, we find such well known companies as the West End Street Railroad Company, Boston, Mass., Baltimore Traction Company, Baltimore, Md., Lynn & Boston Railroad Company, Lynn, Mass., Denver Street Railroad Company, Denver, Colo., and hundreds of other street railway companies.

Chas. A. Schieren & Company, of New York, manufacturers of the celebrated Schieren perforated electric leather belting, have recently received a letter from the Risdon Iron & Locomotive Works, of San Francisco, Cal., which furnished some Schieren belts last summer to the Union Iron Company, of Mentone, Cal. The president of the latter company writes the Risdon Iron & Locomotive Works as follows: "The two double perforated electric leather belts I purchased of you last summer for the Union Ice Company's factory, of Mentone, San Bernardino County, Cal., are doing splendidly. The twenty inch belt on a twenty-six inch motor pulley has a velocity of about 5,000 ft. per minute. The thirty inch belt has a velocity of about 3,000 ft. per minute. Each transmits 1,500 H. P., and are as perfect as when first put on. THOS. J. BARBOUR."

Albert & J. M. Anderson are in receipt of the following very favorable test made by the Brush Electrical Engineering Company, London, Eng., of their "Aetna" globe strain insulation. The test shows that the resistance of this insulation could not be measured by the deflection method; 6,000 volts alternating current were also placed

across it without the slightest sign of breaking down the insulation. A tensile stress of 3,000 lbs. was applied, by means of a lever and weights, but did not affect the insulating material: "Test of Aetna arc lamp hanger. In the original condition the insulation resistance was approaching infinity, but after boiling in water for ten minutes and drying, it was greater than 6,000 megs. It was then allowed to thoroughly dry for seventy-two hours, and again being measured, the insulation resistance went up to over 10,000 megs. It was after this placed across 6,000 volts alternating current without any effect whatever."

Carleton & Kissam, proprietors of the United States Steam & Street Railway Advertising Company, have lately added to their long list of street cars in which they control the advertising privileges, the cars of the North & East River Railway Company, New York; Steinway Railway Company, Long Island City; Newport Street Railway Company, R. I.; Hamilton Street Railway Company, Hamilton, Ont., and also effected a lease with the Brooklyn Union Elevated Railway Company, Brooklyn, N. Y., for the advertising privileges in all its cars and on all its stations from May 1, 1895. Though Carleton & Kissam have suffered the loss of some of their lines in New York City, they have more than made up by adding the above companies' cars to their list, and they have under negotiation several very important deals. Many of the largest corporations and syndicates who control the operation of the street cars in America's greatest cities, prefer to do business with Carleton & Kissam than with others, as they have found the least annoyance and the greatest net income to them from such a source.

The Altoona Manufacturing Company, of Altoona, Pa., builders of improved M. A. Green automatic cut-off engines and general foundry and machine work, reports that recent shipments and orders of the Altoona Manufacturing Company include the following engines and steam plants: One 80 H. P. engine shipped to J. T. Pugh, of Philadelphia, for operating and lighting his new auger factory; one 125 H. P. engine to the Western Glass Company, of Colorado City, Colo., for lighting the factory of the company and the city at large; one 80 H. P. engine to the New Castle Car Manufacturing Company, of New Castle, Pa., for operating and lighting its new street car factory; one 150 H. P. engine with steam power plant complete, shipped to the Farmington Light & Power Company, of Farmington, Ill., for the central station lighting plant in that city; two 175 H. P., special railway engines with boilers and steam plant complete, which were shipped last week to the Lynchburgh & Rivermont Street Railway Company, of Lynchburg, Va., whose plant is now in process of erection. Among the orders received last month were one 60 H. P. engine for lighting the new Christ Methodist Episcopal Church of Pittsburgh; two 50 H. P. engines for lighting the fine new McIntosh-Verner Building on Penn Avenue, Pittsburgh, and two 150 H. P. engines, with steam power plant complete, for the Ringing Rocks Electric Railway Company, at Pottstown, Pa. These two latter engines will be of interest to the electrical fraternity, owing to the fact that they are to be direct connected to two power generators of a design imported from Germany, and they are the first engines that have been direct connected to this make of generators in the United States for electric railway service.

F. W. Friis, principal of the National Railroad Detective Agency, of New York and Newark, has been very busy ever since February 16, when he bought the Special Detective Agency in New York. As he had plenty of business on hand from his New Jersey office, the only thing Mr. Friis had to do was to start up in the new office, to keep both ends busily employed. The location of the New York office at No. 176 Broadway, corner of Cortlandt Street and Maiden Lane, was selected in order that the agency's customers in railroad lines and friends could call without loss of time, when in New York. On March 1 Mr. Friis removed his Newark office from 673 Broad Street to the handsome Prudential Building, Newark. Besides detective work, Mr. Friis is doing a collecting business in his Newark office under the name of the Merchants' Collecting Agency. This department is managed by Jas. C. Thomas, and the business in this line has become extensive, covering claims in all parts of the country. There are telephone connections in both offices. Mr. Friis at first experienced great trouble in obtaining good, honest and reliable inspectors. In several cases, he tells us, inspectors in his employ were guilty of breach of trust; in some instances he has taken them to court to have them punished, but got no satisfaction. In order to avoid this, he has made out a set of rules, which must be kept by all inspectors in his employ, and any one entering his force must furnish a bond of $100 by a responsible real estate owner. This is signed by the bondsman, the inspector, and Mr. Friis, and is also signed and stamped by a Notary Public. This rule of asking each inspector to furnish a bond is so that he may have a hold on his men. Another rule of the Agency is that it will charge nothing for work or expenses if the work does not prove satisfactory; in other words, the company guarantees its work. The Agency makes a written contract with its operatives, in which the latter agree under oath, and the forfeit of their bond, also the forfeit of a week's pay, to report the truth and nothing but the truth. These new regulations cannot fail to give anything but a good result. The New York office is managed by Mr. Friis personally, with the assistance of his superintendent, S. Frankel.

WESTERN NOTES.

L. K. Comstock, of 1437-38 Monadnock Block, Chicago, is putting a 1,500 light, isolated plant in the Leland Hotel, that city. Two M. A. Green engines, and two 50 K. W. generators will be installed.

The Fitzgerald-Van Dorn Company, of Lincoln, Neb., has just closed a contract with the Metropolitan West Side Elevated Railroad Company, of Chicago, to equip its entire rolling stock with its automatic drawbar for elevated railways.

The United States Graphite Company, of Saginaw, Mich., does a large business in the sale of curve grease and motor grease to street railway companies. We understand that these graphite products give good satisfaction. The mines of the company are at Sonora, Mexico.

The Lodge & Shipley Machine Tool Company, of Cincinnati, O., has recently received, with other orders, several for its celebrated motor gear lathe, also triple facing machine, and engine crank, disk turning and boring lathe. This company makes a specialty of machines to rapidly produce work heretofore done in lathes.

The Meaker Manufacturing Company, of Chicago, Ill., on March 1 renewed its contract with the Chicago City Railway Company for the use of the well known Meaker portable register, of which there are 1,600 in use on this road. This contract disposes of the rumor that stationary registers were to be used in place of portable registers on this road.

The Louis K. Comstock Company, is the title of a new corporation doing business in Chicago, which will take care of the work heretofore carried on by Louis K. Comstock, electrical engineer and contractor. The new concern will have the same offices in the Monadnock Building, and is prepared to give prompt attention to all orders in connection with the construction of electric railways, power plants and isolated plants.

L. K. Hirsch, of Chicago, Ill., has worked up a large trade by selling new rails to street railroads and taking old rails in part payment. He finds a market for these old rails at a very low figure. Some of these rails are nearly as good as new. He not only stands ready to furnish bottom prices on new material, but can quote very advantageous prices on second hand material, such as T rails, second hand cars, motors and locomotives. He will also purchase for cash any old equipments.

The Chicago Rawhide Company, of Chicago, reports doing an excellent business. The managers of this company say their trade has been such that they have found it necessary to run their works to their full capacity during all the winter months, a record which speaks well for the executive ability of the management. Mr. Preble says the company's foreign trade is constantly growing, which is indeed flattering. Taking all in all, the Chicago Rawhide Company has reasons to feel proud of the past, and can look forward with certain expectations of a good spring trade.

The Ohio Brass Company, of Mansfield, O., has recently issued a handsome and complete catalogue, giving views of the well known type W trolley wire appliances and other apparatus manufactured by it. This company does not confine itself by any means to equipment necessary for the overhead line, but is ready to supply voltmeters and ammeters, lightning arresters, switches, arc lamps, drills, trolley poles, brackets, etc. In fact, in looking over the index to this catalogue, it is hard to find any item useful on electric railways in the line of general supplies that is not included.

The National Carbon Company, of Cleveland, O., has sent us a handsome calendar for 1894, decorated with a birdseye view of the extensive works of this company. An especially valuable feature of this calendar is that a moonlight schedule for street lighting for each month is given with the calendar. By means of this a central station superintendent operating three arc lights has always before him the time for extinguishing his lights. The view of the company's works gives an excellent idea of the extent of the company's sales and the popularity of its products.

The International Register Company, of Chicago, finds its present quarters too small, and will remove about April 1 to 195-197 South Canal Street, where the company has secured large and commodious space in a modern manufacturing block. The company's new quarters are admirably located for the manufacture of its well known fare register, and are conveniently near the central business district. The company reports business as improving, several contracts for registers having been secured recently, among them the Chicago General Street Railway Company which has adopted the company's portable registers.

Fisher & Porter, of Chicago, tell us that the Providence Steam Engine Company's works are full of orders and are now running a double set of hands night and day. Comments on the merits of these engines "the Improved Greene," are superfluous under such a state of facts these dull times. The Providence Company has a pair of these engines of 1,200 H. P. each in the Rockwell Street station of the Madison Street cable road in Chicago. The running of these engines should be seen to be appreciated. Fisher & Porter are the right men in the right place, and are to be congratulated on having such an excellent engine to represent.

The Fiber & Stowell Company, of Milwaukee, Wis., in spite of the hard times, reports doing an excellent business, so large in fact that the company has outgrown its present quarters, and finds it necessary to add 100 × 80 ft. to its already large plant. The prospects for the future business of this company are more than flattering, as the managers are about closing a large contract, which will keep their works busy during a large part of the spring. The company is also in the market for a large lot of new machinery, and when the new shop is completed it will also be equipped with the most modern labor saving tools known to the trade.

Edward M. Bentley, formerly of the Bentley-Knight Electric Railway Company, who has been for the past four years and a half in charge of the patent department of the Thomson-Houston Electric Railway Company and the General Electric Company, severed his connection with the latter company on March 1. Mr. Bentley has opened an office at 40 Water Street, Boston, taking up the work of expert in patent cases and solicitor of patents. The law firm of Bentley & Blodgett with which Mr. Bentley, who is a member of the bar as

well as an expert, has been connected, will be dissolved, and his former partner, G. R. Blodgett, will succeed him as head of the patent department of the General Electric Company, making his headquarters at Schenectady.

The Metropolitan Electric Company, of Chicago, is getting in a stock of porcelain floor tubing of all sizes, to meet the requirements of the Board of Underwriters. This company carries a full stock of the P. & B. specialties, and is selling a large quantity of P. & B. armature varnish. W. C. McKinlock, secretary of the Metropolitan Electric Company, has just returned from an extensive business trip, with some good sized orders for the specialties handled by his company. One of these, the Xentric switch, is not as generally known as some other switches on the market, as it has but recently been introduced, but it is claimed to have no superior. It is made by that well known manufacturer, H. T. Paiste, the Metropolitan Electric Company handling his specialties.

The Shultz Belting Company, of St. Louis, reports some very large orders, particularly from foreign climes. This company has contracted to fill an order for 10,000 ft. of leather belt for Russia, and 3,500 ft. for India. The head of the company, J. A. J. Shultz, looks to the future with a great deal of encouragement, and rightly so, considering the large number of substantial orders on the company's books. He thinks the prospects exceedingly bright for his business. The company is building up a large foreign business because of the superior make of the Shultz belt. The above order for the Russian market is but one out of many for that country. There are branch offices not only in the principal centers of the United States, but in the chief cities of Europe, India and South America. The Shultz Company, as is well known, manufactures both solid and link belts. The latter have long ago found favor in the largest power plants and manufactories of this country and Europe.

The Heine Safety Boiler Company, of St. Louis, looks upon the coming year as apt to be a lucrative one from the point of view of the manufacturers of high class water tube boilers. Steam users throughout the country are coming more and more to think with the high class boiler makers that a water tube boiler of the first class is, after all, by far the cheapest steam generator, although the first cost may be greater. The company calls attention to the fact that the most economically operated, the largest size and largest paying steam plants in the country are those having high class water tube boilers, and among these may be numbered those in which the Heine safety boiler has become standard. The Heine Company has already obtained some large contracts since the advent of 1894, and among the latest is one for 5,600 H. P., to be installed in the electric lighting plant of the Municipal Electric Light & Power Company, of St. Louis. The contract was awarded to the Heine Company by the Edison Illuminating Company, of St. Louis, which has gained control of both the Municipal and Missouri Electric Light & Power companies.

The Laclede Car Company, of St. Louis, informs us that its works are filled with new cars at the present time in the various stages of construction. This company has received a large share of the car contracts recently let by the Philadelphia Traction Company, of Philadelphia, Pa. The first order called for 250 cars both closed and open, while a second one, recently obtained, calls for 150 additional closed cars. These are to be similar to those obtained in the first order, namely, eighteen foot bodies, equipped with two twenty-five horse power Westinghouse motors, mounted on Bemis extended spring base trucks. The company has received some very encouraging testimonials from the Philadelphia Traction Company, and the Philadelphia press has been unqualified in its praise of the handsome Laclede cars recently put in operation in that city. The Cincinnati Street Railway Company, of Cincinnati, O., has placed an additional order with the car company for thirty sixteen foot motor cars. Laclede cars are the standard of the railway company, this being about the tenth consecutive order that has been placed with the car works. These cars are to be equipped with twenty-five horse power General Electric Company's single reduction motors. The Brightwood Railway Company, of Washington, D. C., has ordered two motor cars. The company looks forward to the future with much confidence, and expects its shops to be continually filled with work. The demand for new cars is especially heavy from the eastern part of the United States.

Guido Pantaleoni, 608 American Central Building, St. Louis, representative in that city of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., reports the sale of three 750 H. P. generators to the Compton Heights, Union Depot & Merchants' Terminal Railway Company, of St. Louis, and one of 750 H. P. capacity to the Lindell Railway Company, of the same city. The former machines are to be belted each to a 750 H. P. engine of the Porter-Allen type, made by the Southwark Foundry & Machine Company, of Philadelphia, Pa. The machine for the Lindell Railway Company has already been delivered and is now in use, while the larger equipment is marked for delivery on May 15. The latest motor equipments of both the above named street railway companies are of the Westinghouse type, and each motor is of twenty-five horse power capacity, two motors to each car. There are now 200 Westinghouse motors in operation on these two systems, and a large number additional on other roads in St. Louis. The former are making a remarkable record for themselves. About one-half of them have been in operation in the neighborhood of ten months and during that time each car equipment has cost the railway company but $11.25. This item includes necessary gear and pinion renewals. The Westinghouse representative, Mr. Pantaleoni, is rightly very proud of this record, because the cars of this company are steadily at work both winter and summer, the conditions being such that the loads are constantly fluctuating, and at times heavy grades and large crowds speak volumes for the efficiency of the Westinghouse Company's motors.

List of Street Railway Patents.

U. S. Street Railway Patents Issued February 20, 1894, to March 20, 1894, Inclusive.

February 20.

Car Brake—Robert S. Haines, Savannah, Ga., assignor of one-half to Benjamin F. Peet, Springfield, Mass. No. 514,926.

Consists of a truck frame, car wheels and brake shoes with links pivotally connected to and suspended from the truck frame and supporting the shoes, the pairs of links or toggles connecting the shoes, and a transverse bar or beam uniting the toggle links at their middle joints and which is constructed to constitute an armature, and an electro-magnet supported by, and depending from the top of the truck frame and in direct working proximity to the electro-magnet.

Brake—Henry Kleiman, Allegheny, Pa. No. 514,940.

Comprises a truck frame, the axles and ground wheels, said truck frame being provided with opposite supports, brake bars arranged in the supports, extending beyond the same and provided with brake shoes for clamping against the wheels, friction pulleys arranged upon the axles, a centrally located vibratory lever provided at its opposite ends with oppositely-disposed standards, flexible friction shoes arranged upon the pulleys, connections between the ends of the standards with opposite ends of the shoes and between the remaining ends of the shoes and the brake bars, and means for vibrating the lever.

Electric Railway System—Nikola Tesla, New York. No. 514,972.

An electric railroad system operated by electric currents of high potential and frequency, having an insulated and electrically screened supply conductor extending along the line of travel, a motor car or cars carrying a conducting plate or bar in inductive relation to the screened conductor and an electrical connection between the said plate and the motor.

Car Brake Adjuster—James Howard, New York. No. 515,079.

Consists of a ratchet bar, a ratchet block connected therewith, a brake lever capable of limited movement on the ratchet block, lengthwise of the car, and a hand pull rod connected with said brake lever.

Automatic Grip Opener—Wm. P. Courtney, Oakland, Cal., assignor of one half to Albert Brown, same place. No. 515,115.

A cable grip provided with the guide and bearing rollers upon the rear edge, a safety bar movable within said guide within the plane of the sides of the grip frame, connections between said safety bar and the detent of the grip, and a spring catch whereby the safety bar and detent are retained in their elevated position when forced upward.

Electric Railway Conduit—Morris S. Towson, Cleveland, O., assignor to Albert G. Wheeler, Chicago, Ill, No. 515,179.

Consists of a slot rail, a conductor and a box, having an open end and a slot in its bottom, a conductor, carrier or clamp passing through said slot, and having an enlarged head secured in said box by an insulating compound.

Safety Car Fender—Francis De Fontes, Baltimore, Md. No. 515,198.

A safety fender having a triangular platform secured to the car truck frame; a car axle having a sprocket wheel; a transverse shaft on the under side of the platform and parallel with the axle, and provided with a sprocket wheel and two mitre gear wheels; two short shafts, each having a gear wheel meshing with the gear wheels of the transverse shaft, and each provided with sprocket wheels; two safety rollers in front of the platform and parallel with the angular sides thereof, and the two together forming a V; a cushion adjacent to the intersection of the V point of the said two rollers; and drive chains between the short shafts and said rollers for actuating the latter.

Trolley Conductor and Support—Myron D. Law, Washington, D. C., assignor to Albert G. Wheeler, Chicago, Ill. No. 515,238.

Embraces a conductor, having rails of L shape in cross section provided with contact flanges and supporting webs, said flanges being arranged in alignment with each other, the supporting webs being overlapped at the connecting ends of the rails.

Indicator for Electric Cars—Henry C. Beckmann, St. Louis, Mo. No. 515,274.

Comprises a fixed conductor, having a freely swinging contact rod electrically connected with the trolley wire; a laterally projecting rigid contact rod moves with the car; a suitable indicator in the car is electrically connected with the rod and also with the return conductor of the road.

Electric Railway Trolley—Chas. J. Van Depoele, Lynn, Mass., assignor to the Thomson-Houston Electric Company, Boston, Mass. No. 515.308.

Consists of a car, an overhead conductor, a contact device making underneath contact with the conductor, a standard on the roof of the car, an arm carrying the contact device pivoted on the standard on a tranverse axis, and free to swing around the standard, a spring connected to the pole or arm for pressing the contact device upward against the conductor, and a line connected with the arm above its pivot for moving the arm.

February 27.

Car Brake—Henry H. Sessions, Chicago, Ill., assignor to the Pullman's Palace Car Company, same place. No. 515,555.

Means for operating car brakes, consisting of an axle having a friction gear secured thereon, a second friction gear slidably mounted thereon, and a bevel faced gear rotatably mounted on a movable sup-

port and adapted to be thrust into engagement with the sliding gear whereby the latter may be thrust into frictional contact with the fixed gear.

STREET CAR—Thomas H. Wickes, Chicago, Ill., assignor to the Pullman's Palace Car Company, same place. No. 515,567.

Consists of a car having its end walls provided with removable and interchangeable bulkheads, one of which is constructed to receive doors to adapt it for a closed car, and the other of which is adapted to contain sashes or panels to provide a closed end wall for an open car.

CONDUIT ELECTRIC RAILWAY—Joseph A. Cassidy and Wm. A. Butter, New York. No. 515,572.

Embraces with a car an electric contact bar to operate contact levers arranged within a conduit, thereby electrically communicating with an electric conductor; toggle mechanism connects said bar to the car, and means for operating the toggle mechanism.

SAFETY CAR FENDER—Wm. R. Fowler, Baltimore, Md. No. 515,581.

Embraces rigid pendent rods, a fender loosely and vertically movable on said rods provided with a projecting lip, springs on the pendent rods to force the fender downward, a pivoted latch having a lip hook to engage the lip on the fender, a pendent swinging frame forward of the fender, and a rod attached to the pivoted latch and operated by the swinging frame to release it.

STREET CAR FENDER—Walter W. Play, Toronto, Can., assignor to John Henry Banes, same place. No. 515,609.

Consists of a mold board shaped foot attached to the end of a vertical spring-actuated spindle below the car in front of the wheel, a spring-actuated brush on the rail behind the mold board, the brush being actuated independent of the foot.

ELECTRIC RAILWAY—Benjamin F. Comstock, Decatur, Ill. No. 515,654.

Embraces with a trolley railway, a double track, electric cars adapted to run on same, a single trolley wire, trolleys provided with rollers and pointed plates carried by the cars, and adapted to run upon and pass each other on the single trolley wire.

CAR BRAKE—George W. MacKenzie, Thomas C. Sloan and Moses B. Sloan, Beaver, Pa. No. 515,692.

Embraces two independent brake-actuating mechanisms connected to and actuating the same winding shaft, and a mechanism for releasing the brakes set by either mechanism.

FENDER FOR STREET CARS—Wm. H. Brock, Brooklyn, N. Y. No. 515,728.

Embraces a fender movable longitudinally of the car, and means for actuating the fender by the rotation of the car axles.

MEANS FOR SWITCHING FROM MAIN TO SIDE TRACKS—John B. Duguid, Toledo, O. No. 515,823.

Consists of a car carrying a wheel guide, standard movable therein and carrying a wheel, a lever for operating the standard, a bar for operating the lever, a catch for holding the same, and a spring for returning it, and a guide upon the track for co-action with the wheel.

STREET CAR FENDER—Randolph C. Lothrop, Somerville, Mass. No. 515,868.

Embraces an advanced frame attached to the car; the forward end thereof being capable of both a vertical and lateral movement; a revolving guard roll is attached to the front of said frame, arranged to be carried along thereby at a slight elevation above the track; means for revolving said guard roll towards the car; and a safety net or platform immediately behind the roll.

HANGER FOR TROLLEY WIRES—George Forbes, Williamsport, Pa. No. 515,907.

Covers a hanger having two separable members adapted to be secured together and hold a trolley wire between them, one of said members having perforations to receive holdback or suspending wires.

STREET CAR SIGN—Edgar J. Rauch and Wilfred A. Keith, Brockton, Mass. No. 515,967.

Comprises a rotatable sign on the exterior of the car having inscriptions on its sides, a dial fastened on the interior of the car correspondingly inscribed, a rotary handle supported at the center of the dial and connected with the sign, and means for locking the handle in different positions.

MARCH 13.

ELECTRIC RAILWAY—Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. No. 516,188.

Embraces in an electric induction railway, a source of irregular or alternating currents, a conductor extending therefrom along the way, a movable coil in electrical connection with the conductor, a vehicle, a magnetic device on the vehicle to move the movable coil, an electric conductor on the vehicle in suitable inductional relation to the coil, and a translating device connected with the latter conductor.

STREET CAR FENDER—Thos. Davies, Toronto, Can. No. 516,266.

Embraces angular plates, supported by springs and held at an angle to each other, in connection with a cup or fingers projecting from the plates.

SAFETY CAR FENDER—George Q. Seaman, Alexandre Wilson and Wm. Jones, Brooklyn, N. Y. No. 516,408.

Comprises a curved, upwardly-inclined bottom or guard secured at its upper and lower edges, having a loose main portion so as to form a yielding pocket, the central portion of which is capable of moving in relation to the edges, and having side guards arranged adjacent to the curved guard.

ELECTRIC RAILWAY SUPPLY SYSTEM—Jas. F. Cummings, Detroit, Mich., assignor of one-half to Eugene M. Engleman, Milwaukee, Wis. No. 516,565.

Embraces a motor, car, conduit and two distributing conductors therein with which said motor is in traveling connection, of a contact device having rotary laterally spring pressed travelers arranged horizontally and contacting with the inner faces of said conductors respectively, and springs engaging the travelers on the opposite side.

CLOSED CONDUIT ELECTRIC RAILWAY—Edward H. Brown, Salem, Mass., assignor to the Magnetic Electric Company of West Virginia, Boston, Mass. No. 516,626.

Embraces in combination with a car provided with magnets, a main electric supply wire, magnet contacts, and separate and independent inclosures for the same, the inclosures forming sections of a continual central rail, said main wire independent of said inclosures and directly connected with said contacts.

MARCH 20.

ELECTRIC RAILWAY SYSTEM—Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company of Connecticut. No. 516,666.

Embraces a vehicle electrically propelled along a line of way, having definite stopping and starting points thereon, of one or more conductors at such points making connection with the electric motor on said vehicle, and an energy storage device in connection with said conductor.

OVERHEAD ELECTRIC RAILWAY—John C. Henry, Westfield, N. J. No. 516,808.

A line structure for an overhead electric railway, comprising a trolley wire, rigid supports carrying insulating hangers for said trolley wire, a guy wire running in a zigzag course along the line of the trolley wire, and connected on one or both sides with said rigid supports, and poles for sustaining the wires.

CONDUIT FOR ELECTRIC RAILWAYS—Herluf A. F. Petersen, Milwaukee, Wis. No. 516,876.

Embraces a conduit for underground conductors, with a casing divided into two longitudinal conduits or passages, one of which is arranged to contain the conductors, and the other provided with a longitudinal slot in its upper wall, arranged out of line with said conduit or passage containing the conductors, and a suitable longitudinal cover arranged to normally close the conduit or passage in which the said conductors are located.

BRAKE—Heinrich Bussing, Brunswick, Germany. No. 516,912.

A brake consisting of a horse shoe fitted to the rail, a brake block supported thereby, a rod, a supplemental brake block and an operating means for moving the brake blocks toward each other.

STREET CAR—Peter M. Kling, St. Louis, Mo. No. 516,934.

Embraces a platform having a partition at one end thereof extending transversely of the length of the car, and dividing the platform into two parallel passageways between the car body and dashboard.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. THE STREET RAILWAY PUBLISHING COMPANY, HAVEMEYER BUILDING, NEW YORK.

The Lake Shore Route.

The Lake Shore Route, between Buffalo and Chicago, is celebrated all over the world as affording the embodiment of luxury in travel. Its new Day Coaches are sixty feet in length, and will seat fifty-eight people, comfortably. They are fitted with the Gould platform and automatic coupler, Westinghouse air brakes and signal, heated with steam taken from the locomotive, and at night are brilliantly lighted with Pintsch gas, for which purpose five elegant bronze chandeliers depend from the roof of the car.

The interior of the coaches is finished in mahogany, highly polished and paneled. Each coach has a nice lavatory and toilet. The latest models contain separate toilet rooms—one for ladies and one for gentlemen. The car seats are of the style known as the Mason tilting, with high, spring backs and broad seats. They are richly upholstered in crimson plush. The windows, which are of plate glass, are large, and each is fitted with a spring-roller curtain, in shade to blend with the interior finish, and every feature is of the best.

The dining cars in service on the trains of the Lake Shore & Michigan Southern Railway are operated by the company. The cars are neat and tasty in all their appointments. Great care is exercised to provide the patrons of the Lake Shore Route with a service which shall prove satisfactory. As a result, dining on the trains of the road is accomplished in a very satisfactory and comfortable way.

The sleeping cars in service on the Lake Shore Route are of Wagner build. Ordinarily, they contain twelve sections, a state-room, a smoking apartment, and toilets for ladies and gentlemen. In some instances, however, there are cars containing sixteen sections, the state-room being omitted. Every valuable device is embodied in their construction.

The Lake Shore operates a most perfect sleeping car service between the cities of Chicago, Cleveland, Buffalo, New York and Boston in connection with the New York Central and Boston & Albany Railways. This is not only the direct, best and only double track route between the cities mentioned, but the Lake Shore is the only line from Chicago conveying passengers into New York City without a ferry transfer.***

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by Spencer Trask & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., March 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	113	115
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	101½	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	101½	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102½	.....
" " " Debenture	1891	200,000	M. & N.	6	1901	112	.....
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	112	115
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	110	115

BALTIMORE STOCKS AND BONDS.—Corrected by Hambleton & Co., Bankers, 9 South Street, Baltimore, Md., March 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	1,000,000	Quart.	3	.....	80	90
City & Suburban Ry. Co	50	3,000,000	.....	1	.....	30	33
Central Pass. Ry. Co	50	300,000	.....	...	.....	60	65
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	15	16

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort	1892	500,000	.....	5	.....	108½	109
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	105	105½
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	108	109
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	100½	101
" " "	1891	1,250,000	M. & S.	6	1901	101½	102½
City Pass. R. R. Co	1891	2,000,000	"	5	1911	112	112½

BOSTON STOCKS.—Corrected by R. L. Day & Co., 40 Water Street, Members of Boston Stock Exchange, March 19. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,400,000	J. & J.	4	1887	76⅞	77
West End Com'n	50	9,085,000	J. & J.	3	1890-1892	46½	47

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. Staples & Co., 215 Montague Street, Brooklyn, March 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co	10	6,000,000	Q.—J.	2	.....	178	.....
Brooklyn Traction Co., pref	100	3,000,000	.....	...	1893	67	.....
" " " common	100	6,000,000	.....	...	1893	18	.....
Coney Island & Brooklyn R. R. Co	100	500,000	Oct. 1.	4	.....	.....	155
Long Island Traction Co	100	30,000,000			1893	22	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	.....	102
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	.....	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	104	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st	.....	3,000,000	J. & J.	5	July, 1916	.....	109

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. Kaufman Charleston, S. C., March 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	0	.....	.....	65
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by William B. Wrenn, 167 Dearborn Street, Chicago, Ill., March 21.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	320	325
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	249⅛	249½
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	145¼	147¾

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	101	.....
Chicago Passenger	1883	400,000	F. & A.	6	1903	102	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	98	100
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	102	103
West Chicago Street	.....	4,160,000	M. & N.	5	.....	102¼	102½
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	.....	98
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	103	103¼

CINCINNATI STOCKS AND BONDS.—Corrected by Geo. Eustis & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, March 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$6,750,000	Q.—J.	5	.....	105⅞	106¼
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	108½	109½
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	60	65
" " " Pref.	100	100,000	.....	6	.....	98	99
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	.	.....	19⅛	21

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1894	100	.....
" "	.....	50,000	J. & J.	7	July, 1895	101⅛	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	99	100¼
	.....	150,000	J. & J.	5	.....	101	103
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107⅛	110
" " "	.....	100,000	A. & O.	6	July, 1905	111⅛	112½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104¾	106
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	109	115
" " " "	.....	300,000	J. & J.	6	Jan. 1914	103	104
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	.....
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	113	115
S. Cov. & Cin. 2d Mort. gold 6's	.....	250,000	J. & J.	...	1932	114½	115½

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. Hayes & Sons, Bankers, Cleveland, O., March 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co	100	12,000,000	.....	....	1893	47	48
The Cleveland City Ry. Co	100	8,000,000	.....	....	1893	57	60

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	101	102¾
" " City " "	1893	2,349,000	.....			95	96

DETROIT STOCKS.—Corrected by CAMERON CURRIE & Co., Bankers and Brokers, 82 Griswold Street, Detroit, March 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. March 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	200	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	100	125

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., March 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	87	88
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	38	39

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	90	99½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	115	115½
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	114½	115
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. March 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$400,000	J. & J.	4	.....	50	55
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	.....	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Aug. 1, 1894	104	.....
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 188 Common Street, New Orleans, La., March 22. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.	100	1,200,000	Quart.	1½	1867	127	131
Crescent City R. Co.....	100	1,150,000	"	3	1866	.....	90
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	40	43
New Orleans City & Lake Co.	100	1,500,000	Quart.	2½	1860	110	118
Orleans R. R. Co.....	50	185,000	"	2	1868	45½	.....
St. Charles Street R. R. Co..	50	600,000	"	2½	1865	56½	58½

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	.....	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	100	.....
do do new	1886	40,000	M & N	6	1896	100	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	113	118
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	96	.....
St. Charles Street R. R. Co...	1881	120,000	J & D	6	'93-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, March 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (p'd up sh.)	50	$2,000,000	M. & N.	4	May, '91.	176½	176¾

BONDS.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by JAMES MCGOVERN & Co., 6 Wall St., New York, March 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	.....	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	186	190
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	145	.....
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	135	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	120	125
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4	.....	298	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	40	50
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	240	260
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q.—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	120	135
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	190	200
Third Avenue.....	100	5,000,000	Q.—M.	4	.....	175	177
23d St.....	100	600,000	Q.—F.	2½	.....	.....	290
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	132	135
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	108	.....
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	104	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	103	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	103	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	100	.....
Broadway Consolidated.....	.....	8,500,000	J. & J.	5	 1943	102	102½
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	115	120
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	100	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	98	100
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	.....	57
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	104	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	114	114¾
23d St.....	.....	250,000	M. & N.	7	May, 1893	100	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	103

PHILADELPHIA SECURITIES.—Corrected by HUHN & GLENDINNING, 143 South Fourth st. (Bullitt Building), Philadelphia, March 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	265	270
Continental.....	50	1,000,000	J.—J.	6	1873	126	130
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	331	335
Germantown.....	50	1,500,000	Q.—J.	2½	1858	110	112
Green & Coates.....	50	500,000	Q.—J.	3	1858	123	125
Hestonville.....	50	2,050,000	.....	...	1859	35	38
Lombard & South.....	25	500,000	A.—O.	8	1861	90	90
People's Traction Co.....	50	10,000,000	.....	...	.....	28½	29
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	152	153
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	77	79
Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	97⅞	99
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	226	230
Second & Third.....	50	1,060,200	Q.—J.	5	1853	207	210
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	225	230
Union.....	50	1,250,000	J.—J.	9⅓	1864	195	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	100½	101
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	102½	103
Baltimore Traction.....	25	5,000,000	.....	1	1889	15⅝	15⅞
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	13	13⅛

BONDS.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	107½	110
" " Imp.	1892	1,250,000	M.—S.	6	1901	104½	105
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100	101
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by Richard C. Patterson, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., March 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by John B. Barbour, Jr., 306 Times Bldg., Pittsburgh, Pa., March 17. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	..	.....	19	.....
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	59	59½
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	12⅞	13
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	57	60
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	18⅜	19
Pittsburgh, Allegheny & Man	50	3,000,000	.....	1¾	.....	39⅛	39½
West End R. R. Co.	50	200,000	J. & J.	...	.....	....	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.. ..	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	25	25¼
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O.	5	1927	108½	109½
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	107½	110
Pitts. & Birmingham Traction Co.	1892	.....	.....	5	.....	95	96
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	99½	101
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	104	105
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	99⅞	100
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	101	103
Central Traction Co.	1889	375,000	J. & J.	5	1919	102	103
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1922	102	103½
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	95
Suburban Rapid Transit.	.....	.....	.....	6	.....	96	100
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	....	.....
Penn Incl'e PlaneCo. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by Chace & Butts, Bankers, Providence, March 17.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	.. .	.....
BONDS.	Date of Issue	Amo'nt Out-stand'g	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	95	98
Newport St. Ry. Co.	.....	50,000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. Clark & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, March 15.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	33	36
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	53	56
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	13	20
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	33	34
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	.....	80
do do Common.	100	4,000,000	.....	...	1892	14	17
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	.....	80
do do Common.	100	3,000,000	.....	...	1892	15	20
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	35	40
BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y) Ry.	1890	3,000,000	A & O	5	1930	88	95
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	95	99
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	85	95
Newark (N. J.) Pass. Ry	1890	6,000,000	J & J	5	1930	93	94
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	88	95
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	85	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by Philip Barth, Broker, 440 California Street, San Francisco, Cal., March 9.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	5	.....	.....	100
Geary St., Park & Ocean R.R.Co	100	1,000,000	.....	1	.....	.....	110
Market Street Cable Co.	.....	17,892,000	.....	...	.....	38¾	39
Metropolitan Electric	.....	.....	.....	...	.....	22½	30
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	.....	13½
Sutter St. R. R. Co.	.....	.....	.....	...	.....	90	.....
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	.....	5	.....	102¼	.....
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	103	.....
Geary St., Park & Ocean.	.....	.....	.....	.....	.....	.....	108
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	119	119½
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	.....	118
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	114	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	99	110
Powell Street R. R.	.....	700,000	M. & S.	6	1912	.....	112
Sutter St. Cable Co.	.....	.....	.....	..	.....	102½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by James Campbell, Banker & Broker, Rialto Building, 218 N. 4th St., March 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	50	60
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue.	100	112,000	Dec. '88	2	1885	125	150
Lindell	100	2,500,000	.....	...	1890	73½	75
Missouri.	100	2,000,000	Q.—J.	2	1891	180	200
People's.	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis.	100	2,000,000	J. & J.	3½	1890	155	160
Fourth Street & Arsenal.	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban.	100	2,500,000	... .	...	1891	30	40
Southern, Pfd.	.....	800,000	.....	...	.....	90	92
" Com.	.....	700,000	.....	...	.....	82	85
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	96	98
Citizens' Cable.	1887	1,500,000	J. & J.	6	1907	102	103
Fourth St. & Arsenal.	1888	50,000	J. & J.	6	1898–1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895–1910	99	101
Missouri Cable.	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	98	100
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable.	1889	800,000	J. & J.	6	1889–1914	90	95
St. Louis Cable.	1890	1,500,000	M. & N.	5	1900–1910	100	102
Union Depot.	1890	4,000,000	A. & O.	6	1900–1910	104	105
Southern.	1884	200,000	M. & N.	6	1904	103	105
Southern.	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban.	1891	1,400,000	F. & A.	5	1921	95	97
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	70	80

WASHINGTON STOCKS AND BONDS.—Corrected by Crane, Parris & Co., Bankers, 1344 F Street, N.W., Washington, D.C., March 17. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	290	305
Metropolitan R. R.	50	750,000	Q. J.	2	1864	84	97½
Columbia R. R.	50	400,000	Q. M.	1	1870	60	75
Belt R.R.	50	500,000	Q. J.	...	1875	20	.....
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	.....	.....
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	.....
Rock Creek R. R.	100	401,700	.....	...	.....	.....	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'ton & Geo'town conv't.	'83–'91	3,000,000	J. & J.	6	1899-1929	130	150
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	80	.....
Belt.	1921	240,000	J. & J.	6	1921	.....	95
Metropolitan R. R. convert.	1901	200,000	J. & J.	5	1901	100	110
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

Financial.

H. V. Harris has been appointed receiver of the Louisville Terminal Railway Company, of Louisville, Ky.

$ $ $

The capital of the Montreal (Que.) Street Railway Company has been increased from $2,000,000 to $3,000,000, the stockholders on March 31 will receive at par one share for every two held.

$ $ $

The Framingham (Mass.) Union Street Railway has petitioned the legislature for leave to raise $24,000 preferred stock, it being under-



Snow Sweeper with full length cab, the motorman operating same on the inside. Same as built by us for Scranton Traction Co.

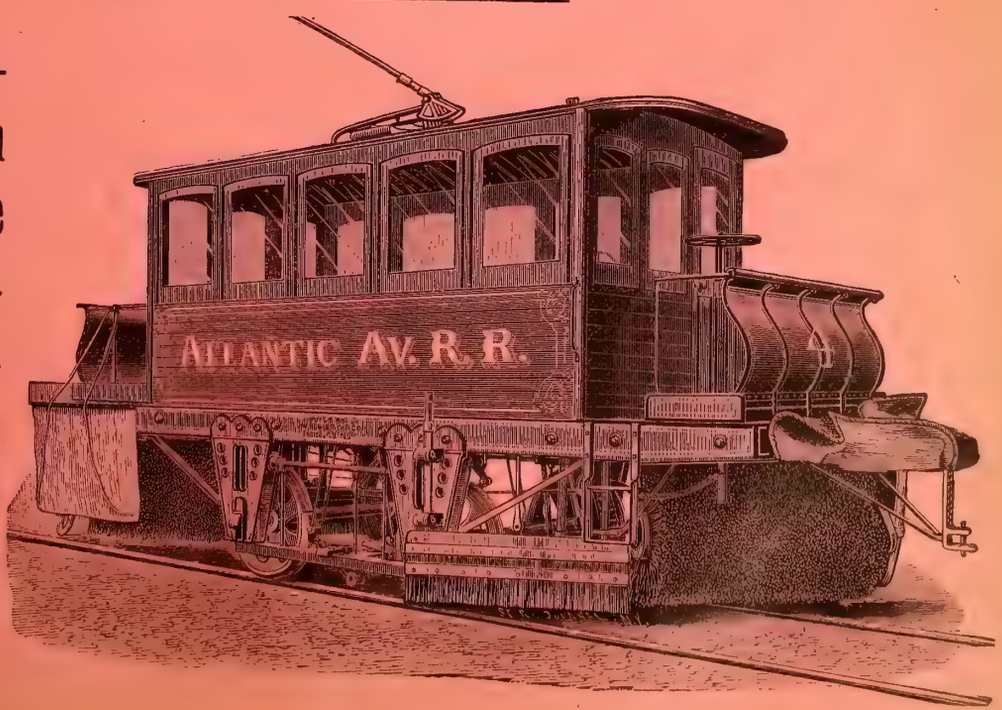
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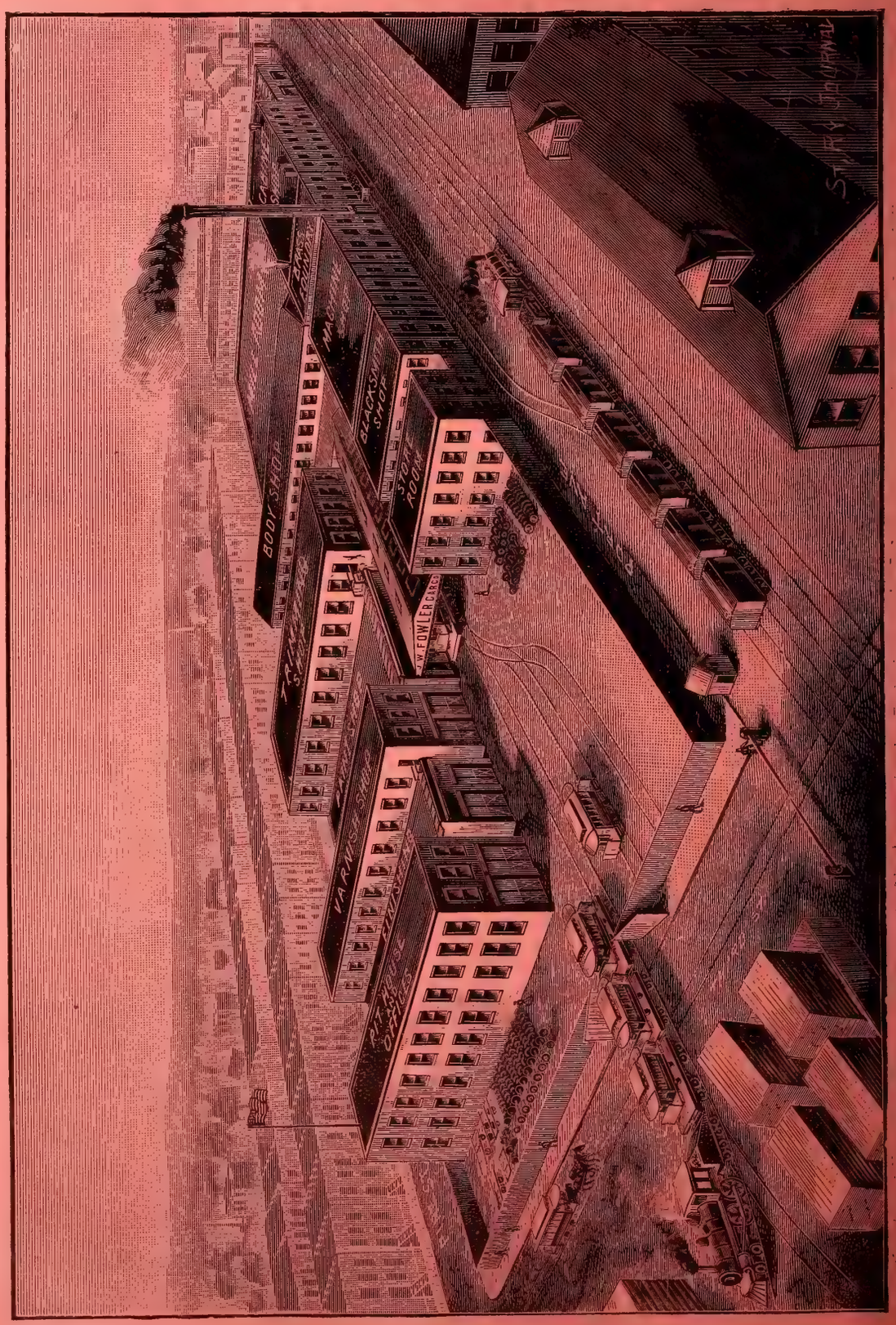
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Cable

AND

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CARS.



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stood that the amount will be used in equipping the line with electricity if the bill is passed.

$ $ $

THE Columbus (O.) Street Railway Company reports as follows for February: Gross earnings, 1894, $36,173.56; 1893, $37,812.27; decrease, $1,638.71. Operating expenses, 1894, $19,937.45; 1893, $27,695.57; decrease, $7,758.14. Net earnings, 1894, $16,236.13; 1893, $10,116.70; increase, $6,119.43.

$ $ $

THE Paterson (N. J.) Railway Company reports as follows for February: Gross earnings, 1894, $15,197.04; 1893, $16,147.56; decrease, $950.52. Operating expenses, 1894, $9,811.80; 1893, $16,519.99; decrease, $6,708.19. Net earnings, 1894, $5,385.24; 1893, deficit, $372.43; increase over 1893, $5,757.67.

$ $ $

THE Scranton (Pa.) Traction Company makes the following statement of its operations for January: Gross earnings, 1894, $19,773.92; 1893, $14,487.25; increase, $5,286.67. Operating expenses, 1894, 10,524, 63; 1893, $9,800; increase, $724.63. Net earnings, 1894, $9,249,29; 1893, $4,687.25; increase, $4.562.04.

$ $ $

THE Scranton (Pa.) Traction Company submits the following statement of its operations for February: Gross earnings, 1894, $15,438.65; 1893, $12,176.28; increase $3,262.37. Operating expenses, 1894, $10,236.54; 1893, $9,450.21; increase, $786.33. Net earnings, 1894, $5,202.11; 1893, $2,726.07; increase, $2,476.04.

$ $ $

THE Buffalo (N. Y.) Railway Company submits the following comparative statement of its operations for February: Gross earnings, 1894, $102,544.17; 1893, $95,794.11; increase $6,750.06. Operating expenses, 1894, $65,884.59; 1893, $75,287.70; decrease, $9,403.11. Net earnings, 1894, $36,659.58; 1893, $20,506.41; increase, $16,153.17.

$ $ $

THE accompanying figures show the gross receipts of several of the street railway companies in Washington, D. C., for the year ending December 31. The statistics are taken from reports made by the railway companies to the Senate in accordance with law: Anacostia & Potomac River Railway, $59,515.24; Belt Railway Company, $141,896.19; Brightwood Railway Company, $36,907.45; Eckington & Soldiers' Home Railway Company, $54,744.53; Metropolitan Railroad Company, $411,582.97; Rock Creek Railway Company, $23,325.42; Washington & Georgetown Railway Company, $1,024,748 45.

$ $ $

THE Hestonville, Mantua & Fairmount Passenger Railway Company, of Philadelphia, Pa., has decided to issue the additional capital stock and bonds for the electrical equipment of its line. The proposition is to issue $533,900 of preferred stock and $750,500 bonds, the latter free of tax, with interest at the rate of 5 per cent., to run for thirty years; dividends on the preferred stock to be at the rate of 6 per cent. per annum, and the stock to be entitled to share in any dividends over and above 6 per cent., after that amount has been paid on the common stock. Holders of the latter are given the privilege of subscribing for one share of the preferred stock for every four shares of the common owned or held by them.

$ $ $

THE annual meeting of the Louisville (Ky.) Railway Company stockholders was held last month. The old board of directors was elected, consisting of Alexander H. Davis, of Syracuse, N. Y.; H. H. Littell, of Buffalo, N. Y.; Isaac N. Seligman, of New York, and J. B. Speed, St. John Boyle, Harry Bishop, J. W. Gaulbert, T. J. Minary and Alex. P. Humphrey, of Louisville. The old officers were re-elected. The report of the treasurer for the year ending December 31, 1893, showed the gross earnings for the year to have been $1,281,992.88, and the operating expenses, including taxes, interest and other charges, $1,208,555.54, leaving a net surplus of $73,437.34. The plans of the company looking to the extension of electrical equipment, were carried forward throughout the year, notwithstanding the stringent money market and depressed state of business, and the directors reported that the gross earnings of the company were slightly in excess of the previous year, and that it has not been deemed absolutely necessary to reduce the wages of its employes.

$ $ $

THE annual report of the Baltimore (Md.) Traction Company, for the fiscal year ending December 31, 1893, shows the following results: Gross earnings, $1,062,884.82; operating expenses (64½ per cent.) $689,317.73; net earnings, $373,567.09; fixed charges, interest on bonds, taxes and insurance, $355,202.10; balance, $18,364.99. During the year there was constructed 22.08 miles of track. The company now has 78.47 track mileage; 15.30 cable, 36.50 electric, 23.59 horse and 3.08 electric owned jointly. The horse car lines are now in process of change to electric power, and it is expected that during the present year horses will disappear from all the lines in the company's system. There were purchased during the year sixty electric cars and two electric sweepers, the company now owning 389 cars, of which 184 are horse, the balance being cable and electric, with trailers and a full complement of sweepers and salt cars. During the year 1893, the company's cars traveled 5,982 646 miles and carried 21,123,916 paying passengers.

The company is capitalized as follows: Stock, $5,750,000; first mortgage, 5 per cent. bonds, $1,500,000; extension and improvement, 6 per cent. bonds, $1,250,000; Traction Company's first mortgage, 5 per cent. bonds, secured by mortgage on North Baltimore division, $1,750,000.

President Hambleton, in his report to the stockholders read at the annual meeting of the company, held February 7, said: "As we all know, the year 1893 was a disastrous one for the country, with great financial stringency and extraordinary business depression. The street railways suffered, in common with all other interests, and while such conditions were operative, together with the sharp competition of rival lines—three of which paralleling our own at different points, all having put into operation their respective cable or electric plants last year—our receipts were made to appear less satisfactory than we had reason at the beginning of the year to expect. Nevertheless the earnings of the company have been, all things considered, quite encouraging. The month of September, being the first month in which we en-

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LINE CONSTRUCTION MATERIAL.

countered the severest competition, showed a decrease of $27,000, as compared with the receipts of the same month of the previous year; since that time the comparative earnings have been very much more favorable, until in January of this year there was a difference of only $8,000, as compared with the same month of last year."

California in Three and a Half Days.

From the snow clad regions of the East to the delightful semi-tropical climate of California is a matter of only a few days' journey if the Northwestern Line is used for the trip. Palace drawing room sleeping cars leave Chicago daily and run through to California without change, covering the distance in the marvellously short time of three and a half days, and all meals en route are served in dining cars. Daily Tourist Sleeping Car service is also maintained by this line between Chicago and San Francisco and Los Angeles, and every Thursday the party is personally conducted by an experienced excursion manager. Completely equipped berths in Tourist Sleepers are furnished at a cost of only $4 each from Chicago to the Pacific Coast, thus affording a most favorable opportunity for making the journey in a comfortable and at the same time economical manner. Variable route excursion tickets, taking in all principal points of interest, are sold at exceedingly low rates. Illustrated pamphlets descriptive of the Mid-Winter Fair and full information concerning rates, routes, etc., will be mailed free upon application to W. A. Thrall, General Passenger and Ticket Agent Chicago & Northwestern Railway Company, Chicago, if you mention this publication.

Of Interest to Travelers.

The Baltimore & Ohio Railroad announces that it has placed on sale round trip tickets at reduced rates to the winter resorts in Florida and the South, and also to such points of interest as Luray, Natural Bridge and Gettysburg. This company has also arranged to place on sale excursion tickets to San Francisco and other points in California, on account of the Mid-Winter Fair, at unusually low rates. Excursion tickets are now on sale to Baltimore and Washington via the famous Royal Blue line.

With its vestibuled train service, via Washington, to Cincinnati, St. Louis and Chicago, the Baltimore & Ohio is in the best of condition to handle Western and Southern travel. That the line is a popular one, is attested by the immense World's Fair business handled this summer.

Those contemplating a trip West or South this winter should write to C. P. Craig, general Eastern passenger agent, 415 Broadway, New York, for rates and other information.

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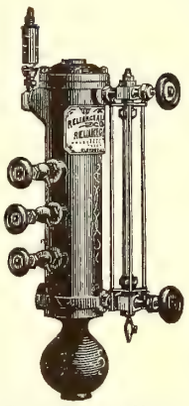
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THE STREET RAILWAY JOURNAL

Vol. X. *NEW YORK & CHICAGO, MAY.* *No. 5.*

Coal Handling Apparatus at the Southern Station of the Brooklyn City Railway.

A full description of the southern power station of the Brooklyn City Railway Company, with sections and plans, was published in the STREET RAILWAY JOURNAL for October, 1892. As will be remembered, this station is located on New York Bay, at the foot of 52d Street, South Brooklyn, is designed for a capacity of 12,000 H. P., and supplies power to the cars operating in the southern and western districts of the city. There are at present six Allis compound, condensing Corliss engines, with cylinder dimensions twenty-six inches and forty-eight inches by forty-eight inch stroke, which are belted to twelve 500 K. W. generators of the General Electric M. P. type. The steam generating equipment at present consists of eight batteries of Babcock & Wilcox boilers, each comprising two water tube boilers of 250 H. P. each.

The facilities for the receipt of fuel are excellent, and its cost for handling has been reduced by the use of labor saving appliances, to a minimum. Through the kindness of M. G. Starrett, chief engineer of the Brooklyn City Railway Company, and Charles A. Moore, engineer of the southern station, we are enabled to give the following details of the system.

Extending from the station into the bay is one of the most substantial piers in the city, 700×200 ft. in size, and reaching out to water of fifteen feet in depth at mean low tide.

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FIG. 1.—GENERAL VIEW OF COAL HANDLING APPARATUS—SOUTHERN STATION OF BROOKLYN CITY RAILWAY.

Coal is landed at this pier in barges, and is then automatically conveyed to a pocket, shown at the center of Fig. 1, by means of a continuous or belt track on a raised trestle, upon which are cars operated by an endless cable, as will be described later. From this pocket fuel is carried to the hoppers over the boilers as required. The system used throughout in the travel of the fuel is that of the C. W. Hunt Company.

The elevator at the extremity of the pier (Fig. 1) is about thirty feet in height, and is supported by rails on a trestle about twenty feet in height, so that its position can be varied.

The elevator presents a number of very interesting

features, some of which have been installed here for the first time. One of these is the shape of the boom arm, which is that of a parabola whose focus is the upper surface of the hoisting drum. In consequence, the direction of the force acting on the boom trolley or truck is always at right angles to its travel. It is, therefore, in equilibrium, and has no tendency to change its own position, no matter what the position of the shovel may be. When the shovel reaches the proper height, it is stopped by a part of the trolley frame, and as the hoist still operates, the shovel is drawn directly over the delivery chute, into which it automatically dumps the coal. The boom, when not in use, is arranged to be swung close to the side of the elevator. The hoisting engine is of the Hunt type, with two 10×10 in. cylinders, and is geared to a Lidgerwood drum hoist of the ordinary type, the ratio of reduction being 4 to 1. This engine takes the steam from the main boiler house through a three inch pipe, and at 160 lbs. pressure, the pipe being protected by Magnesia covering to prevent loss of heat during the long transmission.

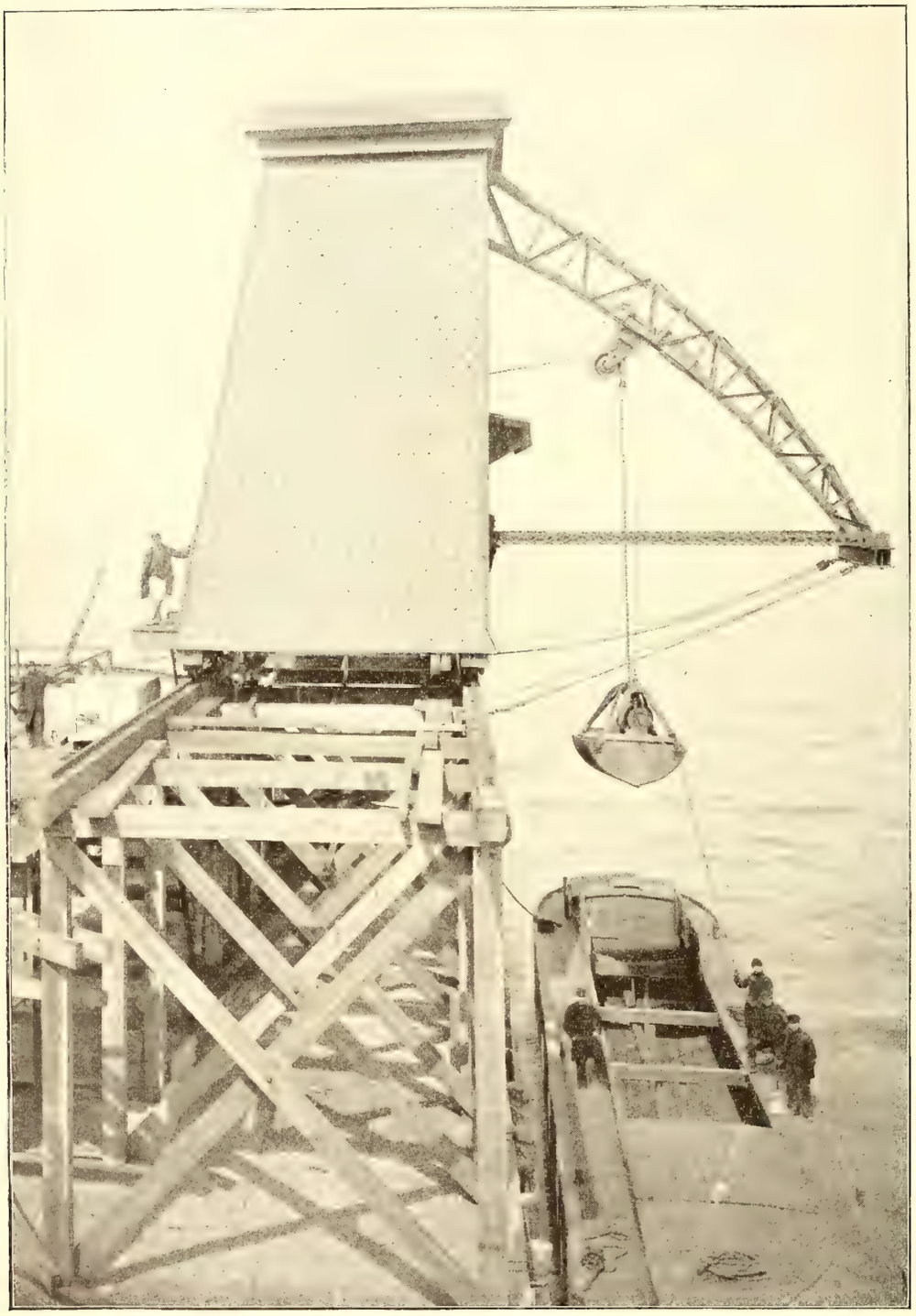


FIG. 2.—COAL ELEVATOR WITH PARABOLIC BOOM—SOUTHERN STATION OF BROOKLYN CITY RAILWAY.

Only one man is required in the tower to govern the movement of the dredge and hoist. These movements are controlled by four levers, two of which, the throttle and the friction brake on the drum hoist, are operated by the foot, and that for throwing the drum hoist out of gear and for opening and closing the bucket, by hand. From his position in the tower, this man can command a view of the barges below. Only three other men are required on the latter, one to direct the movement of the shovel and two additional to clean up the bottoms.

As already mentioned, the coal is carried from the elevator to the pocket by cable cars, each car having a capacity of about 3,300 lbs., which is also the capacity of the shovel. A general view of the cable railway, as seen from its upper end, is shown in Fig. 3. All the details of this portion of the installation have been carefully planned, and are of great interest. To prolong the life of the cable, there are no short turns made of the rope, the radii of all the curves being twenty feet. The curve sheaves are placed only twelve inches apart to reduce the flexure of the cable, and have wide, inclined flanges to retain the latter in place. The sheaves are cast with large hubs, which turn in journals bolted to the ties. These hubs are cast hollow and are filled with oil, and as a circular channel is cut in the base of the journal, each sheave practically revolves in a well of oil. The cable is seven-eighths of an inch in diameter, and is operated by a Hunt engine, with two 6 × 6 in. cylinders, located under the elevator. The cable is kept taut by a tension device of the ordinary type.

The sides of the coal cars are hinged at the top, and those of each car open sideways simultaneously. The sides are normally kept closed by rods, which are connected to the opposite ends of a double crank at both ends of the car, as shown in Fig. 3. The centers of the rods just pass over the center of the crank so that the sides are locked in a closed position. They open automatically on passing an obstruction set to trip the crank, when the coal falls out by force of gravity.

Each car is mounted on a two-wheeled radial truck, the framework of which is supported from the axle boxes by links, which allow the axles to depart from parallelism when passing around curves. The car wheels have outside flanges, and their treads are slightly cone shaped, the greatest diameter being nearest the flange. The effect while passing around a curve, therefore, is the same as if the diameter of the outside wheel was increased and that of the inner decreased, thus reducing the friction on the rails.

Each car carries its own grip, and consequently is

operated independently. The grip is set by the turn of a star shaped wheel on the rear of the car, and is so arranged that the car passes around the curve without the need of a guard rail, the grip itself acting as a guard. As soon as each car is loaded with coal at the elevator, its grip is tightened by a man located at that point, and it is then drawn to the coal pocket. Here it is automatically dumped while in motion, distributing its load, then returns to the extremity of the dock, where its grip is loosened and the brakes are applied. Only one man is required for this work. A view of the pocket, showing the circular track for the cars, is given in Fig. 4.



FIG. 3.—VIEW OF CABLE RAILWAY FROM COAL POCKET—SOUTHERN STATION OF BROOKLYN CITY RAILWAY.

From the pocket to the boiler room, the coal is conveyed by the Hunt bucket system. This, as will be remembered, consists of a series of buckets linked together in an endless chain, each being hung on pivots, and held in a normally upright position by gravity. The links are made of heavy wrought iron bars, and the entire system is mounted on wheels which run on tracks provided for the purpose. Each of the buckets has a capacity of about 200 lbs.

The bucket conveyor at the southern power station of the Brooklyn City Railway is 500 ft. in length. It extends entirely below the center of the coal pocket where it is filled, the pocket having inclined sides, so that its central line is its lowest part. Thence the conveyor is brought up at the front end of the pocket, thence, over a bridge of ninety-one feet seven and a half inches span, into the boiler room, where it travels about a circular track, after which the empty buckets return to the pocket to be coaled again.

They are filled by a rotating filler which consists of a revolving bucket driven by the conveyor chain, so that the proper load is secured whether the speed of the chain is fast or slow. There are thirteen discharge points on the bottom of the pocket, at any of which the filler can be located.

The conveyor is driven by a special engine located in the pocket, and with two cylinders, measuring 6 × 6 ins. each. This engine is supplied with steam from the boiler room. In the latter the coal from the conveyor is automatically dumped into hoppers by trips set from the floor. Each hopper has a capacity of ten tons, and one is located over each battery of boilers. From these the coal can be taken as required. It is the intention of the engineers of the Brooklyn City Railway to have weighing chutes located below these hoppers, so that all fuel will be weighed before being fed to the furnaces.

The coal handling apparatus has a capacity of about fifty-five tons an hour, or sufficient, with present consumption, so that enough fuel can be conveyed to the hoppers in an hour for an entire day's run. The cost of transferring fuel by this system is much less than by the old methods.

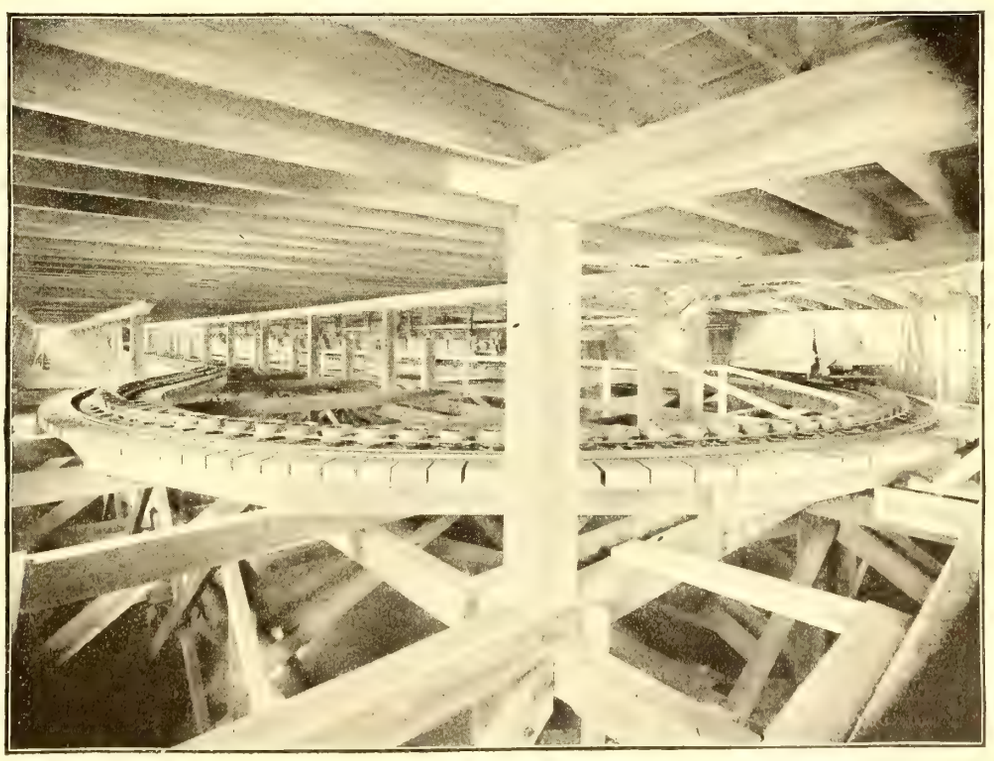


FIG. 4.—INTERIOR OF COAL POCKET—SOUTHERN STATION OF BROOKLYN CITY RAILWAY.

Buda-Pesth Electric Conduit System.

The results of the operation of the electric street railways at Buda-Pesth, which, it is remembered, are on the conduit system, has been most successful, according to the foreign electrical papers. In 1893 the road carried 12,500,000 passengers, and the receipts amounted to 2,500,000 francs, or nearly $500,000. A dividend of 8 per cent. was declared on the capital stock of 12,000,000 francs. Thenumber of cars has been considerably increased, and is now over 100.

THE Massachusetts Senate has voted to permit the street railways in that state to carry merchandize and mails.

Three Phase Electric Transmission of Power Applied to Electric Railway and Mill Operation.

The first important application of electrical power transmission to street railway and other power purposes has just been installed by the General Electric Company at Taftville, Conn., the power being transmitted from Baltic to Taftville, a distance of nearly four and one half miles. It is a typical transmission by three-phase currents, in which motors of the synchronous type are used not only to operate one of the most interesting cotton mills in this country, but also the power station of the Norwich (Conn.) Street Railway.

E. P. Taft, who is largely interested in the Taftville

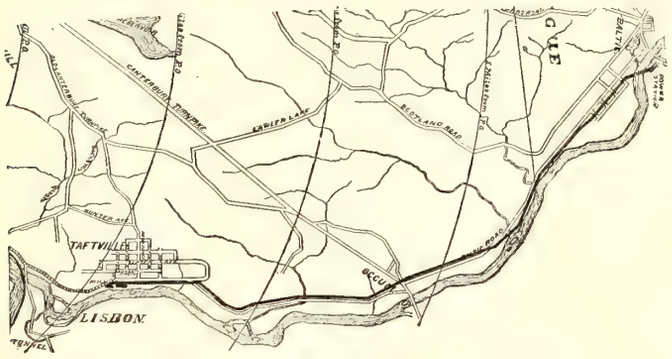


FIG. 1.—ROUTE OF THREE-PHASE ELECTRIC LINE.

cotton industry, long ago recognized the value of the available water power at Baltic, on the Shetugket River, near to which stood a ruined mill destroyed by fire some years ago, and having secured the property with the water rights, determined to utilize the power as soon as a successful means could be discovered. When the General Electric Company announced a practical solution of the power transmission problem, Mr. Taft carefully investigated the system and finally decided to adopt it for the operation of his cotton mills. The installation has now been completed, and the successful operation of the plant proves the advantages of the choice.

The Ponemah Mills are situated at Taftville, also on the Shetugket, and about three miles distant from Norwich. The original mill was operated for nearly a score of years by water power taken directly from the river, and when the new mill was erected it was found necessary to



FIG. 2.—BALTIC MILL, SHOWING RESERVOIR AND INTAKE GATES.

drive it from two 350 H. P. Corliss engines, the existing dam being insufficient in capacity. In Fig. 1 are shown the relative positions of the generating station at Baltic and the receiving station at Taftville. The line is nearly four and one half miles in length and is carried along the highway up the river, skirting its bank in places and crossing it at intervals to shorten its route.

The rebuilt mill and generating station at Baltic is shown in Fig. 2. In the basement of this building are the wheel and dynamo rooms of the generating plant. The mill is of four stories, built of stone, and will presently be used as the Ponemah Mills in the cotton weaving industry. 400 ft. above the mill a fine stone dam 525 ft. long has been thrown across the river. The effective head on the turbines is thirty-two feet, and the water available, even in the driest seasons, is sufficient to furnish not less than 1,500 H. P.

Fig. 3 is a plan of the basement of the mill in which

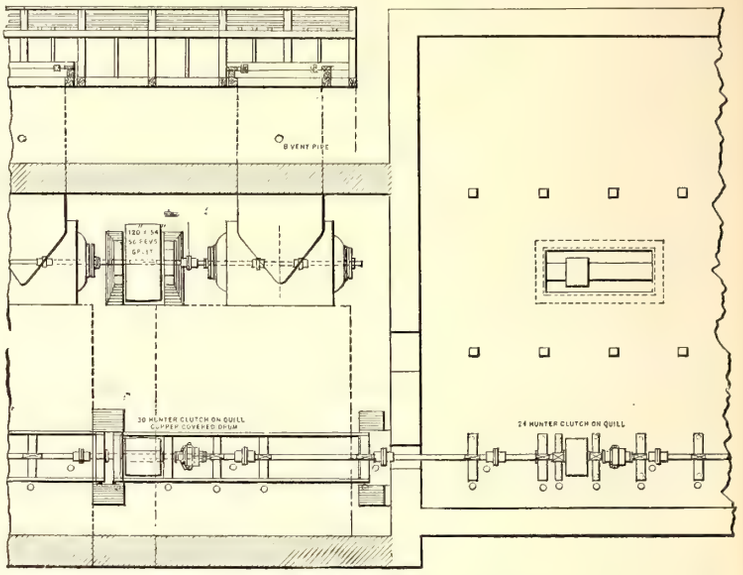


FIG. 3.—PART PLAN OF TURBINE AND GENERATOR ROOMS.

the power plant is located. It will be seen that the turbines are belted to pulleys on the main line shaft extending the whole length of the wheel room, and continuing through the partition walls into and along one side of the generator room. The pulleys are thrown into or out of action by Hunter clutches mounted with pulleys on quills, so that any or all of the wheels can be applied to driving the shafts. Similar pulleys and clutches are furnished in the dynamo rooms for throwing in or out the various machines that may there be placed.

Fig. 4 shows the wheel room and the arrangement of the turbines and line shaft. There are three double, forty-two inch, horizontal wheels and one double, twenty-

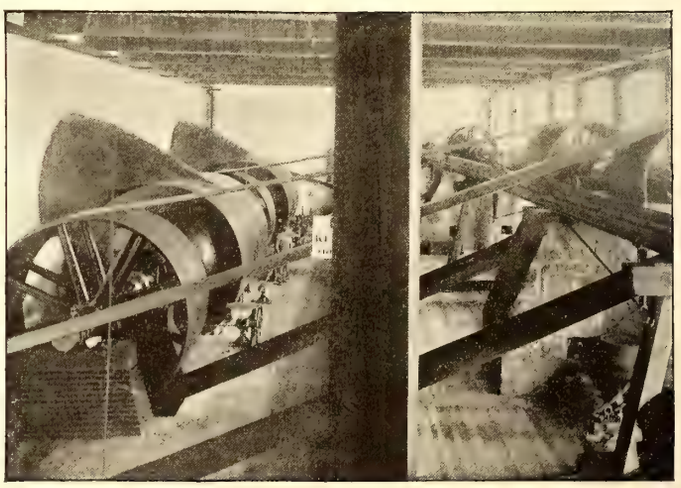


FIG. 4.—TURBINE ROOM AT BALTIC.

seven inch wheel, the former developing 800 effective H. P. each, at 157 revolutions per minute, and the latter 300 H. P. at 244 revolutions per minute. The belts pass obliquely upward to the pulleys on the line shaft, and the turbines are kept at speed by Schenck electric governors, which have proved themselves capable of doing very fair service. The wheel plant and shafting were made and installed by the P. C. Home Company, of Gardiner, Me. The line shafting is supported by heavy iron girders set on stone piers and additionally braced by timbers.

The dynamo room (Fig. 7), besides the shafting, is occupied by two 250 General Electric three-phase generators, delivering current to the line at 2,500 volts. Each



FIG. 5.—PORTION OF LINE—TAFTVILLE TRANSMISSION PLANT.

machine is provided with its own exciter, a three kilowatt, bipolar dynamo. The three-phase machines run at 600 revolutions per minute, and are set so firmly on substantial foundations as to run with scarcely a perceptible vibration. The driving pulleys on the main shaft are fitted with Hunter clutches, so that either machine can be dropped out without the slightest disturbance to the service.

The generators are connected to a common switchboard (Fig. 6), and may be run in parallel whenever desirable. To this end the board is furnished with synchronizing apparatus, the acoustic synchronizer being mounted on the face of the switchboard, and the equalizing switch being at the back. The most interesting novelties on this switchboard are the high voltage switches on the lower part of the board. These are mounted on marble bases, with substantial barriers erected between the switchblades, so that the circuit at full load and voltage may be broken without the slightest danger of arcing across from point to point. They have been amply tested, and have proved their ability to cope with the trying work required of them with the greatest ease.

The generators fall into parallel easily, and run as smoothly together as would a couple of railway generators. No artificial load is used in throwing them together, none having proved necessary.

The line, a characteristic bit of which is shown in Fig. 7, is a good piece of construction on substantial wooden poles placed 100 ft. apart. The upper wires on the cross arms are of No. 0 bare copper, and form the original three-phase circuit designed for the transmission. The wires on the lower cross arm are No. 0000 insulated wire, and are four in number. They were originally intended for a railway circuit, the generators for which were to be installed at Baltic to feed the Norwich Street Railway; but as the amount of copper necessary to do the work succesfully appeared too great, the system was changed, a second three-phase generator and motor were added, and three of the four proposed feeder wires were utilized for the three-phase circuit. All are supported on the General Electric Company's standard oil insulator, the fourth No. 0000 wire forming a convenient relay in case of accident to any of the others.

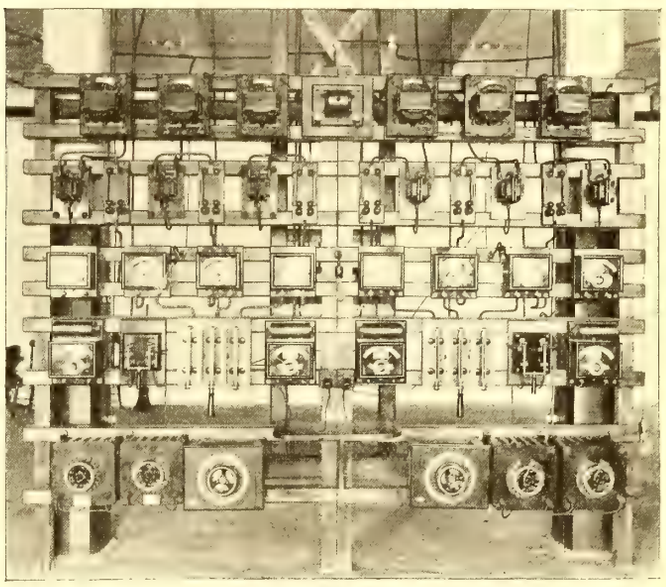


FIG. 6.—SWITCHBOARD IN BALTIC MILLS.

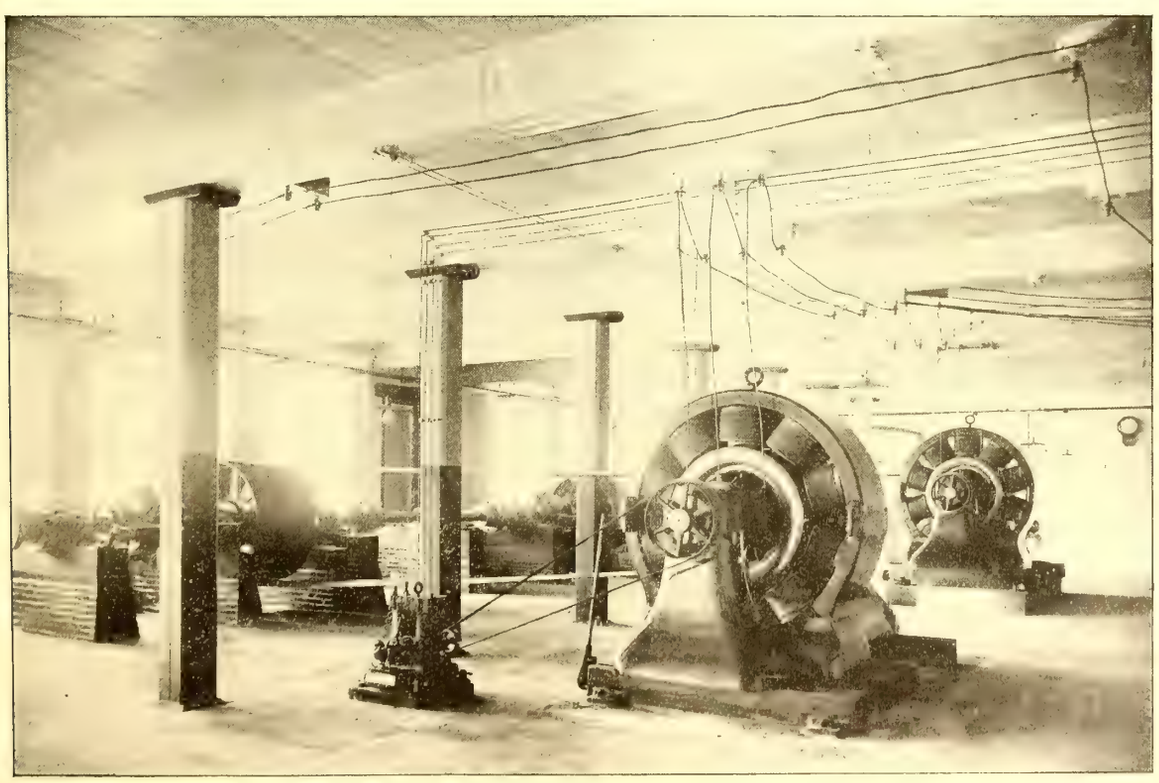


FIG. 7.—GENERATOR ROOM, BALTIC MILLS—TAFTVILLE TRANSMISSION PLANT.

At Taftville the three-phase circuits are led into the basement of the new mill, where they drive two three-phase, synchronous, self starting motors (Fig. 3), identical in size with the generators at Baltic. A view of this basement is given in Fig. 8, and one motor and a switchboard are shown in Fig. 9. Both motors are belted to a jackshaft which drives the mill machinery, and from which the railway generators are operated directly. The pulleys on this shaft are being equipped with friction clutches, so that the load can be thrown in and out of circuit.

The efficiency of the complete transmission at full load, from the power applied to the dynamo pulley to that delivered to the motor pulley, is just 80 per cent.

The motors start entirely unaided, coming up to synchronous speed in about fifty seconds from the time the current is thrown on. They are, like the generators, separately excited, the exciters being driven from the pulleys on the end of the motor shaft.

This is believed to be the first application of the three-phase system to street railway operation, and the success of the installation will go far toward popularizing the method for cases where it is applicable. In this connection a brief description of the Norwich Street Railway may not be without interest.

The Norwich Street Railway Company was organized in 1875 to take over the property of the Norwich Horse Railway Company, which was sold under foreclosure. The property of the company was operated by horse power until the spring of 1892, when the road, having been sold to Messrs. Shaw, Pond and Mason, of Boston, and Charles P. Cogswell, of Norwich, equipment with electric motors was commenced. The tracks were relaid with new fifty pound steel rails, on a well ballasted roadbed, and cars of modern type were obtained from the Newburyport Car Company. The motor equipment purchased was of the W. P. type.

In January, 1893, a syndicate of Boston capitalists, headed by Messrs. Tucker, Anthony & Company, bought both the Norwich and New London systems entire, with the exception of the interests retained by Messrs. Shaw and Cogswell. The electric equipment has been rapidly extended during the past year, and the road is now excellently equipped and operated under the efficient management of E. P. Shaw, Jr.

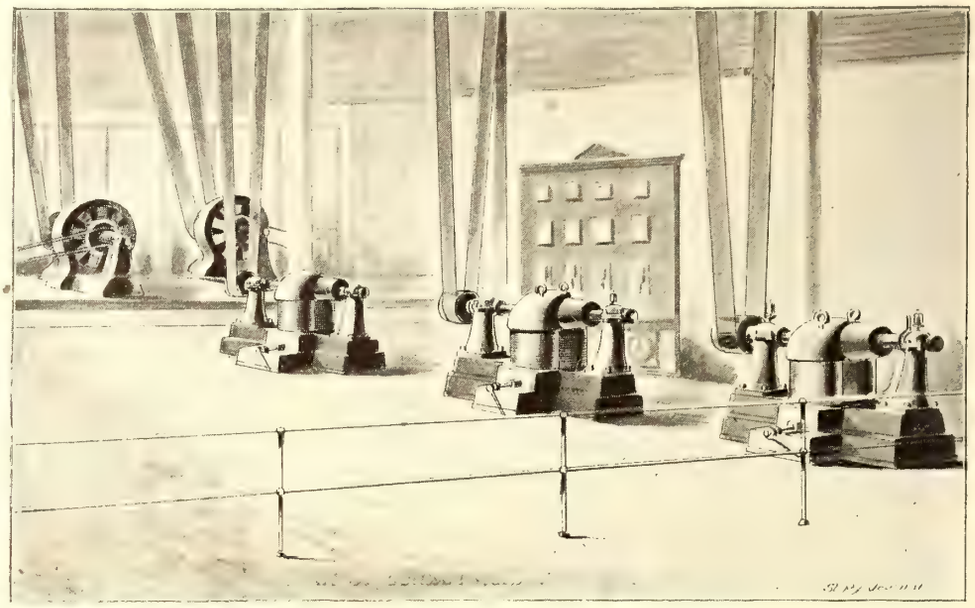


FIG. 8.—SYNCHRONOUS MOTORS OPERATING RAILWAY GENERATORS—PONEMAH MILLS.

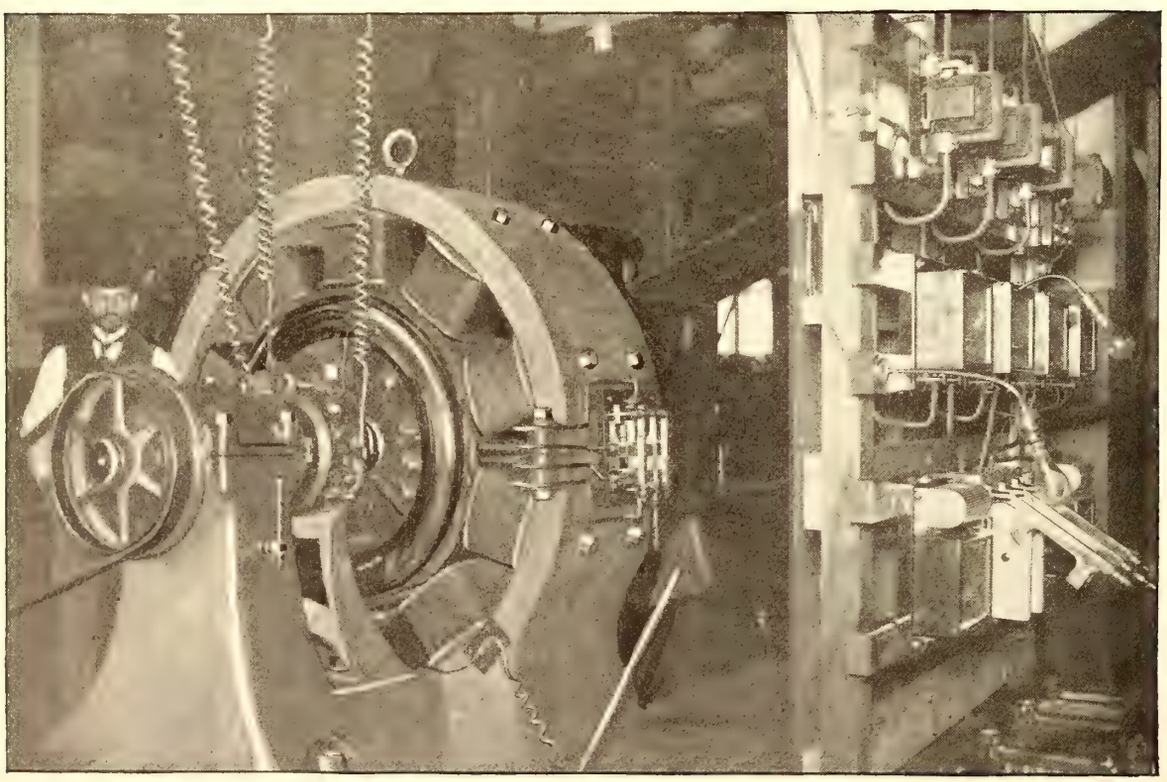


FIG. 9.—SYNCHRONOUS MOTOR AND SWITCHBOARD—PONEMAH MILLS.

Some interesting figures in regard to the comparative cost of maintaining macadamized roads with and without car tracks in the middle were recently presented by W. L. Dickenson in an address before the Massachusetts Highway Association. Mr. Dickenson found, as a result of a long series of observations at Springfield, Mass. that on residential streets having a moderate traffic and a driveway of thirty feet between curbs, unencumbered with street car tracks, so that the traffic is distributed over the entire surface, it is possible to furnish a good surface of macadamized pavement at an average annual cost of 1.3 cts. a sq. yd. for maintenance. On the other hand, when a track is laid in the middle, and the traffic is confined to a narrow strip on each side, travel soon grinds up the surface, increasing the cost of maintenance from four to five times.

The Isle of Man Tramways.

The Isle of Man is a beautiful little island, lying between England and Ireland, in the stormy Irish Sea. It is peculiar in many respects. Its arms are three legs; its cats and fowls have no tails; its government is carried on by a House of Keys, and no law is valid until the people, assembled around Tynwald Hill, give their consent.

But even the Isle of Man has been seized by the epidemic of progress, and its people have gotten an electric railway, hoping, by its introduction, to cope with the immense influx of visitors who begin to pour in in the early summer. The necessity for a new system of traction has been plainly evident for some years, the old horse car lines having proved themselves painfully inadequate, and as a considerable part of the income of the islanders is derived from their summer visitors, it was felt that a better system of traction would increase the inducement to visit.

It is at Douglas that the visiting multitudes converge. A fine line of steamboats connects this city with Liverpool, and in summer these boats are taxed to their utmost to carry the thousands anxious to escape from the crowded centers of trade in the northern and middle counties of England.

A joint stock company, known as the Isle of Man Tramway & Electric Power Company, has been recently incorporated with a nominal capital of £150,000 ($750,000) divided into 125,000 shares of £1, each of which 50,000 are 6 per cent. preference and 75,000 ordinary shares. There will also be £50,000 debenture bonds at 5 per cent., redeemable in 1914. The object of this company is the consolidation of the two existing car lines, that running from the Victoria Landing pier at Douglas to the Derby Castle gates, and that from the latter point to Grondle Glen; and the extension of the latter line as far as Laxey, where the famous Laxey lead mines wheel forms a perennial attraction. The franchise over this route, with the exception of about three miles controlled by the Town Commissioners of Douglas and which they will have the right to acquire by purchase, is perpetual. The length of the line when completed will be about seventeen miles of single track.

The Isle of Man Tramways is a horse line, employing fifty horses. Outside the station and buildings, a rolling stock of thirty-one cars and various machinery, it owns a large strip of land fronting upon Douglas Bay.

The electric line at present runs from the Derby Castle gates to Grondle Glen, a distance of about two and one-third miles. This line was operated experimentally during three weeks last summer with considerable success. The station for the generation of current is situated at Douglas, and another is at present in course of erection at Laxey. That at Douglas is a substantial building in which are housed the steam and electrical plants, the latter consisting of a generator and an accumulator plant.

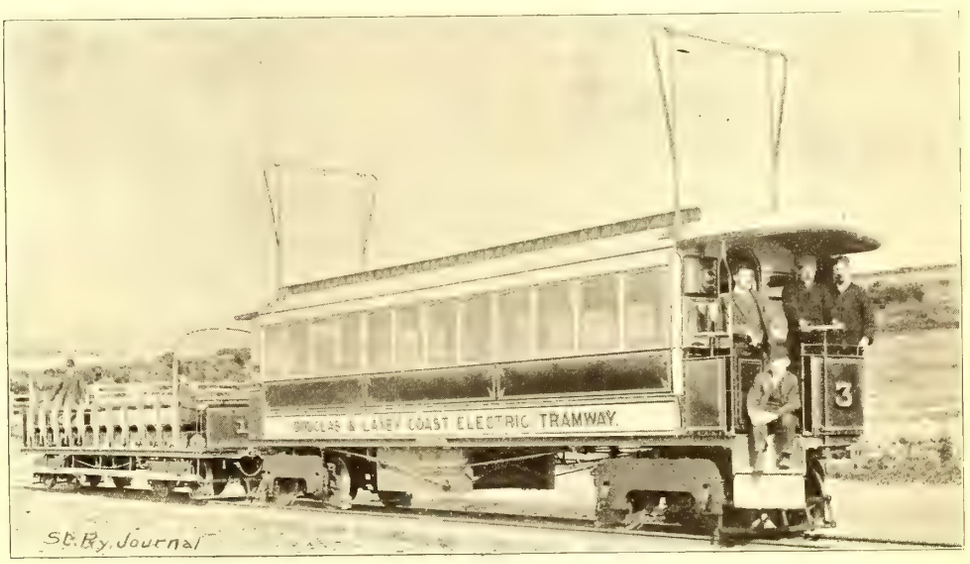
The boiler plant consists of five steel boilers of the Lancashire type, furnishing steam to five compound condensing engines. These are connected by rope drives to five Hopkinson dynamos built by Mather & Platt, Limited, of Manchester. These dynamos, when operating, furnish current to the line as well as to the accumulators, which serve to regulate the output. The whole electrical work, both plant and machinery, was designed by Dr. Edward Hopkinson.

The rolling stock consists of nine large motor cars and twelve open cars, such as are shown in the illustration. The current is brought from the line to the motors on the cars by a peculiarly European method. Instead of the trolley with an underrunning wheel, two collecting bars are fixed on the car, one at each end. These press against the overhead conductors, and take the current by a sliding contact. Thus when they pass a pole, one bar is always in contact with the overhead wire.

The extension of the line to Laxey, seven miles from Douglas, is rapidly nearing completion, and is expected to be in operation this summer. It will be double track throughout, except two short single tracks at Douglas, constructed of heavy steel rails set on ties laid on a well grouted bed. The bridges and culverts are of stone. The road is really a railroad if judged by its construction, but as it has been classed as a tramway, the speed of travel is limited by law to ten miles per hour.

The overhead wires will be suspended from double armed center brackets.

The company owns about fifty acres of land at Onchan Head, which overlooks Douglas Bay. This is to be enclosed and laid out as a park, free of expense to the company, and is expected to become a source of considerable revenue on a short trip service.



ELECTRIC CAR—ISLE OF MAN TRAMWAY.

The horse road carried in 1892, 813,114 passengers, and in 1893, 911,410, and showed a net profit of £3,784 on the latter year's working, the expenditures being about £100 over 50 per cent. of the receipts. Referring to the experimental operation over the two and a third miles at the close of the visiting season last summer, 20,000 passengers were carried in nineteen days, 1,689 miles were run and the receipts averaged 35.36*d.* or about seventy-one cents per car mile. The fare charged from Derby Castle to Laxey is one shilling or twenty-five cents, that from Derby Castle to the grounds three pence or six cents, and a similar fare from the landing pier to the Castle.

In addition to the operation of the road, the company contemplates the supply of current to large consumers located in the vicinity of the Douglas generating station.

The three miles mentioned as being open to purchase at the end of four years by the Douglas town commission, form the only difficulty which this electric railway has to face. According to a decision of the Queen's Bench, the value of a tramway undertaking to fall into the hands of a municipality is to be arrived at by giving a certain number of years' purchase on a rental value. According to Sir F. Bramwell, the judge, the purchase amount would mean the value of the lands and buildings of the company, with such sum added as would represent the cost of construction of the road, less an allowance for depreciation, no account being taken of past or prospective profits. This decision has just been affirmed by the Court of Appeals, but is now to be carried up to the House of Lords, the court of last resort.

New Motors of the Westinghouse Electric & Manufacturing Company.

The accompanying engravings will give an excellent idea of a new type of motor brought out by the Westinghouse Electric & Manufacturing Company, styled by its manufacturers their No. 10 and No. 12 motors. As will be seen, the type appears to resemble the No. 3 single reduction motor of the same makers, without the iron frame which serves as its support. The absence of this frame reduces the weight of the new motor without diminishing its rigidity. As a circular form of field may be mathematically proven to afford the greatest strength for any given weight of material, as a four pole field must evidently give greater output than one of only two poles, and as the toothed armature, with a two circuit winding and lathe wound coils, has been practically demonstrated to be unsurpassed, all these features of the No. 3 type of motor are retained in the newly designed machine.

The No. 12 motor is manufactured in three standard sizes, as follows: Of 20, 25, and 30 H. P. capacity.

The No. 10 motor, which is designed for heavier work, is built in 40 and 50 H. P. sizes.

The armature is of the drum type and wound with machine made coils, each consisting of heavy insulated wire wound in rectangular form. The two longer sides of the coil are enclosed in cells of special insulating material, the whole being then wrapped with insulating tape of a superior quality. The coils are connected to the commutator segments so that the armature winding has only two circuits, obviating the possibility of the armature becoming electrically unbalanced, and requiring the use of but two brushes. The armature is short and compact, and special means have been employed in its construction to prevent grease from the bearings coming in contact with the coils.

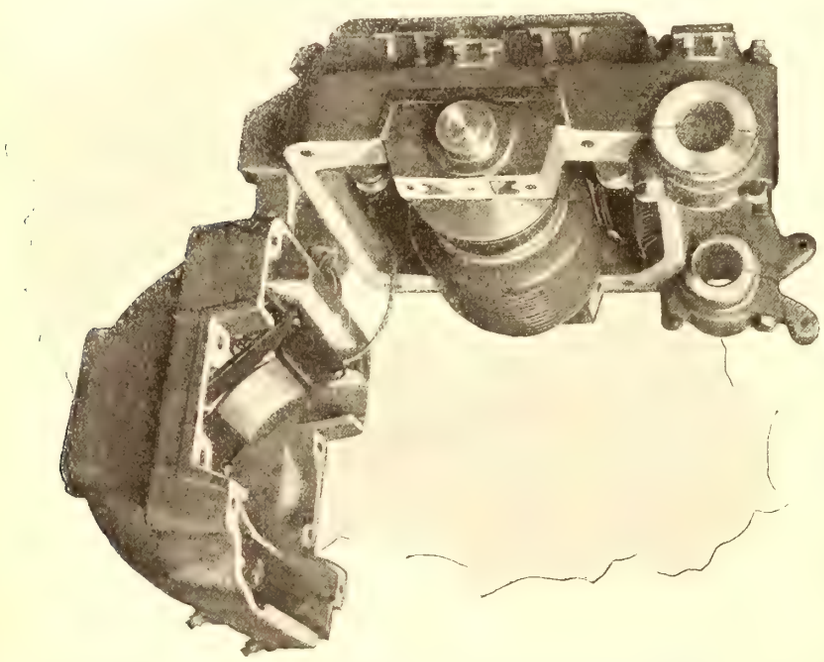


FIG. 1.—SINGLE REDUCTION MOTOR WITH ARMATURE IN UPPER FIELD.

The field consists of four pole pieces projecting radially inward from a circular yoke or ring which parts in a horizontal plane through the shaft. In order to secure rigidity of construction the two lower pole pieces, half of the circular yoke and end plates are made in a single, solid casting, which secures strength and at the same time completely protects the lower half of the motor. These features are well shown in Fig. 1.

The rectangular frame which was a distinct feature of the No. 3, has been incorporated into the upper half of the field of the No. 10 and No. 12, so as to do double service, forming a part of the magnetic circuit and a part of the frame, and thus giving sufficient strength to the motor to hold the armature shaft always in perfect alignment with the car axle. On the side which is farthest from the axle of the car, the two halves of the yoke are hinged together, so that the interior parts of the motor are made easily accessible without the necessity of dismounting.

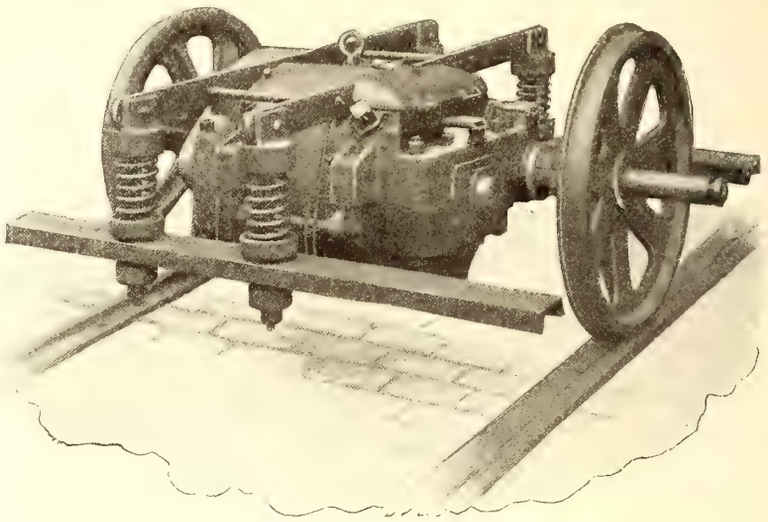


FIG. 2.—SINGLE REDUCTION MOTOR, SHOWING SUSPENSION.

The lower field casting has three openings, one directly below the commutator and the others at opposite ends of the casting. These openings are closed by watertight covers, which may be removed to give access for the purpose of repair or removal of dust or dirt.

The two brush holders, 90 degs. apart on the top of the commutator, are held in position by a frame which is so designed as to constitute a part of the end of the upper field, and, together with a lid, completely encloses the commutator end of the motor, and entirely protects the inner parts. The lid is hinged and normally kept closed by a stiff spring.

The method of suspension shown in Fig. 2 relieves the axle of practically all the direct weight of the motor, and avoids entirely, it is claimed, what has been termed "hammering" of the rail joints. By reason of the increased strength of the upper field yoke, it is possible to suspend the motor directly in the line of its center of gravity, by means of suspension bars which run parallel to the sides of the truck, and have their ends supported upon spiral springs. The motor is thus freed from jars and yet accurately maintains the meshing of the gears while yielding to the motion of the truck.

By reason of the improvements and of a more efficient utilization of the iron in the fields and armature and of the copper in the windings, it has been possible to effect a material reduction in the weight of the new motor.

Reference to the illustrations shows the advantages of the motor in respect to accessibility. The hinged lid, already referred to, permits ready handling of the brushes and inspection of the commuter. The openings in the lower field afford access to the lower part of the motor. When it is desired to gain access to the whole interior of the motor, the car is run over a pit and the lower half of the field opened down, either with or without the armature, as may be desired. The armature bushings are carried in pillow blocks which, when the motor is closed, are secured to both the upper and lower fields. By removing the bolts holding the pillow blocks to the upper half of the field, the lower half may be opened down with the armature, which can then be rolled out upon a board, thus avoiding the necessity of lowering the armature into

the pit and again raising it. By removing the bolts between the pillow blocks and the lower half of the field, the armature is kept in the upper half of the field, permitting removal of field coils, etc., in the lower half.

The lower half of the field is readily opened down by the use of a rope passed around the axle, which is thus made to take the part of a pulley block.

From what has gone before it will be seen that the following are the characteristics of the machines described: Light weight, ample capacity of the armature and field windings, large bearing surface in the journals, protection from external injury, very high efficiency, great starting torque.

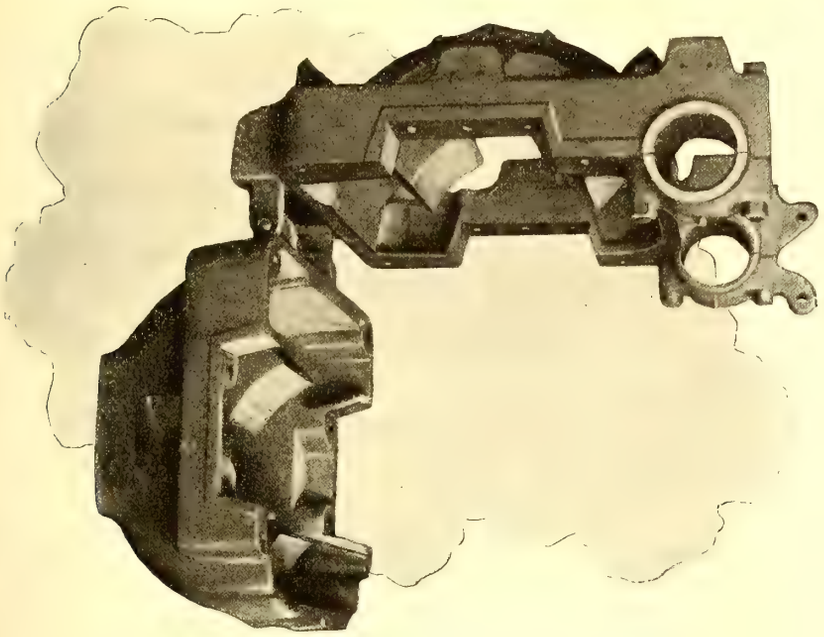


FIG. 3—SINGLE REDUCTION MOTOR CASTINGS.

The controlling apparatus is second only in importance to the motor. The series-multiple controller which the Westinghouse Company introduced with type "G," has proved so acceptable that it is with the utmost confidence the company now offers its new and improved controller stand No. 14, shown in Fig.

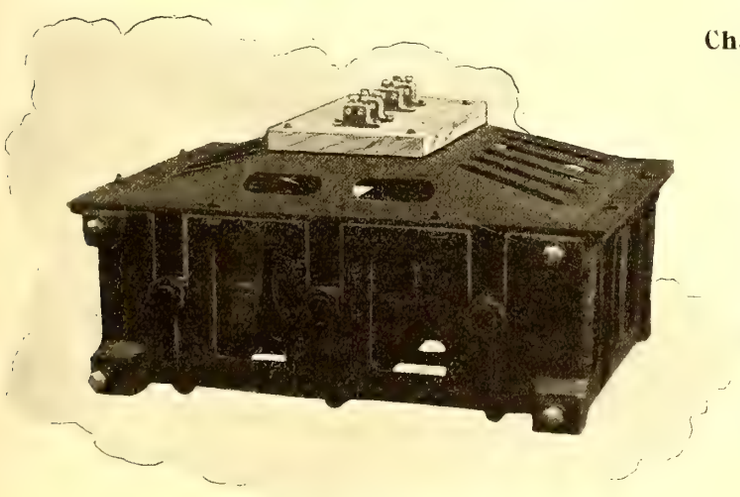


FIG. 5.—DIVERTER.

The No. 14 is a platform controller having two removable handles, one for controlling the speed and the other the direction of travel of the car. The handles are provided with locking devices which prevent their removal except when in the position for no current. The electrical combinations of the motors made by the new controller are improved over those of the earlier type, in that the motors divide the work equally, and the car starts more easily and attains its maximum speed more smoothly.

The construction of the new controller is similar to that of the old type. Corresponding positions of the handle give speeds to the car similar to that of the old style. This feature will at once recommend itself from the fact that the motormen accustomed to running cars with the "G" controller will be able to use the new one.

The new diverter, type No. 7, is shown in Fig. 5. The resistances are made up of strips of sheet iron placed between strips of mica. The diverter is made completely fireproof, and at the same time there is provided the very best ventilation.



FIG. 4.—SERIES MULTIPLE CONTROLLER.

One of these diverters is used on each car, its function being to reduce the current while the motors are being started, thereby preventing the sudden jerking of the car and unnecessary strain on the motors.

Changes in the 50th Street Power House of the Broadway Cable Railway.

As already mentioned, the lower section of the Columbus Avenue cable railway of New York, upon which work is now being pushed, will be operated from the 50th Street power station of the Broadway & Seventh Avenue Railway Company. The plans adopted for altering this power station to admit two new sets of drums are the addition of a driving drum at each of the outside ends of the present driving drum shafts. The drums for operating the upper section of the Broadway road are now keyed to their shafts, but they will be mounted on quills and arranged so that they can be thrown in and out of connection with the shaft, by means of friction clutches. The new drums will be of the overhanging type, that is, will have no outside bearings, and will be designed to operate the cable at a speed of twelve miles per hour.

Plans are being drawn up for the uptown power station for the Columbus Avenue line and for the Lexington Avenue line, but the details have not been entirely settled on yet.

ON removing the tracks of the horse car construction on Prytania Avenue, New Orleans, preparatory to the electric construction, the cypress ties, which had been in service for about thirty years, were found to be in so sound a condition that they were employed in the new construction, resulting in quite a saving, as new ties had been distributed over the route before the work had been begun.

Problems in Straddled Track Construction.

During the recent construction of the lines of the City & Suburban Railway Company, in Baltimore, it became necessary to devise a new arrangement of the tracks on Pratt Street, which is occupied jointly by two tracks of the City & Suburban Railway Company and a single track of the Baltimore & Ohio Railroad. Pratt Street extends along the water front of the city, is only from twenty-nine to thirty nine feet in width, and during the day it is crowded with heavy traffic, which not only greatly

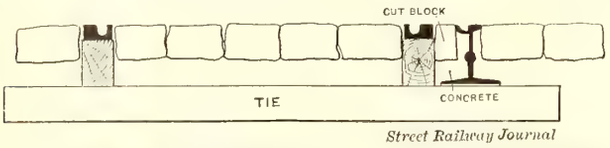


FIG. 1.—ORIGINAL ARRANGEMENT OF TRACKS—BALTIMORE.

impedes street railway service, but also renders the maintenance of the tracks difficult and expensive. About one mile of the street is occupied by the tracks of the two companies, which are broken by numerous switches reaching the different piers along the water front. The cars of the Baltimore & Ohio Railroad run through the street only between midnight and about 5.30 A. M. They are hauled by a four-wheel locomotive weighing about fifty-eight tons, from which it will be seen that the track is subjected to heavy service. In reconstructing this portion of the City & Suburban system several plans for would prove most satisfactory, as it reduces the number of rails to four, and also occupies less street room. In this plan the Baltimore & Ohio track was placed in the center, using a center groove tram rail, 6⅝ × 2½ ins., on a 6½ × 7½ in. stringer. The outer rails are ten inch Johnson girders with electrically welded chairs. In this plan the center track is given additional support by ties placed between those carrying the outer rails. This plan, apparently so admirable, could not be adopted on account of the danger of blocking both of the electric tracks by a car on the center track.

Fig. 3 is a plan submitted by the Johnson Company. This shows only the combination of the steam and electric tracks on one side of the street, the other electric track being entirely independent. While this plan presented a compact arrangement of the tracks, it was considered objectionable because of the large surface of metal in the street, presented by the close contact of the two tracks. The width of the tram rail is four and seven-eighths inches, and the girder three and seven-eighths inches, making two surfaces of eight and three-quarters inches of metal.

Fig. 4 presents a modification of the plan shown in Fig. 3, giving only one wide surface of metal by straddling the steam and electric tracks instead of placing the steam track wholly inside the electric rails. The rails shown in this plan are the same as shown in Fig. 1, a grooved tram rail, 2½ × 5 ins., and a ten inch Johnson girder with electrically welded chairs. A desire to avoid even a single wide surface of metal, and the rather narrow space of nine

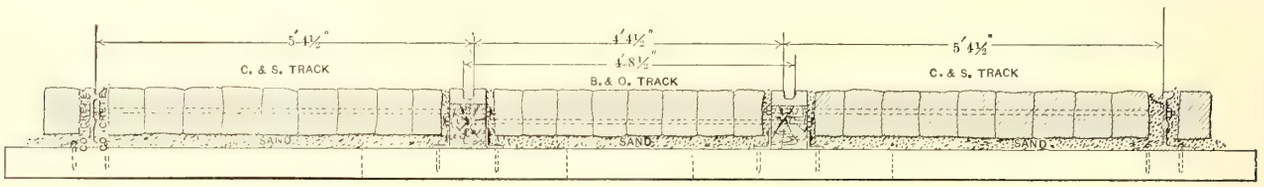


FIG. 2

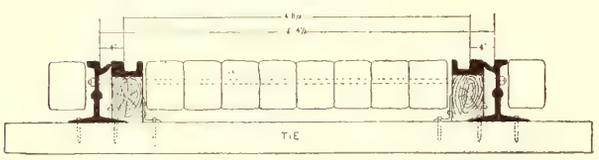


FIG. 3. DIFFERENT ARRANGEMENTS OF TRACKS PROPOSED—BALTIMORE.

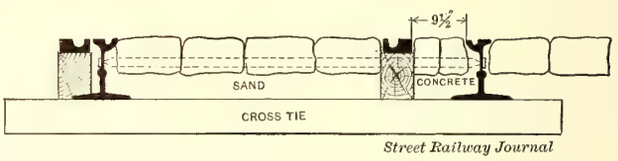


FIG. 4.

improving the arrangement of the tracks were worked out by Frank H. Sloan, chief engineer of the company, and as they may furnish helpful suggestions to others who are called upon to deal with similar problems, the various plans are reproduced, together with brief notes about each of them.

Fig. 1 shows the original arrangement of the tracks, modified by the substitution of girder rails for the old tram rails formerly used in the tracks of the City & Suburban Railway. In this plan one track of the City & Suburban Company is entirely independent, the outer rail of the other being used by both steam and electric cars. The gauge of the steam track is four feet nine inches, and the electric tracks five feet four and a half inches. The rail of the steam track is a grooved tram rail two and a half inches deep, laid on a 5 × 8 in. yellow pine stringer, giving a depth of ten and a half inches from the tie to the top of the rail. The girder rail of the electric tracks is a Johnson eighty pound, ten inch girder, with electrically welded chairs, the difference in height between this and the tram rail being met by a one-half inch iron plate placed beneath the chairs of the girder rail. The objection to this plan was the space of four inches between the girder and tram rail, which was filled by a cut paving block on concrete. Former experience demonstrated the difficulty of keeping this small space filled, as it was frequently cut out by the wheels of heavy teams, and the loss of horses by catching their hoofs in this space was a considerable item of cost to the City & Suburban Company. It was, therefore, deemed advisable to adopt some plan by which this small space could be avoided.

Fig. 2 shows a plan which, under some circumstances, and a half inches between the two center rails, led to the rejection of this plan.

Fig. 5 is the finally adopted plan which met most fully the views of the two railroad companies and the city authorities. As will be observed, it is simply a modification of the plan shown in Fig. 4, the distance between the rails of the two straddled tracks being increased, so as to avoid any wide surface of metal, and any paved space so narrow as to promise trouble. The outer rail of one electric track is placed in the center of the steam track, and the four rails of these tracks are carried upon one set of

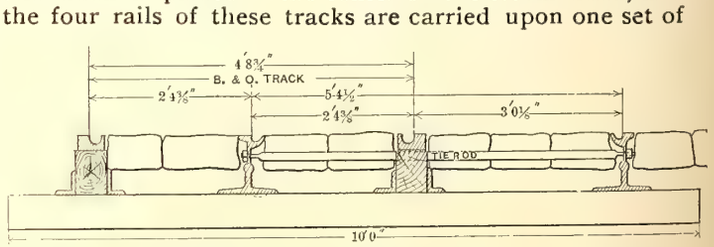


FIG. 5.—ARRANGEMENT OF TRACKS ADOPTED—BALTIMORE.

10 ft. × 6 × 8 in. yellow pine ties, spaced three feet center to center. The other independent electric track is carried on ties 8 ft. × 5 × 8 ins. similarly spaced. The rails are a grooved 2½ × 5 in. tram rail for the steam track, and a ten inch Johnson girder, with electrically welded chairs, for the electric tracks. The stringer for the tram rail is reduced to 5 × 7½ ins., so as to give this track the same height as the girder of the electric track, and the steam track is strengthened by bracing the stringer on the ties with angles, which was also done in the ori-

ginal construction. The rails of the straddled electric track are stiffened with tie rods which cut the stringers of the steam track just beneath the rail. On the other electric track tie rods are also used. This construction was put down ten months ago, and although it has been subjected to very heavy service, it has given entire satisfaction.

"Brothers-in-Law."

Of all the troubles which arise in the management of a street railway, one of the greatest is, how to prevent dishonest conductors from "knocking down." We will not say stealing; oh, no, taking money is not stealing. All kinds of schemes and devices have been tried, from the much hated spotter to the famous bell register. When the register first put in an appearance it gave the conductor much trouble; he was terribly afraid that he would be compelled to be honest, but after much effort he found a way to overcome even this objection.

There are three classes of registers, the hand register and punch, the portable register, which the conductor suspends from his neck, and the stationary register, which has a dial similar to a clock. Of these the first two styles have been successfully beaten by bogus registers or the "brother-in-law" method. For the benefit of those who are unacquainted with these instruments we will say that there are three styles of "brothers-in law." These are



FIG. 1.—PALM "BROTHERS-IN-LAW."

the palm signal bell, the vest signal bell, and a bell which works under the arm. We illustrate the different styles of the "palm" bells in Fig. 1. It will be noticed each has a small push knob. This knob when pushed will trip a lever, which rings "one fare;" it is a small device compact in shape, intended to be carried in the palm of the hand, so that the conductor, when he wishes to appropriate a fare, will have a bell to sound, thus deceiving the passenger.

In Fig. 2 we illustrate the "vest bells," which are designed to be suspended from the neck, and so constructed that they can be rung from the same position that the register is rung from; in fact the same motion is used, and unless you are watching the dial to see that it moves, you will be deceived every time.

The largest of the group is a clumsy affair, intended to be worked under the arm, but was never much of a success. The one in the form of a change box was

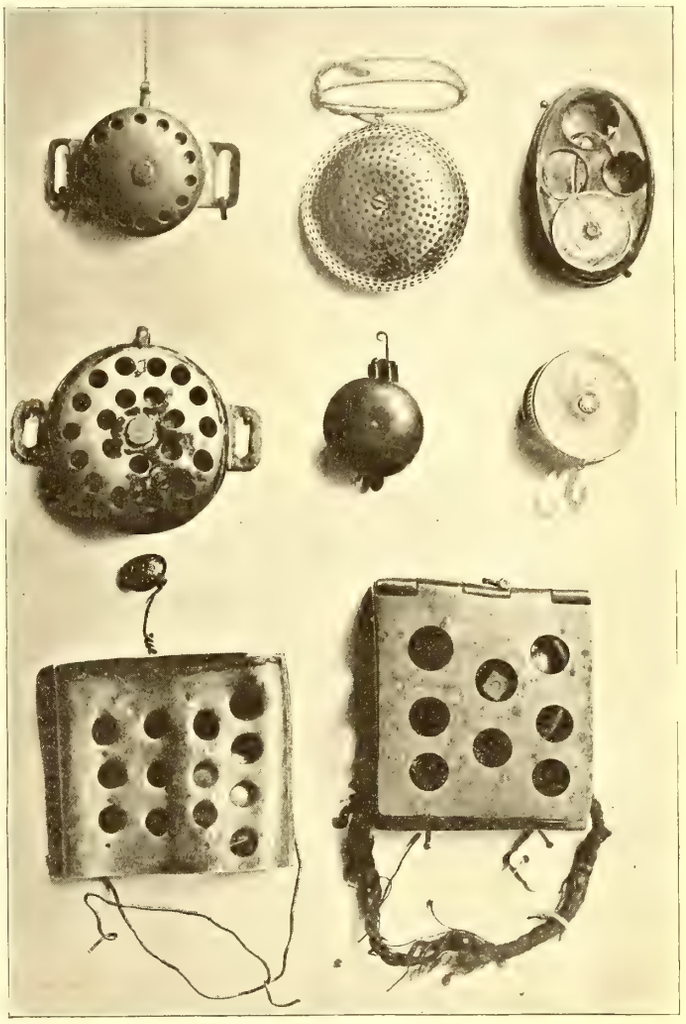


FIG. 2.—VEST "BROTHERS-IN-LAW."

one of the first produced. It was taken from a conductor in 1878, and was only secured after a hard fight.

The conductor said he would never give it up, that he would fight first. The superintendent who made the demand was a man of muscle; he quietly walked to the door and securely locked it, remarking that he would see about it. They had a rough and tumble fight right then and there, first one on top and then the other; finally the superintendent got the better of his man and secured the "brother-in-law." This man was arrested, as have been dozens of others for the same offense, but when brought to trial could not be convicted; the jury nearly always disagree in such cases a sad commentary on our laws and our courts, for this is out and out stealing.

In justice to the present conductors we wish to say, that very little of the "brother-in-law" work is being done at the present time.

THE Bristol (Eng.) Tramways & Carriage Company, Ltd., has deposited a bill in Parliament asking for power to extend several of its existing lines. There will be in all about three and a half street miles of new track. The present St. George's line, which has many steep grades, has been operated by horse power since the opening, now for about sixteen years. This line is two and a half miles in length. It is proposed to extend this line a little more than one and a half miles up what is known as Two Mile Hill to Kingswood, a boot and shoe manufacturing town of 11,000 population, and which, on account of its altitude and consequent difficulty of access, has neither steam railroad nor street railway accommodation.

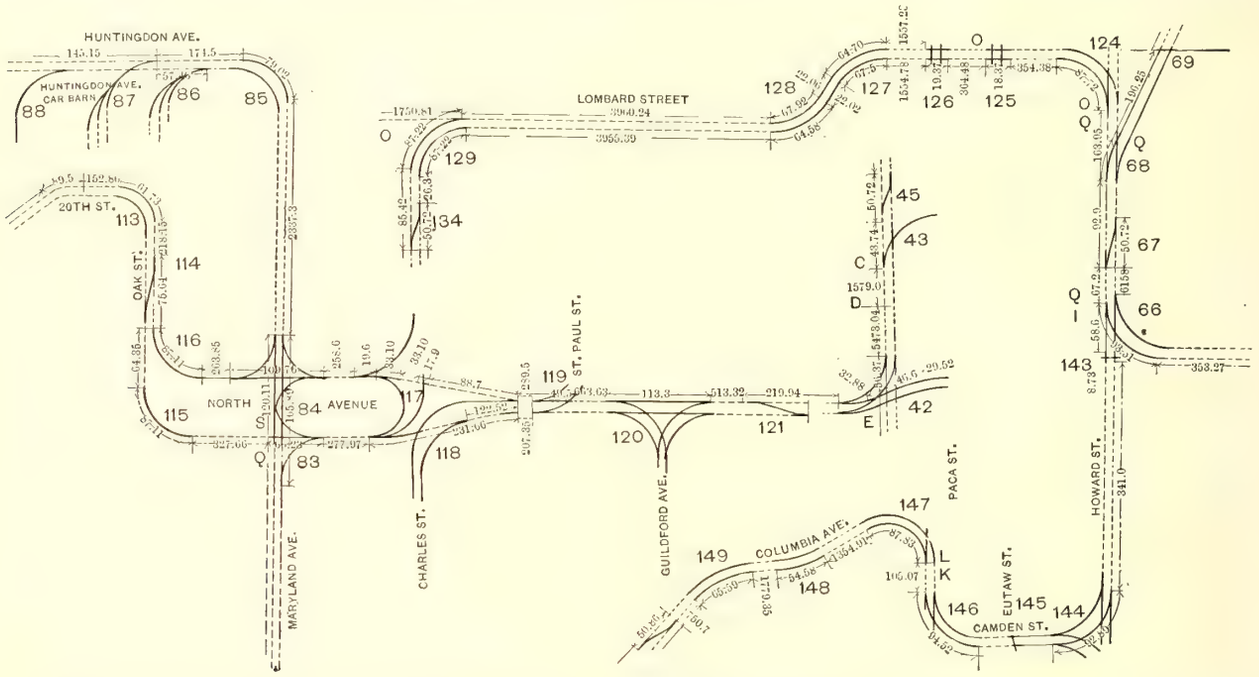
Reference Map of the City & Suburban Railway, of Baltimore.

An elaborate reference plan of the entire system of the City & Suburban Railway Company, of Baltimore, Md., showing distances, track construction, location of special work, length of curves, etc., in great detail, has recently been made by Frank A. Sloan, chief engineer of the company. The map is seven feet six inches square, and is drawn on a single sheet of heavily mounted paper made especially for the purpose. Every curve, piece of special work, crossing, switch, etc., is shown on the map, each with its individual number, and in its proper location relative to other parts of the system. The tangents, of course, are necessarily shortened, in order to bring the plan within bounds, but the length of each is indicated, and the relative position is given.

The numbers assigned to the special work refer to a tabulated statement on the margin of the map, where all the details of construction of each piece of work are given. Large letters indicate the different subdivisions of track, and marginal tables give the length of each in feet of single track, together with full details of track construction. It will be seen that such a map as this embodies a complete record of the permanent way of the system, and is of inestimable value to the maintenance-of-way department. In the event of repairs at any point on the entire system, no search for plans is necessary, as the entire record of every portion of the track is available at a glance.

The map will admit of the addition of extensions of the system, and any changes from the present standards of construction can be indicated in a marginal table of changes.

The great size of this map precludes its reduction to a size that will permit us to show it entire in our pages, but we have reproduced portions of it, which will suffice to indicate the character and the manner in which the details are shown. We also reproduce the headings of the



PORTIONS OF REFERENCE MAP, SHOWING METHOD OF CONSTRUCTION—CITY & SUBURBAN RAILWAY, BALTIMORE.

STRAIGHT TRACK CONSTRUCTION—GAUGE OF TRACK 5 FT. 4⅛ INS. STANDARD TRACK CENTERS 9 FT. 8½ INS.

Ref. Map Letter.	Rail. Size.	Rail. Manufacturer.	Rail. Sect.	Rail. Wt.	Rail. Spike.	Joint. Style.	Joint. Bolt. No.	Joint. Bolt. Size.	Joint. Spike.	Joint. How Laid.	Tie Rods. Size.	Tie Rods. Space.	Chairs. Size.	Chairs. Kind.	Cross Ties. Kind.	Cross Ties. Size.	Cross Ties. Space.	Remarks
A	7″	Penna. Steel Co.	91	80	5″x⅝″	26″ splice.	6	1″x3½″	.....	Opp. & sus.	1½″x⅜″	7½′ c c	.....	.....	Ga. pine.	6″x7″x8′	2′ 6″ c c	.....
B	4″ T	" " "	6A	58	5½″x½″	24″ angle fr.	4	¾″x3½″	.....	Brok. & sus.	.....	.....	.....	.....	" "	" " "	"	trk. cen.
C	7″ Gr.	Johnson Co.	80-254	80	"	Whit'n spl.	6	1″x3½″	5″x½″	Opp. & sus.	1½″x½″	7½′ c c	.....	.....	" "	" " "	"	11′ 10½″
D	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
E	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
F	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

SUMMARY OF DISTANCES BY SUBDIVISION OF TRACKS IN FEET OF SINGLE TRACK.

Ref. Map Letter.	Towson & Pratt St. Route only.	Circuit.	Hampden and Highland Town Route only.	Common to Hampden and Highland T'wn and Towson & Pratt St. r'ts.	John St. Route only.	Common to John St., Hampden & Highland Town and Towson & Pratt St. routes.	Common to John St. and Hampden & Highland Town routes.	Wilkens Ave. and Claremont St. Yard route.	North Ave. route.	Supplementary track.	Total Electric Track, Jan. 1, 1894.
A	4,576.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	4376.6
B	40,729.6	.....	.....	.....	.....	.....	.....	.....	.....	387.00	41116.6
C	10,783.6	.....	.....	.....	.....	.....	.....	.....	.....	240.64	11024.24
D	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
E	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
F	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

SPECIAL WORK CONSTRUCTION.

Ref. No.	Manufacturer.	Manufacturer's Blue Print No.	C. and S. Ry. Plan No.	Total Angle.	Rail Sec.	Construction. Chairs.	Construction. Spikes.	Construction. Joints.
1	Johnson Co.	16165	M 7	90°0′0″	75.213	St. Gr.	3½x½ ins.	St'd Girder
2	"	17569	M 9	16°0′0″	75.213	"	" "	" "
3	"	13307	.....	90°0′0″	66½.141	4 in. bulb	" "	16 in. "
4	.....	.....	.....	.....	.....	.....	.....	.....
5	.....	.....	.....	.....	.....	.....	.....	.....
6	.....	.....	.....	.....	.....	.....	.....	.....

CITY AND SUBURBAN TRACKS USED BY FOREIGN RAILWAY COMPANIES.

Foreign Company.	Location.	Feet of Single Track.
Baltimore Traction Co	Hillen St. bet. Forrest St and High St.....	2,041.1
" " "	Howard St. bet. Lombard St. and Camden St..	1,602.59
" " "	Park Ave. bet. Saratoga St. and Franklin St..	720.71
.....	.....	.....
.....	.....	.....
.....	.....	.....

various marginal tables which appear upon the map, in order to show how fully the record of construction is pre-

CAR MILEAGE.

Route.	Miles.
Towson and Pratt St. Route (Towson to W. Pratt Stable)	21.05
Hampden and Highland Town Route (Falls Rd. to Highland Town Barn)	13.84
John St. and Columbia Ave. Route (Madison and No. to Gwynn Falls)	4.65

served. The map will be properly framed, and placed in the office of the general manager, J. F. Heyward.

Committees to Report at the Atlanta Convention.

A list of the subjects to be discussed at the next meeting of the American Street Railway Association at Atlanta, Ga., October 17, 18, and 19, 1894, has already been published in these columns. The committees appointed to report on these subjects have just been announced by the secretary of the Association. We give below a complete list of the committees and subjects:

1. "Can the T Rail be Satisfactorily Used in Paved Streets?" Joel Hurt, president of the Atlanta Consolidated Street Railway Company, Atlanta, Ga.; S. Hendrie, manager of the Wyandotte & Detroit River Railway Company, Detroit, Mich.; H. J. Crowley, engineer of the Atlanta Consolidated Street Railway Company, Atlanta, Ga.

2. "City and Suburban Electric Railways:" Elwin C. Foster, superintendent of the Lynn & Boston Railroad, Boston, Mass.

3. "Mail, Express and Freight Service on Street Railway Cars:" Richard McCulloch, electrical engineer of the Citizens' Railway Company, St. Louis, Mo.

4. "The Best Method of Treating Accidents and Complaints:" John B. Parsons, general manager of the West Chicago Street Railroad, Chicago, Ill.

5. "Street Car Wheels and Axles:" D. S. Cook, electrical engineer of the Trenton Passenger Railway Company, Trenton, N. J.

6. "Transfers and Commutation:" Rodney Curtis, president of the Denver Tramway Company, Denver, Colo.

7. "The T Rail Construction of the Terre Haute Street Railway Company:" M. F. Burke, superintendent of the Terre Haute Street Railway.

8. "A Standard Form for Accounts for Street Railways:" H. I. Bettis, consulting engineer of the Atlanta Consolidated Street Railway Company, Atlanta, Ga.

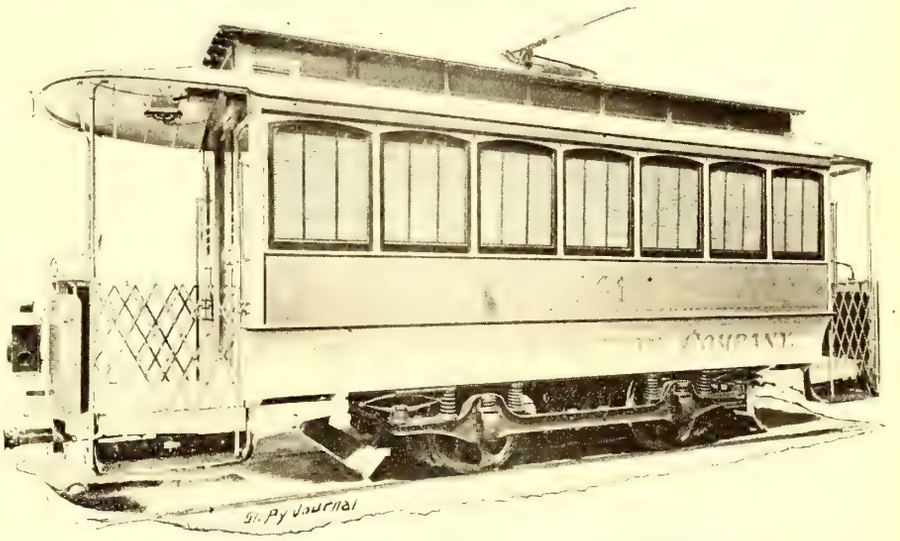
SOME very quick work in electric railway construction was recently performed on West State Street, Trenton, by the Passenger Railway Company of that city. The erection of poles, it was known, would be strenuously opposed by certain residents of the street, on which are located the homes of some of the most prominent and wealthy residents of the city. For this reason, the company's workingmen did not commence the work of overhead line construction until late on the afternoon of April 6, and by 11 o'clock the following morning electric cars were running over the road. The day before, not a single evidence could be seen of the company's intention to put up their wires. A few of the residents commenced hostilities as soon as the intention of the railway company was evident. Its workmen were assaulted with brooms, water and other weapons, and a judge was called out of bed at 5 o'clock in the morning to grant a writ of certiorari, but the railway company secured its point.

Cars for the Electric Traction Company, Philadelphia.

We present an engraving of the type of cars being built for the Electric Traction Company of Philadelphia, by the Jackson & Sharp Company of Wilmington, Del. The length of the car inside is 18 ft. 7 ins., and over the platform it measures 26 ft. 7 ins. The width of the car over the panels is 6 ft. 6 ins., and at the sash rails 7 ft. 6 ins. The height of the car body from the under side of the sill to the trolley board is 9 ft., and from the track to the top of the trolley board 11 ft. 5½ ins.

All sills are of Georgia long leaf, yellow pine, all cross framing is of oak, and all posts, top rails, ventilator rails and all material used in the framing are of white ash. The roof is of the dome pattern, extends the whole length of the car, and is covered with the best quality of duck. The ceiling is of three-ply, bird's eye maple veneer neatly and tastefully decorated. The car is lighted with one large bronze combination candle and electric lamp in the center, and one light at each end.

The deck sash is of cherry pivoted in the center and glazed with Muranese glass, wine color. Two beveled edged plate glass mirrors are located in each end in neat cherry frames in the interior of the car. The hand rails are of cherry and are mounted on bronze brackets with twenty padded hand straps to match the finish. There are seven windows on each side and two in each end glazed with double thick glass embedded in rubber on all edges. The blinds are of cherry with white bass slats. The doors are double and operate simultaneously.



CAR FOR THE ELECTRIC TRACTION CO.—PHILADELPHIA.

The finish of the car is cherry throughout, with neat carving over all windows and doors. The seats and backs are covered with handsome Wilton carpet. The space between the seats and floor is neat panel work. The floor is covered with slats of maple.

There are large roomy platforms equipped with Stanwood steps and a new style of gate. Fitzgerald-Van Dorn radial drawbars are used. The cars are painted chrome yellow, with white concave panels and corner posts, with the name of the railway company in silver on the concave panel, and the numbers in gold on the panels and dashes. The ornamentation is in gold, and the corner posts are blue.

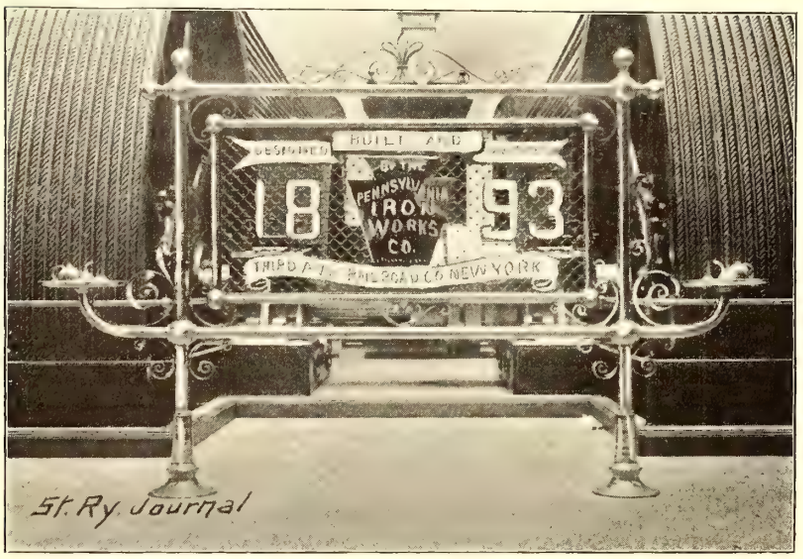
The trucks are of the McGuire type, neatly painted, striped and varnished. The electric equipment is of the Curtis Electric Manufacturing Company's make.

Consolidation at Grand Rapids.

The Consolidated Street Railway Company, of Grand Rapids, Mich., has purchased the North Park dummy line, which will hereafter be operated as part of that system. The deal also includes the summer resort of the North Park Company, comprising fourteen acres of land and a pavilion, certain valuable rights, etc.

A Handsome Name Plate.

A very handsome name plate has recently been erected in the 65th Street station of the Third Avenue cable railway of New York. It is located in the center of the room directly in front of the main line of shafting, and faces the visitors' gallery, is constructed of highly polished brass tubing, and is 14 × 8 ft. high. Between the uprights is an open work panel, bearing in the center the keystone emblem of the State of Pennsylvania in polished brass, on which appears in black letters the name of the Pennsylvania Iron Works Company, the builders of the station. Above and below the keystone are handsome ribbons of brass, with the name of the Third Avenue Railway Company in black letters.



NAME PLATE—THIRD AVENUE UPTOWN CABLE STATION, NEW YORK.

The whole is beautifully decorated with brass scroll work on each side, and attached to the uprights by handsome brackets are brass trays for holding the oil cans.

Changing Grade in Chicago.

The question of elevating the tracks of the Chicago, Rock Island & Pacific and the Lake Shore & Michigan Southern Railways, in Chicago, has recently taken on a new phase. The subject is of interest to street railway companies from the fact that the lines of the Chicago City Railway Company cross the right of way of the roads whose tracks it is proposed to elevate. At first, a head room of twelve feet was proposed, but this, it was maintained by the officials of the Chicago City Railway Company, was insufficient for the operation of its trolley cars. An agreement was finally reached by which the head room was increased to thirteen and thirteen and a half feet, except in one or two places. For this, and other considerations, the railway company was to pay them the sum of $250,000, out of which a second amount was to be paid the railway company for the work required to deepen the subways the required amount. The ordinance was passed and vetoed by the mayor.

During further consideration of the question a new council was elected, and negotiations are now under way for another agreement on the subject.

New Chicago Tunnel.

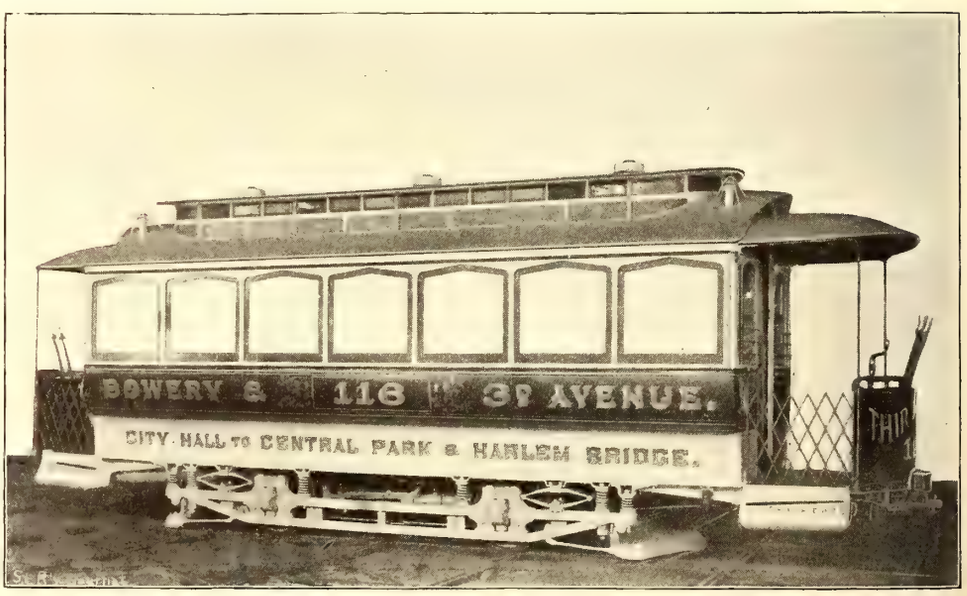
The new tunnel at Van Buren Street under the Chicago River, constructed for the use of the West side Cable cars of the Blue Island Avenue and South Halsted Street lines, was opened last month. The construction has taken four years and has necessitated the expenditure of $1,500,000, including the cost of right of way, legal expenses, etc. The length of the new tunnel and its approaches is 1,513.9 ft. The arch is fifteen feet nine inches in height above the level of the car tracks, and has a span of thirty feet. The steepest incline is a 10 per cent. grade for 500 ft., and at the foot of this grade there is a second one of 1.81 per cent. for 100 ft., where the lowest point of the tunnel is reached. The ascent is then made by three grades.

The tunnel is lighted by arc lamps driven by three sixty kilowatt Waddell-Entz dynamos, directly connected to three McEwen high speed, simple engines of 100 H. P. capacity, each running at 275 revolutions per minute. The capacity of these dynamos is much in excess of the present demand; and a number of incandescent lamps, for use in neighboring buildings, will probably be run in connection with the plant.

Peckham Trucks in New York.

The latest street railway in New York to operate the Peckham truck, is the Third Avenue Railway Company. A view of one of the handsome cars of the Third Avenue Railway mounted on this style of truck is shown in the accompanying engraving.

The car is of the Laclede type, with a twenty-two foot body, and measuring thirty feet over all. These cars are fitted up in an extremely tasteful manner, and have proved quite popular with the patrons of the company.



THIRD AVENUE CABLE CAR WITH PECKHAM TRUCK—NEW YORK.

The truck is of the 6 D, standard Peckham type, and though it has been running for a short time only on the road, has attracted much attention, on account of its easy riding qualities and absence from jar. The success of the Peckham trucks on the Broadway cable railway, of New York, was one principal reason for their adoption on the Third Avenue road, and it is said that most of the 175 cars which the Third Avenue Company has ordered from the J. G. Brill Company will be mounted on Peckham trucks.

The street railroad vestibule law of Ohio, has been declared invalid by the Common Pleas Court at Springfield.

THE INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS.*

BY EDWARD E. HIGGINS.

FIFTH PAPER.

Class V. Surface Railways in American Cities of from 100,000 to 500,000 Inhabitants.

There are twenty-four cities in the United States having a population of from 100,000 to 500,000 by the census of 1890. Fifteen are in the Eastern States, six in the Central, two in the Western and one in the Southern. The total track mileage exceeds 3,000, of which about 65 per cent. is operated by electricity, 20 per cent. by horses, 10 per cent. by cable and the balance by other systems of motive power.

Twenty-one of these cities are represented in the Table of Statistics, twenty appearing in the class now under consideration. The population of one city and its suburbs exceeds 500,000; two are grouped together in one population center; two cities are represented, first, separately, and, again, in combination; and one city is represented, first, alone and, second, with a large addition of suburban population served by a separate railway system. The statistics of three cities are not sufficiently complete to be included in the table.

Only four cities of the entire number were operated in either 1890 or 1892 wholly by horses or by any one motive power. In this class, for the first time, we find a fair proportion of the mileage operated by the cable system, and, as early as 1890, several of the systems had commenced the introduction of electricity, although to hardly so great an extent, proportionally, as in the classes hitherto discussed. In 1894, however, we find the electric mileage, as above stated, about 65 per cent. of the total, with only 20 per cent. still operating by horses.

We are now dealing with properties of size and earning power sufficient to merit the attention of the best financial talent and the ablest and most sagacious management. Capital liabilities of from $5,000,000 to $40,000,000, gross income of from $1,000,000 to $2,000,000 and net earnings of from $300,000 to $800,000—all indicate a speculative and investment field in which the wide variety of financial methods—good, bad and indifferent—which have been developed in the steam railroad industry of the country can find full play. The increasing disposition of conservative banking houses and investors to extend their operations into this field, the profits which have been realized in the important transfers, reorganizations, consolidations and reconstructions of the last five years, and the frequent listing of the more important securities upon the great stock exchanges of the country make it certain that, whatever good or ill fortune may befall individual investors in time to come, the great street railway industry has emerged from its comparative obscurity and will henceforth rank second only to steam railroads in the money markets. Certain elements of safety in street railway investments will come to be more generally recognized. Competition, for example, is much less a menace to consolidated street railway properties serving single municipalities than is the case with even widely ramified steam railroad systems which can be easily paralleled or, in various ways, injured by rivals. "Cut rates," "rebates," "differentials," and all similar methods of attracting business, together with the credit system in any form are unknown in the street railway industry. "Bills and accounts payable" is far more likely to form an important feature of a street railway balance sheet than is "bills and accounts receivable," and in this respect the business is much more attractive than are the numerous "industrial" enterprises. As against these obvious and most important advantages we have, in some cases, franchise limitations and burdens of more or less importance, but possible losses from these causes may always be provided for by amortization funds, the annual burden of which, if established in the early days of the enterprises, may be almost insignificant. Such companies as are fortunate enough to have obtained "perpetual" franchises are in a most favorable position.

It is worth while then to study with the utmost care the results so far achieved by these large properties and to carefully weigh the influences which will affect their permanently safe earning power and their ability to meet the expectations of their security holders.

The twenty-one cases of this class represented in the table differ from those heretofore discussed, in that few of them were operated, either in 1890 or 1892, exclusively by any one motive power. Moreover, the complete municipal systems are made up in most instances of independent roads, and the changes in motive power and service within the two years specified have taken place somewhat less rapidly than in the smaller cities. Without attempting, therefore, to discuss the statements of 1890 and 1892 separately, it seems best to divide the entire twenty-one cases into four groups according to the gross earning power per capita developed up to 1892. The first group contains two systems only, which earned $4.06 and $4.95 per capita respectively in 1892, the second group contains five systems, which earned from $5.18 to $5.51 per capita, the third group contains ten systems, which earned from $6.32 to $8.08 per capita, and the fourth group contains four systems, which have earned from $10.14 to $13.35 per capita in 1890 and 1892.

DISCUSSION OF TWO SYSTEMS SHOWING A PASSENGER INCOME LESS THAN $5.00 PER CAPITA PER ANNUM.

Case No. 115, which serves a well known Eastern city of over 250,000 inhabitants, has exhibited a gross earning power much inferior to all the cities of this class, although the margin of profit with horse operation has been satisfactory and has rapidly increased from year to year. The manufacturing interests in this city have been, until lately, secondary in importance to the commercial, and the city has been somewhat "sleepy" in consequence. The business district is exceedingly small and the residential section covers a large area, so that distances are great and compel riding. The policy of the horse railway management was to keep the horse equipment up to a high standard of excellence at the expense of speed, and the horse car schedules were consequently "slow" to a fault. This fact is responsible for the extremely low gross earning power in 1890 ($2.99), and although this was increased in 1892 to $4.06 (and in 1893 to $5.31), owing largely to the increasing proportion of electric railway mileage, the present totals are still much below the average. The proportion of operating expenses to passenger income has steadily decreased since 1890, and is now less than 65 per cent., while the net income, although but 2.8 per cent. in 1890 on the extremely heavy capitalization, $113,000 per mile of track, was, in 1893, 3.7, and will doubtless materially increase for several years to come, as the future of this city and its street railway systems is, for various reasons, unusually promising.

The street railway system represented in case No 121 was wretchedly poor in 1890 both in physical condition and in service rendered. The city itself is prosperous, with large manufacturing and commercial interests, and with many special attractions for residence. During the last three years immense improvement has been made in the street railway system, and the passenger income is now (1893) $6.46 per capita, a moderately large figure, though by no means up to the average of other cities in this class. This system also has a large capitalization due, in part, to the somewhat extensive cable mileage introduced since 1890.

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TABLE V.—AMERICAN STREET RAILWAY SYSTEMS.

PART I.—STATISTICS OF CAPITALIZATION.

SEE "INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS." Horse Railways are given in Roman figures.

Case Number	Miles of Track					Miles of Street	Capital Stock			Funded Debt			Capital Liabilities			Floating Debt		Case Number
	Horse	Electric	Cable	Miscel.	Total		Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Memo.	
A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T
102	70.0	.....	.....	.....	70.0	45.0	1,000,000	14,300	9.50	300,000	4,300	2.90	1,300,000	18,600	12.40	425,000	B.A.P	102
	50.0	30.0	.....	.....	80.0	.....	1,500,000	18,800	14.30	800,000	10,000	7.60	2,300,000	28,800	21.90	.....	.....	
103	*45.0*	*27.5*	*42.0*	*6.0*	*120.5*	*69.6*	*3,668,700*	*30,300*	*34.30*	*4,859,000*	*40,200*	*45.40*	*8,527,700*	*70,500*	*79.80*	*761,536*	B.A.P	103
	5.0	*145.6*	*30.0*	*15.0*	*195.6*	.....	*8,420,000*	*43,000*	*78.70*	*7,617,000*	*38,900*	*71.10*	*16,037,000*	*81,600*	*149.80*	.....	.....	
m 104	*14.4*	*14.5*	*61.0*	*22.7*	*112.6*	*58.4*	*6,923,400*	*61,200*	*52.00*	*5,272,000*	*46,600*	*39.60*	*12,195,400*	*107,800*	*91.70*	*272,808*	B.A.P	m 104
	14.5	*18.3*	*62.6*	*23.9*	*119.3*	.....	*7,035,000*	*59,200*	*52.90*	*5,410,000*	*45.500*	*40.70*	*12,445,000*	*104,700*	*93.20*	.....	.....	
105	29.3	11.2	10.0	.....	50.5	25.3	5,000,000	99,000	37.60	2,170,000	43,000	16.30	7,170,000	142,000	53.90	994,185	B.A.P	105
	.....	*86.2*	*10.0*	.....	*96.2*	*53.6*	*5,000,000*	*52,000*	*37.60*	*4,683,500*	*48,600*	*35.20*	*9,683,500*	*100,600*	*72.80*	*1052,724*	Net.	
106	53.2	8.8	.....	.....	62.0	35.7	4,200,000	67,700	31.30	2,875,000	46,400	21.50	7,075,000	114,100	52.80	s 389,073	Net.	106
	14.5	*55.8*	.....	.....	*70.3*	*39.5*	*5,200.000*	*74,000*	*38.80*	*3,327,500*	*47,400*	*24.90*	*8,527,500*	*121,400*	*63.70*	*307,090*	"	
107	56.3	.....	3.0	.....	59.3	46.2	1,800,000	30,400	11.20	.....	.....	.....	1,800,000	30,400	11.20	27,700	.....	107
	61.4	.....	3.4	.....	64.8	49.0	2,300,000	35,500	14.30	.....	.....	.....	2,300,000	35,500	14.30	83,287	.....	
108	119.0	9.0	.....	.....	128.0	84.4	500,000	3,900	3.10	.....	.....	.....	500,000	3,900	3.10	.....	.....	108
	81.0	50.0	.....	.....	131.0	81.0	6,000,000	45,800	37.30	6,000,000	45.800	37.30	12,000,000	91,600	74.50	.....	.....	
109	80.0	.....	.....	23.0	103.0	58.0	5,385,000	52,300	32.70	2,595,000	25,200	15.80	7,980,000	77,500	48.40	1242,377	B.A.P	109
	.....	*114.4*	.....	.....	*114.4*	*60.3*	*5,385,000*	*47,300*	*32.70*	*5,071,000*	*44,500*	*30.70*	*10,456,000*	*91,800*	*63.60*	*838,406*	Net.	
110	88.4	.....	.....	.....	88.4	.....	6,147,000	69,600	33.00	5,375,000	60,900	28.90	11,522,000	130,500	61.90	213,200	Net.	110
	.....	.....	.....	.....	*104.1*	.....	*7,054,000*	*67,800*	*37.90*	*7,128,000*	*68,600*	*38.30*	*14,182,000*	*136,500*	*76.30*	*719,718*	.....	
111	64.7	.....	3.0	.....	67.7	54.6	2,000,000	29,500	9.20	.....	.....	.....	2,000,000	29,500	9.20	55,700	.....	111
	73.3	.....	3.4	.....	76.7	59.6	2,500,000	32,600	11.50	.....	.....	.....	2,500,000	32,600	11.50	226,787	.....	
112	76.4	9.0	7.4	.....	72.8	.....	2,166,600	29,800	9.40	1,100,000	15,100	4.80	3,266,600	44,900	14.20	81,929	B.A.P	112
	38.9	*43.5*	*22.0*	*2.0*	*106.4*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
p 113	76.2	.....	.....	73.4	149.6	109.6	4,669,350	31,100	19.30	1,608,200	10,700	6.70	6,277,550	41,900	26.00	49,078	B.A.P	p 113
	104.1	45.0	.....	.....	149.1	.....	4,894,350	32,800	20.20	1,054,000	7,000	4.30	5,948,350	39,900	24.60	.....	.....	
114	67.5	.....	2.4	5.0	74.9	47.2	1,077,400	14,400	4.30	2,786,500	37,300	11.00	3,863,900	51,500	15.20	98,948	.....	114
	58.3	13.0	2.5	7.5	81.3	z 53.2	1,538,255	18,800	6.10	3,756,000	46,200	14.80	5,294,255	65,100	20.90	28,400	.....	
115	63.8	.....	.....	.....	63.8	42.3	205,000	3,200	.80	1,500,000	23,500	5.90	1,705,000	26,700	6.70	188,907	.....	115
	47.0	*52.5*	.....	.....	*99.5*	*60.4*	*5,870,500*	*59,000*	*22.90*	*5,370,257*	*54,000*	*21.00*	*11,240,757*	*113,000*	*43.80*	*518,736*	.....	
t 116	*44.0*	*52.4*	.....	*32.0*	*128.4*	*67.4*	*3,925,000*	*30,700*	*14.40*	*1,400,000*	*10,900*	*5.10*	*5,325,000*	*41,600*	*19.50*	*211,437*	B.A.P	t 116
	.....	*188.7*	*19.0*	.....	*207.7*	.....	*19,050,000*	*91,800*	*70.00*	.....	.....	.....	.....	.....	.....	.....	.....	
117	109.3	11.2	10.0	23.0	153.5	83.3	10,385,000	67,500	34.90	4,765,000	31,000	16.00	15,150,000	98,700	51.00	2236,562	B.A.P	117
	.....	*200.6*	*10.0*	.....	*210.6*	*113.9*	*10,385,000*	*49.300*	*34.90*	*9,754,500*	*46,200*	*32.70*	*20,139,500*	*95,300*	*67.60*	*1891,130*	Net.	
u 118	*45.0*	.....	*84.2*	*18.2*	*147.4*	*66.1*	*13,331,173*	*90,500*	*44.50*	*7,375 000*	*50,200*	*24.70*	*20,706,173*	*140,800*	*69.20*	*37,740*	B.A.P	u 118
	59.0	*47.7*	*107.0*	*21.3*	*235.0*	... .	*25,892,000*	*110,200*	*86.60*	*10,956,000*	*46,800*	*36.80*	*36,848,000*	*157,000*	*12340*	.....	.....	
119	*49.7*	*24.9*	*29.8*	.....	*104.4*	*61.9*	*10,983,953*	*105,800*	*32.00*	*5,441,500*	*52,300*	*15.80*	*16,425,453*	*158,100*	*47.70*	.....	.....	119
	28.0	*100.8*	*24.1*	.... z	*152.9*	*102.6*	*17,588,095*	*115,000*	*51.20*	*9,185,500*	*60,100*	*26.70*	*26,773,595*	*175,100*	*77.90*	.....	.....	
v 120	110.7	12.6	24.5	.....	147.8	86.2	7,694,950	52,000	20.60	2,327,000	15,700	6.30	10,021,950	67,600	26.80	19,200	B.A.P	v 120
	71.3	*138.0*	*26.5*	.....	*235.8*	.....	*10,275,000*	*43,700*	*27.60*	*2.550,000*	*10,800*	*6.80*	*12,825,000*	*54,200*	*34.30*	.....	.....	
w 121	144.0	.....	.....	.....	144.0	93.8	7,590,000	52,700	17.50	1,772,500	12,300	4.10	9,362,500	65,000	21.60	420,072	B.A.P	w 121
	41.0	*155.7*	*37.0*	.....	*233.7*	.....	*11,050,000*	*47,400*	*25.60*	*10,727,000*	*45,700*	*24.70*	*21,777,000*	*93,100*	*50.20*	.....	.....	
x 122	116.1	.....	15.9	45.0	177.0	103.3	6,861,000	38,800	15.20	4,439,500	25,100	9.70	11,300,500	63,800	25.00	110,827	B A.P	x 122
	16.7	*220.5*	*43.4*	.....	*280.6*	.....	*23,237,000*	*82,600*	*51.30*	*16,025,000*	*56,900*	*35.40*	*39,262,000*	*139,500*	*86.90*	.....	.....	

m. This report does not include about 15 miles of miscellaneous and newly constructed track. p. This report does not include one insignificant horse road. t. This report does not include one 12 mile horse railway which was in the process of conversion to the cable system in 1890, and which earned about $250,000 during their financial year of 1890. u. One road reports capital liabilities, mileage and gross income ($895,000) only, but calculations are carefully made with due allowance therefor, and the resulting statistics are "true." v. One road operating partly by horses and partly by cable does not return its horse railway statistics of operation. w. This report does not include three small suburban roads and one horse railway operating 22 cars. x. This report does not include one 10 mile road commencing cable operation in 1890, and with capital liabilities of $1,300,000. z. Approximate.

DISCUSSION OF FIVE SYSTEMS SHOWING A PASSENGER INCOME OF FROM $5.00 TO $5.50 PER CAPITA PER ANNUM.

Case No. 116 was an imperfectly developed horse and electric railway system in 1890. This was one of the first cities to adopt electricity, the original apparatus was defective, and the percentage of operating expenses to passenger income in 1890 was 78, in spite of the large proportion of electric mileage. The net earnings were equal to 7.7 per cent. on a moderate capitalization, $41,600 per mile of track. Since 1890 the entire system has been completely transformed, and the physical condition and service now rendered are all that could be desired. The passenger income and net earnings have both increased enormously, although, unfortunately, exact figures cannot be obtained for all of the roads. It is worthy of note that, on certain important through lines in this city, electric

SERVING FROM 100,000 TO 500,000 POPULATION.

PART II.—STATISTICS OF OPERATION.

Electric, Cable and Steam Railways are given in italics.

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Case Number	Population Served	Area	Population Per Mile Street	Population Per Square Mile	Year Ending	Car Mileage Total	Car Mileage Per Capita	Passenger Income Total	Passenger Income Per Mile Street	Passenger Income Per Car Mile	Passenger Income Per Capita	Operating Expenses Total	Operating Expenses Per Car Mile	Operating Expenses % Passenger Income	Net Earnings Total	Net Earnings Per Car Mile	Net Earnings % Passenger Income	Net Earnings % Cap. Liab.	Case Number
a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u
102	105,000	....	2,300	.....	6-30-1890	3,615,000	34.5	493,150	11,000	.136	4.70	377,880	.105	76.7	116,155	.032	23.5	8.9	102
	105,000	....	.....	.....	12-31-1891	.....	.....	689,413	.....	....	.6.56	.....	...	.....	.....	....	....	....	
103	*107,000*	....	*1,500*	.....	n *1890*	.....	.....	*1153,578*	*16,500*	....	*10.74*	*820,409*	....	*71.3*	*341,756*	....	*29.7*	*4.0*	103
	107,000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	....	....	....	
m 104	*133,000*	....	*2.300*	.....	n *1890*	*11,598,004*	*87.2*	*1743,729*	*30,000*	*.150*	*13.08*	*1292,851*	*.111*	*74.1*	*498,758*	*.043*	*28.7*	*4.1*	m 104
	133,000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	....	....	....	
105	133,000	....	5,300	.....	6-30-1890	3,146,716	23.7	523,254	20,700	.166	3.93	373,954	.119	71.5	147,427	.047	28.1	2.1	105
	133,000	....	*2,500*	.....	*12-31-1892*	.....	.....	*869,449*	*16,200*	....	*6.53*	*656,020*	....	*75.5*	*254,102*	....	*29.2*	*2.6*	
106	134,000	....	3,500	.....	6-30-1890	.....	.....	578,658	16,200	....	4.32	425,359	....	73.4	156,145	....	26.9	2.2	106
	134,000	....	*3,400*	.....	*6-30-1892*	.....	.....	*730,040*	*18,500*	....	*5.45*	*483,029*	....	*66.1*	*252,775*	....	*34.6*	*2.9*	
107	161,000	....	3,500	.....	6-30-1890	2,927,278	18.2	q 896,685	19,400	.306	5.57	722,934	.247	80.6	185,828	.063	20.7	10.3	107
	161,000	....	3,300	.....	6-30-1892	.....	.....	1068,179	21,800	....	6.65	975,415	....	91.1	112,047	....	10.5	4.9	
108	161,000	....	1,900	.....	6-30-1890	7,099,498	44.1	958,741	11,400	.135	6.00	644,882	.091	67.2	320,486	.045	33.4	6.4	108
	161,000	....	*2,000*	.....	*12-31-1892*	*9,248,831*	*57.5*	*1270,827*	*15,700*	*.137*	*7.89*	*789,450*	*.085*	*62.1*	*481,378*	*.052*	*37.9*	*4.1*	
109	165,000	....	2,800	.....	6-30-1890	3,293,905	19.9	732,426	12,600	.222	4.44	547,421	.166	74.7	180,427	.055	24.6	2.3	109
	165,000	....	*2.700*	.....	*12-31-1892*	.....	.....	*1267,208*	*20,000*	....	*7.70*	*816,633*	....	*66.4*	*460,825*	....	*36.3*	*4.4*	
110	186,000	....	.....	.....	12-31-1890	.....	.....	1136,524	.....	....	6.13	.....	.....	.....	.....	.....	.....	.....	110
	186,000	....	.....	.....	*12-31-1892*	.....	.....	*1352,365*	.....	....	*7.26*	.....	...	.....	.....	....	....	....	
111	217,000	....	4,000	.....	6-30-1890	.....	.....	944,939	17,300	....	4.35	768,213	....	81.4	190,159	....	20.1	9.5	111
	217,000	....	3,600	.....	6-30-1892	.....	.....	1141,641	19,120	....	5.25	1034,275	....	91.2	125,030	....	11.0	5.0	
112	230,000	....	5,400	.....	n 1890	6,772,090	29.0	1329,821	31,000	.196	5.78	1110,609	.164	83.4	284,695	.042	21.4	8.7	112
	230,000	....	.....	.....	n *1892*	.....	.....	i *1606863*	.....	....	*7.00*	.....	...	.....	.....	....	....	....	
p 113	242,000	....	2,200	.....	6-30-1890	9,233,950	38.1	1531,727	13,900	.166	6.32	1109,277	.120	72.6	448,807	.049	29.4	7.2	p 113
	242,000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	....	....	....	
114	254,000	....	5,400	.....	n 1890	r 4,412,339	17.4	1213,067	25,600	.263	4.76	887,499	.190	72.5	331,169	.075	27.4	8.6	114
	254,000	....	4,800	.....	12-31-1892	.....	.....	1399,841	26,300	....	5.51	.....	...	.....	.....	....	....	....	
115	256,000	....	6,100	.....	6-30-1890	.....	.....	765,645	18,100	....	2.99	624,059	....	81.5	141,586	....	18.5	8.3	115
	256,000	....	*4,200*	.....	*6-30-1892*	.....	.....	*1043,546*	*17,200*	....	*4.06*	*754,915*	....	*72.6*	*313,072*	....	*30.1*	*2.8*	
t 116	*273,000*	....	*4,100*	.....	n 1890	.....	.....	*1422,625*	*21,100*	....	*5.18*	*1114,452*	.. .	*78.2*	*415,288*	....	*29.2*	*7.7*	t 116
	273,000	....	.....	.....	l	....	.....	.....	.....	....	.....	.....	...	.....	.....	....	....	....	
117	298,000	....	3,600	.....	6-30-1890	6,440,621	21.6	1255,680	15,100	.196	4.23	921,375	.143	73.1	327,854	.051	26.0	2.2	117
	298,000	....	*2,600*	.....	*12-31-1892*	.....	.....	*2136,657*	*18,800*	....	*7.18*	*1472,653*	....	*68.6*	*714,927*	....	*33.4*	*3.6*	
u 118	*299,000*	....	*4,500*	.....	*6-30-1890*	*11,077,722*	*37.1*	*3985,502*	*60,400*	*.278*	*13.35*	*2225,722*	*.201*	*72.6*	*882,560*	*.080*	*28.6*	*5.3*	u 118
	299,000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	....	...	....	
119	*344,000*	....	*5,600*	.....	n *1890*	.....	.....	*2012,236*	*32,500*	....	*5.84*	*1264,162*	....	*62.7*	*877,827*	....	*43.7*	*5.4*	119
	344,000	....	*3,300*	.....	n *1892*	.....	.....	*2781,238*	*27,000*	....	*8.08*	*1971,091*	....	*70.9*	*970,731*	....	*34.9*	*3.6*	
v 120	373,000	....	4,300	.....	6-30-1890	9,796,964	26.3	1960,397	22,700	.200	5.25	1359,307	.144	71.6	561,693	.059	29.6	5.6	v 120
	373.000	....	.....	.....	l	.....	.....	.....	.....	....	.....	.....	...	.....	.....	....	....	....	
w 121	434,000	....	4,600	.....	6-30-1890	8,675,114	20.0	1839,043	19,600	.212	4.24	1526,713	.176	83.2	342,959	.040	18.6	3.7	w 121
	434,000	....	.....	.....	l	.....	.....	*2365,822*	.....	....	*5.46*	.....	...	.....	.....	....	....	....	
x 122	452,000	....	4,400	.....	6-30-1890	.....	.....	2645,736	25,700	....	5.86	1983,617	....	74.7	721,860	....	27.2	6.4	x 122
	452,000	....	.....	.....	*12-31-1893*	.....	.....	*4784,059*	y	....	*10.58*	.....	...	.....	.....	....	....	....	

i. Does not include earnings of one road which probably approximated $35,000. l. Latest returns. m. This report does not include about 15 miles of miscellaneous and newly constructed tracks. p. This report does not include one insignificant horse road. q. One cable road included in this report commenced operation Jan. 1, 1890, and operating statistics are for six months only. r. The car mileage of one road is not given and its operating returns are subtracted from the totals before figuring returns per car mile. t. This report does not include one 12 mile horse railway which was in the process of conversion to the cable system in 1890, and which earned about $250,000 during their financial year of 1890. u. One road reports capital liabilities, mileage and gross income ($895,000) only, but calculations are carefully made with due allowance therefor, and the resulting statistics are "true." v. One road operating partly by horses and partly by cable does not return its horse railway statistics of operation. w. This report does not include three small suburban roads and one horse railway operating twenty-two cars. x. This report does not include one 10 mile road commencing cable operation in 1890, and with capital liabilities of $1,300,000. y. Based on passengers carried, at an average rate of $.05 each. This figure is probably slightly higher than the true passenger income. z. Approximate.

and cable roads parallel each other about two blocks apart, and the electric lines are so much more popular than the cable that there is serious thought of converting the latter to electricity.

Case No. 120 is a highly developed system giving excellent service to an important Eastern city. The motive power in 1890 was chiefly animal, although there were several cable lines on certain heavy grades within

the city. The car service (26 miles per capita), was reasonably large and brought about a passenger income of $22,700 per mile of street, $.20 per car mile and $5.25 per capita—results which compared very well with those of the other cities of the class for that year. The net income was equivalent to 5.6 per cent. on capital liabilities of $68,000 per mile of track. Although complete figures for 1892 are not available, there is no question that the passenger income at present exceeds $7.00 per capita per annum.

Case No. 106 serves one of the smaller cities of the class—bright, enterprising and prosperous, with important manufacturing interests. Its passenger income in 1890 was $4.32 per capita, which has been since increased, by improvements in service, to $6.38 (1893). The present excellent management is responsible for a steady reduction of the percentage of operating expenses to 66 in 1892, and to 60 in 1893, the net income being now equal to 4.1 per cent. on excessive capital liabilities of $100,000 per mile of track.

Cases No. 111 and 114 serve population centers of about the same size, with important suburbs. The similarity between the statements is quite marked, except in the matter of capitalization, which is in Case No. 111 but half that of Case No. 114. The cause of the great increase in the percentage of operating expenses to passenger income shown in Case No. 111 is not known to me.

Discussion of ten systems showing a passenger income of from $6.00 to $8.00 per capita per annum.

These ten systems represent the average earning power of the class as developed up to the present time, although the fact that nearly all of the systems are not yet fully converted to the more modern systems of motive power points to larger earnings per capita in the future when the change shall be complete.

With the exception of Cases No. 102 and 107, which are exceptional, the track mileage of the systems of this group ranges from about 100 to 150 and the street (or road) mileage, from 45 to 110. The development of Cases Nos. 102 and 107 has been retarded by serious difficulties with the city regarding franchises, and both cities are among the smallest of the class, the principal city of Case No. 107 being less than 140,000.

Excluding Case No. 107, which has no funded debt, and No. 117, which is a combination of Cases No. 105 and 109, the funded debt of the remaining eight systems ranges from $7,000 to $68,600 per mile of track, and the total capital liabilities from $28,800 (1891) to $175,100 per mile of track, the figure last named being for a city which is served chiefly by cable and electric systems. Case No. 107 had no funded debt in either 1891 or 1892, but is now burdened with $8,000,000 of 5 per cent. bonds, a load which may be found difficult to bear. Case No. 112 also shows reasonable capital liabilities per mile of track ($44,900) in 1890. The capital liabilities of Cases No. 102 and 113 will be greatly increased within the next two years. Larger capital liabilities per mile of track than have been found in the classes hitherto discussed are to be expected here for several reasons. In the first place, the cost of construction and reconstruction is greater, since the burdens imposed by the city in the matter of paving, together with the cost of labor, etc., are greater than in the smaller cities. Again, the magnitude and earning power of the properties offer greater temptation to overcapitalization of costs, and these temptations have in few instances been resisted.

The passenger income reported ranges from about $14,000 to $31,000 per mile of road and from $.14 to $.22 per car mile, Case No. 107 showing $.31 in 1890.

The operating expenses range from $.085 to $.166 per car mile (Case No. 107 showing $.247); and the percentage to passenger income ranges from 62.1 to 75.5 for those systems which are equipped chiefly by electricity and cable, from 73 to 83 for three roads operating chiefly by horses, while Case No. 107 shows 91 per cent. in 1892 as against 81 in 1890. As before stated, the cause of the sudden drop in the net earnings shown in this statement is not known to me, but is probably due to exceptional causes which will not obtain in 1893 and thereafter.

The net income of all the cases is evidently sufficient to show a considerable margin over the fixed charges, but not enough as yet, except in three instances, to return a satisfactory dividend on the capital stock. It is probable that with the more complete development of the systems of this group will come a large increase in both gross and net income and it is to be hoped that this increase will be sufficient to justify the promoters of the various enterprises in the heavy overcapitalization of costs for which they are responsible.

Discussion of four systems showing a passenger income exceeding $10.00 per capita per annum.

These four systems represent the highest gross and net earning power of the class. All are cities west of the Mississippi River. In all the cable system was introduced prior to 1888, and electricity in its early stage of development. Their street railway systems are to-day, with but few exceptions, the most complete and perfect to be found among the cities of the world. Their people are liberal, careless of the little economies, and have always been "free riders."

Case No. 122 has the largest track and road mileage of the group. Its capital liabilities are enormous, being $139,500 per mile of track, of which the funded debt is nearly $57,000. Its large horse railway mileage in 1890 has almost entirely disappeared, and the passenger income for 1892 is nearly double that of 1890. No operating expenses are obtainable for 1892, but the percentage is probably between 60 and 65, which would leave a net income of perhaps $1,600,000, equivalent to somewhat less than 5 per cent. upon the capital liabilities. The industries of the city served by this system are so extensive and varied that the street railways are likely to be less affected by financial depressions than is the case with the others of the group; and to this extent this system is "safer" as an investment than at least two of the other three.

Case No. 103 is an excellent and highly valuable property, whose permanent value depends, however, rather too much on the continuing success of a few special industries. Nevertheless, the city is well located to serve as the capital of an extensive territorial area, and it is probable that its manufacturing and commercial industries will increase in extent and variety in the future. In this city, as in others previously noted, the introduction of electric lines has so seriously injured cable lines serving the same districts that much of the cable mileage has been converted to electricity within the last two years—of course, at an enormous loss of invested capital.

Case No. 104 showed remarkable results in 1890. The cable system of this city was then, and perhaps still is, the most perfect in the country. The city was the center of business and manufacturing activity and real estate was "booming" to an extent that seemed to put wealth within the reach of all. The street railways shared the general prosperity, and the gross and net receipts seemed to ensure handsome returns upon the very large capitalization. At the present time, however, this city is suffering from the effects of a collapse in values which, it is to be hoped, is but temporary, and the street railway properties are unable to more than pay fixed charges.

Case No. 118 deals with the largest gross and net income so far discussed. This was the first city in the world to adopt the cable system as a motive power, and its cable mileage is now very large. Its passenger income was, in 1890, equivalent to the so far unprecedentedly large figure of over $60,000 per mile of road, to nearly $.28 per car mile, and to $13.35 per capita. The operating expenses were larger than is usually the case with the cable system, owing chiefly to the heavy grades encountered in the city, and perhaps also to the faults of the early apparatus, some of which is still used. The net income was equivalent to a return of 5.3 per cent. on capital liabilities of $157,000 per mile of track—the largest capitalization of the class.

Discussion of six systems operating chiefly by horses in 1890, and by electricity and the cable system in 1892.

One of these systems was in operation entirely by horses in 1890, two were in operation almost wholly by

horses with but small electric mileage, in one about 80 per cent. of the mileage was animal and the balance steam, and in two somewhat more than 50 per cent. of the mileage was animal. In 1892 the entire system of three cities was in operation by electricity and the cable, two cities had equipped about three-fourths of their mileage by electricity and the cable, and one was operating by horses and electricity in about equal proportions. The total track mileage was increased from 512 (395 horse, 54 electric, 40 cable and 23 miscellaneous) in 1890, to 694 (160 horse, 500 electric and 34 cable) in 1892. The funded debt in 1890 was $28,500 per mile of track, and in 1892, $48,500; while the total capital liabilities, which were $79,800 in 1890, were $113,500 in 1892. All these figures represent heavy overcapitalization of costs and of the present value of tangible assets, and there is, in several instances, more or less serious overcapitalization of earning power, although the fixed charges do not seem to be yet in danger.

The passenger income of these five roads in 1890 was $5,570,960, equivalent to $18,100 per mile of road and $4.68 per capita. The passenger income in 1892 was $7,962,308, equivalent to $20,000 per mile of road and $6.69 per capita, an increase of 43 per cent.

The operating expenses in 1890 were 69.7 per cent. of the passenger income, and in 1892, 68.7 per cent., the reduction being unimportant. The net income in 1890 was $1,823,898, and in 1892, $2,732,883, an increase of 50 per cent. The return on the capital liabilities was 4.4 per cent. in 1890, and 3.5 per cent. in 1892. The net income was also equivalent to 12.5 per cent. upon the funded debt in 1890 and 8.1 per cent. in 1892.

WHAT ARE "OPERATING EXPENSES"?

Before drawing the usual general conclusions, it may be well at this point to discuss certain features of "operating expenses," which are not always borne in mind by investors, and which will serve to explain the somewhat conservative character of the criticisms and conclusions which have been arrived at in these papers.

The operating expenses of steam or street railroads are usually separated into four general divisions, "General Expenses," "Transportation," "Maintenance of Way and Structures" and "Maintenance of Equipment." The first two divisions represent direct expenditures and are easily understood. The last two—which, for present purposes, I shall consider as consolidated into one general "Maintenance" account—represent not only the direct expenditures for repairs, which are always, of course, charged up against the business of the year in which they are made, but also a more or less uncertain and variable allowance for "depreciation" of plant.

The physical condition of electric railway road and equipment, as we find it to-day, is, in general, good. The properties are, for the most part, reorganized and reconstructed horse railways, with important and recently constructed extensions. Both roadbed and equipment are therefore comparatively new and—except where mistakes of construction have been made—the serious effects of depreciation have not yet come to light. The electric railway industry being hardly six years old, and the equipment of a majority of the electric railways of the country being less than three years old, it is probable that the direct expenditures for repairs ("wear and tear") during the past three years, is somewhat less than will be the average cost of such repairs for a period of ten, fifteen or twenty years. True, the defects of the early apparatus and the inexperience which has led to imperfect construction of track, have had a serious effect on the repair account, and roads which have suffered greatly from these troubles are now effecting such economies and gradually introducing new apparatus to such an extent as perhaps to reduce, rather than increase, their repair accounts. As a general rule, however, the repair account for the first few years of electric operation is not a fair criterion for judgment. It is probable, therefore, that unless economies are effected in other directions (which can easily be done by a large majority of American street railways) the "operating expenses" of many and perhaps most of the roads will gradually increase from year to year until an equilibrium is reached, as has been the case with steam railroads.

Now in addition to the ordinary "repairs" (or "wear and tear") of street railway roadbed and apparatus, we ought, with new roads at least, to determine upon some method of annually charging off an allowance for "depreciation" so that we may be certain that our so called "net earnings" are properly applicable to returns upon the investment, and are not, in part at least, deferred operating expenses. In other words, there will come a time—ten, fifteen, perhaps twenty years hence—when it will be impossible to patch up and further repair cars, motors, track, etc. They must be *replaced*—money must be found to replace them—and the problem of finding this money may be serious indeed.

Perhaps the best method of anticipating these necessary expenditures for renewals is to establish, early in the life of the reconstructed properties, a "Depreciation (or Reserve) Fund" into which shall be passed every year, out of the apparent net earnings, an amount which, accumulating at compound interest, will eventually reach a sum sufficient to replace the different sections of the plant at the end of their estimated life. For example, we may estimate that our motors, which cost us to-day $100,000, will last for ten years without renewals. The sum of $7,153 passed annually to the Reserve Account for ten years will, at 5 per cent. interest, amount to $90,000 at the end of that period, and this sum, added to an estimated salvage of $10,000 on the old motors, will repurchase new motors at that time. In the same way, a calculation may be made for car bodies and trucks, for roadbed, power station apparatus, etc. All sums passed to the reserve account should of course be charged to operating expenses. The funds in the reserve account may be used to purchase in open market the Company's bonds or other securities which will yield the required rate of interest, and the sale of these securities, when necessary, will provide the funds for renewals.

Now it may be urged that steam railroad properties have not found it necessary as a rule to establish such reserve funds. The answer to this is that the most conservatively managed railroad corporations, even in this country, have special funds under one name or another for just such purposes, and that a much larger proportion of foreign railroads make a special point of so providing for renewals or for other similar contingencies. At the same time it is true that the necessity for such a fund is not so great with old established properties which have been in operation long enough to have ascertained their average renewals during a period of years as it is with such properties as are now under consideration, where we are working largely in the dark.

It is clear therefore that since the "operating expenses" of many, and perhaps most of the street railway statements discussed in these chapters do not include an allowance for "depreciation" beyond the direct expenditures for "wear and tear," the resulting "net earnings" are too great and, if paid out in dividends, may imperil the permanent solvency of such companies as are "running close to the wind."

In the light of the above discussion it is now possible to draw the following

GENERAL CONCLUSIONS.

1. The magnitude of the interests involved in handling the street railway properties of this class will insure the continued employment of the best managing ability obtainable, and the interests of the security holders will be, in this respect, carefully and thoroughly protected.

2. Animal motive power will soon disappear entirely in the cities of this class and will be replaced chiefly by the overhead electric system, unless further improvements in the science of transportation be made. Existing cable lines will continue in use on streets where the density of traffic is very great, but it is possible that little or no additional cable mileage will be built, on account of the large initial cost of construction, as compared with that of the electric system.

3. When the process of conversion to improved systems of motive powers shall have been completed in the cities of this class, a few exceptional street railway systems will be able to earn from $10 to $15 per capita by the cultivation of traffic in every possible manner; nearly all of the remainder will develop an earning power of from $7.50 to $10 per capita; and few will fall below $7.50 per capita.

4. Many of these properties have been slow in adopting new rapid transit methods and are fortunate in profiting by the experience of those earlier in the field. The electric railways may hope to operate, therefore, at from 65 to 70 per cent. of the passenger income, and the cable railways at a somewhat smaller ratio, owing, not so much to a lower cost of operation per car mile, as to a larger passenger income per car mile.

5. A net earning power of from $2.75 to $3.50 per capita, with occasional figures slightly larger than these may be expected.

6. Such net earnings are equivalent to a return of from 15 to 25 per cent. on the actual net cost of duplicating the tangible assets of the railway systems under consideration. The cost of track construction and paving in the crowded streets of these cities ranges from $15,000 to $30,000 per mile of track, according to the amount of paving required by the city. The investment required for equipment is proportionately larger on account of the greater number of cars per mile of track necessary for properly handling the traffic, and the actual cash cost of building and equipping new electric railway systems in these cities will rarely be less than $50,000 per mile of track and may easily be somewhat more. The cost of building and equipping cable roads varies within wide limits on account of interference with water and gas pipes, etc., but is rarely less than $100,000 per mile of track. Bearing in mind, then, the statements previously made that these systems are operating from 100 to 150 miles of track, it is seen that, while capital liabilities of from $15 to $25 per capita are not unreasonable, larger amounts may well be regarded with suspicion.

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 100,000 TO 500,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
MILES OF TRACK.				
No. of miles operated	1503.0	722.6	764.0	2176.9
FUNDED DEBT PER MILE OF TRACK.				
No. of miles not reporting	.....	.....	.....	314.1
" " having no funded debt	255.0	.....	141.5	.....
" " " an indebtedness less than $20,000 per mile	584.2	128.4	229.1	235.8
" " " " " from $20,000 to $30,000 "	343.8	.....	.....	.....
" " " " " " 30,000 to 40,000 "	228.4	.....	.....	195.6
" " " " " " 40,000 to 50,000 "	112.5	233.1	81.3	1210.5
" " " " " " 50,000 to 69,000 "	88.4	251.8	.....	533.0
CAPITAL LIABILITIES PER MILE OF TRACK.				
No. of miles not reporting	.....	.....	.....	314.1
" " capitalized at less than $30,000 per mile	329.5	.....	80.0	.....
" " " at from $30,000 to $40,000 "	59.3	.....	290.6	.....
" " " " 40,000 " 50,000 "	222.4	128.4	.....	.....
" " " " 50,000 " 75,000 "	543 7	120.5	81.3	235.8
" " " " 75,000 " 100 000 "	256.5	.....	.....	885.3
" " " " 100,000 " 150,000 "	200.9	260.0	.....	665.9
" " " over 150,000	.....	104.4	.....	387.9
POPULATION SERVED PER MILE OF STREET.				
No. of roads not reporting	1	.....	2	9
" " serving less than 2,000 inhabit. per mile	1	1	.....	.....
" " " from 2,000 to 3,000 " "	3	1	.....	4
" " " " 3,000 " 4,000 " "	3	.....	2	2
" " " " 4,000 " 5,000 " "	4	2	1	1
" " " " 5,000 " 6,000 " "	3	1	.....	.....
" " " over 5,000 " "	1	.....	.....	.....
CAR MILEAGE PER CAPITA.				
No. of roads not reporting	5	3	5	15
" " giving a service of less than 20 car miles per capita	3	.....	.....	.....
" " " " of from 20 to 30 " " "	5	.....	.....	.....
" " " " " 30 " 40 " " "	2	1	.....	.....
" " " " " 40 " 50 " " "	1	.....	.....	.....
" " " " over 50 " " "	.....	1	.....	1

AMERICAN STREET RAILWAY SYSTEMS SERVING FROM 100,000 TO 500,000 POPULATION.	1890. Horse.	1890. E. C. M.	1892. Horse.	1892. E. C. M.
PASSENGER INCOME.				
No of roads not reporting	.....	.....	1	5
" " earning less than $500,000 gross per annum	1	.....	.....	.....
" " " from $500,000 to $750,000 gross per annum	3	.....	1	1
" " " " 750,000 " 1,000,000 " "	4	.....	.....	1
" " " " 1,000,000 " 1,250,000 " "	2	1	2	1
" " " " 1,250,000 " 1,500,000 " "	2	1	1	3
" " " " 1,500 000 " 2,000,000 " "	3	1	.....	1
" " " over 2,000,000 " "	1	2	.....	4
PASSENGER INCOME PER MILE OF STREET.				
No. of roads not reporting	1	.....	2	9
" " earning less than $15,000 per mile	4	.....	.....	.....
" " " from $15,000 to $20,000 per mile	6	1	1	5
" " " " 20,000 " 25,000 "	2	1	1	1
" " " " 25,000 " 30,000 "	2	.....	1	1
" " " over 30,000 "	1	3	.....	.....
PASSENGER INCOME PER CAR MILE.				
No. of roads not reporting	5	3	5	15
" " earning less than 15 cents per car mile	2	.....	.....	1
" " " from 15 to 20 " " "	4	1	.....	.....
" " " " 20 " 25 " " "	3	.....	.....	.....
" " " " 25 " 30 " " "	1	1	.....	.....
" " " over 30 " " "	1	.....	.....	.....
PASSENGER INCOME PER CAPITA.				
No. of roads not reporting	.....	.....	1	5
" " earning less than $4.00 per capita	2	.....	.....	.....
" " " from $4 00 to $5.00 per capita	7	.....	.....	1
" " " " 5.00 " 6.00 "	4	2	2	2
" " " " 6.00 " 7.00 "	3	.....	2	1
" " " " 7.00 " 8.00 "	.....	.....	.....	5
" " " " 8.00 " 9.00 "	.....	.....	.....	1
" " " " 9 00 " 10.00 "	.....	.....	.....	.....
" " " over 10.00 "	.....	3	.....	1
OPERATING EXPENSES PER CAR MILE.				
No. of roads not reporting	5	3	5	15
" " operating at less than 10 cents per car mile	1	.....	.....	1
" " " from 10 to 15 " "	5	1	.....	.....
" " " " 15 " 20 " "	4	.....	.....	.....
" " " over 20 " "	1	1	.....	.....
PERCENTAGE OF OPERATING EXPENSES.				
No. of roads not reporting	1	.....	3	9
" " operating at less than 65 % of pass. income	.....	1	.....	1
" " " from 65 to 70 % " "	1	.....	.....	3
" " " " 70 " 75 % " "	8	3	.....	2
" " " " 75 " 80 % " "	1	1	.....	1
" " " " 80 " 85 % " "	5	.....	.....	.....
" " " " 85 " 90 % " "	.....	.....	.....	.....
" " " over 90 % " "	.....	.....	2	.....
NET EARNINGS.				
No. of roads not reporting	1	.....	3	9
" " earning less than $100,000 net	.....	.....	.....	.....
" " " from $100,000 to $200,000 net	7	.....	2	.....
" " " " 200,000 " 300,000 "	1	.....	.....	2
" " " " 300,000 " 400,000 "	4	1	.....	1
" " " " 400,000 " 500,000 "	1	2	.....	2
" " " " 500,000 " 750,000 "	2	.....	.....	1
" " " " 750,000 " 900,000 "	.....	2	.....	.....
" " " over 900,000 "	.....	.....	.....	1
PERCENTAGE OF NET EARNINGS TO CAPITAL LIABILITIES.				
No. of roads not reporting	1	.....	3	9
" " earning less than 2½ % on capital liabilities.	4	.....	.....	.....
" " " from 2½ to 5 % " "	1	2	1	7
" " " " 5 " 7½ % " "	4	2	1	.....
" " " " 7½ " 10 % " "	5	1	.....	.....
" " " over 10 % " "	1	.....	.....	.....

The Trolley Wire in a New Role.

The value of the trolley wire as a weapon was demonstrated recently in a dispute which occurred in Brooklyn, over the right of one of the street railway companies of that city to string wires over the Grand Street Bridge crossing Newtown Creek. The railway employes arrived on the ground early in the day and commenced their work. Just before reaching the bridge, one of the workmen connected a live wire with a loose coil lying in the bottom of the wagon.

Deputy Sheriff Meyer tried to stop the work when the wagon reached the bridge, but one of the street railway men seized the end of the live wire in his rubber encased hands and jumped down from the wagon. There was an immediate retreat on the part of the deputies, and as the man with the wire approached nearer, the retreat was turned into a rout. No further interference was made on the part of the sheriff, and the bridge is now equipped with overhead wires.

Receipts and Expenses Per Car Mile.

The following tabulated statement shows the receipts and operating expenses, in cents, per car mile on seven street railway systems which are operated by electric power in the same number of cities, and by the same syndicate, the books of each being kept in about the same manner.

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
Receipts	17.03	16.91	20.36	19.67	18.45	41.00	25.45
Expenses.							
Maintenance of way	.79	.36	.83	.27	.57	2.83	1.23
Maintenance of equipment	.68	1.67	1.21	1.59	2.24	1.51	2.08
Transportation	4.88	4.88	5.56	6.52	5.38	10.98	7.60
Power, including coal, oil and salaries of engineers and firemen	.91	1.33	1.12	1.50	2.18	2.59	2.45
General expenses	1.67	1.32	1.58	2.20	2.13	1.91	2.40
Total expenses	8.93	9.56	10.30	12.08	12.50	19.82	15.76
Net earnings per car mile	8.10	7.35	10.06	7.59	5.95	21.18	9.69
Per cent. of expenses to receipts	52	56	50	60	67	48	61

In the case of No. 6, large eight-wheel cars are employed to a considerable extent.

The price of coal per ton, delivered at the station, in the cases above quoted is as follows:

No. 1	$ .90	No. 4	$2.10
" 2	1.25	" 5	2.75
" 3	1.80	" 6	3.30
No. 7	$3.77		

Percentages of Operation and Maintenance on a Southern Street Railway for 1893.

We are permitted through the courtesy of the management of a street railway in a Southern city to present the following detailed statement of expenses for 1893. The line is operated by electric power mostly.

OPERATING EXPENSES.

		Percentage of gross earnings.
Cost of operation of cars, including salaries of conductors, motormen, car expenses, etc.	$48,385.53	or 24.55
Operation of engines, boilers and dynamos, including salaries of engineers and firemen, coal, oil, etc.	29,514.89	" 14.98
Insurance, taxes and damages	11,438.00	" 5.81
Attractions, band, and advertising same	6,901.58	" 3.46
Office expenses, including printing and stationery	835.03	" 0.42
Feed, shoeing, and cars of live stock	1 839.11	" 0.93
Track expenses, including oil, labor, etc.	1.571.81	" 0.80
Fuel and light	1,850.37	" 0.94
Miscellaneous expenses, gratuities and rents	2,278.80	" 1.15
Salaries of officers and clerks	6,270.10	" 3.19
Total	$110,885.32	" 56.23

MAINTENANCE OF PROPERTY.

		Percentage of gross earnings.
Cars and motors	$7,773.88	or 3.94
Buildings	88.69	" 0.05
Power station, including engines, boilers, dynamos, etc	3,543.80	" 1.79
Track, including overhead line	4,630.95	" 2.35
Miscellaneous repairs	1,008.38	" 0.51
Total	$17,045.70	" 8.64

Operating expenses	56.23 per cent. of gross earnings.
Maintenance of property	8.64 per cent. of gross earnings.
Grand total	64.87 per cent of gross earnings.
Total miles run	1,136,856 $\frac{8}{10}$
Gross earnings per car mile	$0.17.35
Gross expenses per car mile	$0.11.26
Net earnings per car mile	$0. 6.09
Total number of passengers carried	3,994,123
Expense per Passenger carried	$0.03. $\frac{1}{4}$
Net earnings per passenger carried	$0.01. $\frac{3}{4}$

John Walker Goes to Chicago.

John Walker, founder and, until February 12 last, vice-president and general manager of the Walker Manufacturing Company, of Cleveland, O., has been appointed general manager of the Fraser & Chalmers Company, of Chicago and London, extensive manufacturers of engines, mining machinery, etc. Mr. Walker has licensed the Pennsylvania Iron Works Company, of Philadelphia, Pa., to manufacture under his cable patents for the Atlantic States, and the corporation of Fraser & Chalmers, of Chicago, for the Middle States and Pacific States with the exception of California, Oregon and Nevada. The licensees of these states are the Union Works Company, of San Francisco, Cal. Fraser & Chalmers, Ltd., of London, will manufacture under the same patents for Great Britain and all the British colonies and possessions. Mr. Walker has served notice on the Walker Company to refrain from further sale of the patents in question, some nineteen in number, and including differential drums, struts, U frames, cable friction clutches, etc. Mr. Walker is a prominent member of a number of the leading engineering societies and clubs in the country. Chicago is to be congratuated upon having secured him as a resident.

Electric Railroad Construction in Baltimore.

Baltimore is to-day one of the most active electric railroad centers in the country. During the last two or three years about $15,000,000 have been invested in the construction of electric and cable lines, and about eighty miles of additional road are now under construction or will be built this summer. Perhaps no other city in the United States can show such a record of activity and so many lines built and projected as Baltimore.

A list of the new roads proposed or under construction in and around Baltimore, recently appeared in the *Manufacturers' Record* of that city. It included the following:

The Baltimore, Middle River & Sparrow's Point Company intends building an electric road estimated at fifteen miles in length. George R. Willis and F. W. Trimble, of Baltimore, and several Philadelphia people, it is understood, are interested.

The Canton, Sparrow's Point & North Point Railway Company intends building an electric road from or near the terminus of the Central Railway in the city to North Point, at the mouth of the Patapsco River. The distance is ten miles. Pres. F. W. Wood, of the Maryland Steel Company, and T. Wallis Blackistone, of Baltimore, are among the members of this company.

The Baltimore, East Baltimore & North Point Company holds a franchise, which was renewed March 17, to build an electric line between the points named. It is learned that about five miles only will be built this spring, from the city limits to a resort called Keller's Pavilion. O. Hammond, of Baltimore, is associated with this enterprise.

The City & Suburban Railway Company is about to extend its Highlandtown branch a distance of two miles. Work will be completed by June 1.

The City Passenger Railway Company will also extend its Canton division one mile.

The City & Suburban Railway Company will also rebuild its Catonsville division, seven miles in length, for electric motors.

The Edmondson Avenue, Catonsville & Ellicott's Mills Company, which is a part of the company recently formed to construct an electric road from Baltimore to Washington, it is understood, contemplates building nine miles of its road west of Baltimore during the summer. George Yakel and Alexander Brown, of Baltimore, are interested.

The Baltimore Traction Company, has obtained permission to connect its Fremont and Ridgely Street lines and extend them to the southwestern city limits, with a possible terminus at Westport.

Work has commenced on the Walbrook, Gwynnoak & Powhatan, an electric road four miles long, extending from the terminus of the Walbrook division of the Lake Roland Elevated Railway system to Powhatan. The road is to be completed by June 1. F. H. Calloway is secretary of the company. Smith & Schwarz, of Baltimore, are also interested.

The Baltimore Traction Company is completing an extension of one mile to its Arlington division.

The Pikesville, Reisterstown & Emory Grove Company has been formed to build from the terminus of the Pikesville branch of the Baltimore Traction system, a distance of ten miles. Geo. R. Webb and John L. Cowen, of Baltimore, are prime movers in the project.

The City Passenger Railway Company is about to extend its Hall's Springs division to Lauraville, five miles.

All of these projects are backed by responsible parties, who are actually preparing to complete them. They embrace, all told, about eighty miles of electric road.

In addition, two companies have been formed to build electric roads from Baltimore to Washington, the routes being thirty-eight and forty-two miles long.

A BILL has been introduced in the Maryland legislature to charter the Maryland & Columbia Railway Company. The bill gives the company extended privileges, permitting it to construct any kind of a railway—steam, electric or a canal between the District of Columbia and the Pennsylvania line, through the counties of Prince George's, Montgomery, Howard, Baltimore, Carroll, Frederick, Harford and Cecil. The scheme is said to be backed by Senators Stephen B. Elkins, A. P. Gorman, Mathew S. Quay, Henry G. Davis and T. Edward Hambleton.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

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Havemeyer Building, 26 Cortlandt St., New York.

We Have Been Very Much Encouraged by the hearty support which our Financial Supplement has received. The plan of an authoritative source of information concerning street railway properties seems to have met with popular favor, and the general sentiment is clearly that a publication of this kind will prove of great value to both street railway companies and investors. The returns sent us show in many cases very interesting results, and the large number of excellent records made prove that street railway securities present excellent advantages to investors. When these become better known the market for such securities will become broadened, and in consequence there will be a decided increase in the amount of general street railway investments by the general public.

The Agitation of the Question of Electrolytic Action as an agent in the deterioration of water and gas pipes and metallic cable coverings is working both to the advantage and disadvantage of electric street railway companies. It is of advantage so far as it induces the employment of an adequate return conductor, for this results in the saving of power, but when it leads to the institution of claims for damage on the part of the owners of these substructures it causes direct loss and militates against the present method of electric traction. That water and gas pipes deteriorate rapidly in certain cities and in certain soils is admitted, but that any great damage has resulted in any particular case by the action set up by the street railway current is a question that may require very thorough investigation to settle. Pipes deteriorate in cities where there are no electric railways, and were also known to fail from corrosion in many places before the advent of electric railways. Time and the character of the soil are features in every case that must be considered in studying the cause of failure, and in many cases these features are probably more responsible for pipe deterioration than the current. The danger is not one-half so great as the alarm might lead people to suppose.

Metropolitan Rapid Transit as embodied in the New York Chamber of Commerce Bill had a long fight in the New York State Legislature, and at one time it seemed as if its life were greatly in jeopardy. On April 26, however, a few days before the day set for the close of the session, it passed the Senate and Assembly, and was forwarded to the Governor for signature. The bill as amended provides for the appointment of a non-partisan board of railroad commissioners, consisting of John H. Starin, William Steinway, Seth Low, John Claflin and Alexander E. Orr, and permits the people of the city to vote at the next election in November on the question, "Shall the city of New York itself construct a rapid transit railroad?" The introduction of the referendum clause, it is said, makes the bill unconstitutional. But whether this is so or not, it is hard to see any good reason for submitting a financial question of this moment to popular ballot, since the number of those voters who have practically nothing at stake vastly exceeds those directly affected by the result. It is to be hoped that the evils of political jobbery, so closely associated in the popular mind with large undertakings under municipal control, will not be allowed to enter into this affair. Fortunately the commissioners named possess the confidence of the public and can be relied upon to prevent, so far as lies in their power, any abuses and favoritism in a work of this character. Should the bill pass and receive the Governor's sanction, all action, of course, would have to be postponed until the popular vote on the question shall be taken, which will not be until next November. After that there must necessarily be another delay to complete organization, drawing up of plans, etc., so that it seems hardly possible that any active work will be begun on a rapid transit system in New York for two years yet.

The Long Distance Transmission of Power by electrical means is something new in street railway practice. Electric railway engineers are familiar, in their daily work, with the transmission of railway currents for distances up to six miles from the power station, and, in many instances, even farther away from the station than this. But until last month, when the Norwich-Taftville three-phase plant, described elsewhere in this issue, was put into operation, there were no special plants in this country for the long distance transmission of power for street railway uses. Although this branch of electrical research has, during the past decade, received a fair share of attention from electricians of the highest rank, little has been done in the line of practical construction. It was freely predicted by prominent engineers, five years ago, that in 1894 immense strides would have been made in utilizing a large amount of the horse power then, as now, running to waste in many rivers which flow near manufacturing districts. But these predictions have not been verified, though, it is true, a few plants have been installed in mining districts where fuel is expensive, and cheap and practically inexhaustible water powers are close at hand. The street railways are increasing consumers of power, and if any methods are to be developed to secure this at a lower rate than at present, the solution of the

problem possesses a vital interest for them. All engineers are looking forward with great interest to the results to be secured at Niagara. The advantages and defects, if such exist, of the long distance transmission of power can be studied in that plant on a large scale, and the success which will undoubtedly be attained at Niagara will be an encouragement to develop the powers at other points. In the meantime we must extend congratulations to the little plant at Norwich and Taftville upon being the first to enter the street railway field.

Excellent Records in Operating Expenses per Car Mile can often be made by skillful book-keeping, and in comparing the financial reports of street railway companies a knowledge of the system of accounting employed is necessary to a full understanding of the results secured. The operation of roads by electric power is of such late date that there are many expenses which experience has not yet shown us how to classify. Most roads are at present following individual elaborations of old horse car methods, which themselves were not more systematic than the needs of a relatively smaller business required. Fortunately street railway accountants are not obliged to work unaided in this field, for the classification of transportation accounts has been carefully studied by the steam railroad companies. One important element in systematizing the accounts of these roads has been the Interstate Commerce Commission. This commission, in prescribing the form for reports to it from railroad companies, adopted the general theory of classification decided upon at the Convention of State Railroad Commissioners at Saratoga, June, 1879. According to its latest report on classification just issued, this commission now recognizes four general divisions; maintenance of way and structures, maintenance of equipment, conducting transportation, and general expenses, these heads being altogether divided into fifty-three sub-accounts. Although the system of this commission has been frequently revised in the past, the commissioners feel that they have now evolved such a sufficiently complete system, that in their report just issued (to take effect July 1, 1894) they announce that there is no reason to expect changes in their standard of accounts for a considerable number of years. Another most important element in systematizing and simplifying this department of operation has been the Association of American Railway Accounting Officers, which includes among its members most of the auditors and many of the comptrollers and chief clerks of the principal railway lines. Much of the work accomplished by this association is equally pertinent to street railway affairs, and of great value from the fact that the ground covered by this association will not have to be gone over again by street railway accountants.

The Rights of the Bondholders of a company under reorganization have recently been clearly set forth by Messrs. Evarts, Choate & Beaman, of New York, in an opinion expressed by them on the rights of the holders of the second consolidated mortgage bonds of the Erie Railroad. The managers of the reorganization scheme for this railroad some time ago decided to issue a new series of consolidated bonds, and owners of outstanding prior bonds, according to the plan proposed were invited to deposit them, and receive new securities therefor. This is the common method of reorganizing companies, and to be successful, must be acquiesced in by the holders of outstanding bonds, which are prior liens on the property. Should any such holder object to the exchange, however, there seems to be no legal method of compelling acquiescence. In other words, the rights under any mortgage apply just as completely to the holder of a single bond as to the holders of the rest of the issue, and such person cannot be deprived of his rights without his consent, even though the success of the reorganization depends on the consent of all the bondholders to agree. In the case of most street railway companies, the value of the bonds depends principally on the income of the company, and not on the real estate or other property owned. For this reason, a common method of compelling the dissenting minority of bondholders to co-operate in a reorganization is to tire them out by ceasing to pay interest on the bonds for so long a time that they will come into the plan of reorganization. Of course, if any considerable number of bondholders should continue to refuse their assent to the conversion of their property, the purposes of the reorganization are defeated and the scheme will fall through. Commercial reasons, therefore, should dictate compliance with the conditions, and if the terms are fair the reorganization is generally successful. At the same time, the fact remains that by holding out persistently, an obstinate bondholder can sometimes secure much better terms than the majority, by compelling the latter to buy him out, or, as in the case with a number of bondholders in the reorganization of the Central Railroad, of New Jersey in 1887, can have their securities considered as part of the new bonded indebtedness by the reorganizing committee.

The Chronic Agitation of Rapid Transit, which has gone on for many years in the Massachusetts General Court, has continued with vigor during the present term of the Legislature. At the bottom of the whole discussion are the geographical features of the situation. In most cities there is a district containing the great retail stores, the hotels, depots, theatres, etc., that is the natural focus of street railway lines and riding. In Boston, Beacon Hill and the Common, on one side, and the Charles River and the Harbor, on the other, so reduce the general business area that this particular district is restricted to the narrowest limits. Its length is only one and a quarter miles, its maximum width is only 1,500 ft. and the minimum width is only 700 ft. The broadest streets are only sixty feet in width, and the narrowest are only ten. Within this section railway tracks are laid on forty-three streets. All told, there are sixteen miles of single track. No wonder there is congestion. The West End Company has done as much as any surface road can do to meet and overcome the difficulties in the case. Its equipment is all that money, expended by liberal intelligence, can buy, and its service all that experienced management can give. Unfortunately, however, the cars have not wings. They cannot fly. When they come from all parts of the vast system into the worm like lanes and narrow streets of this "congested district," they have to thread their way as best they can. In the meantime the Bostonion finds out that to be between Beacon Hill and the Harbor is much the same as being between the devil and the deep sea. Three remedies for the trouble have been suggested: To go through the air, to go under the ground, to go across the Common; that is, to have an

elevated road, or a subway, or a surface line across Beacon Hill, and the Common. The last scheme encounters sentiments and traditions whereof the mind and memory of the Boston man runneth not to the contrary. It has no prospect of success. The first two plans have been welded together in a bill just submitted by Mayor Matthews to the Committee on Rapid Transit. It provides that, under a commission, a subway shall be built under Tremont Street and the "congested district," and an elevated section, to be operated in connection with it, and to be extended to Charleston, in one direction, and to Franklin Park, in another. By the terms of this bill, the city is to build the subway and purchase the right of way for the elevated to Franklin Park, and also to build a bridge across the Charles River to Charleston. The subway is to contain four tracks, two to be leased to the surface road and two to be used by the elevated road. The elevated sections are to be built and operated for a term of years by a private corporation under competitive bids. The purpose of this measure is to unite rapid transit in the outlying district with relief to the crowded streets in the heart of the city. The principal protest, thus far, comes from persons doing business or owning property on Tremont Street, which, they contend, will be materially affected during the construction of the subway. Another scheme strongly urged has been the Meigs elevated. This system once obtained a charter, but it was heavily saddled with conditions that prevented the construction. The Boynton bicycle road has been vigorously presented. In the various discussions of the season the West End Company has taken little or no part. Its attitude is said to have been one of "inquiry and observation." Possibly their large experience with the difficulties of the case leads the directors and officials of this company to be silent and count the cost while others do the talking.

Oscar T. Crosby.

Oscar T. Crosby—one of the ablest and best known electrical engineers and business men of the country—has severed his connection with the General Electric Company, and will on May 1, as previously announced, enter into business with J. G. White, under the corporate name of the White-Crosby Company, a new corporation organized to continue the electric railway construction business built up by Mr. White under the firm name of J. G. White & Company. Mr. Crosby's prominence in street railway circles, and his connection with much which is now historical in the industry, warrants a somewhat extended review of his career. He was born in Louisiana, but his boyhood was spent chiefly in Brookhaven, Miss., from which state he was appointed to the United States Military Academy in 1878. He was graduated four years later, second in rank in a large class. On receiving his commission as an officer in the Engineer Corps, he was stationed at Willets Point, N. Y., and two years thereafter was sent to New Orleans, La., for river and harbor duty.

In May, 1887, he obtained a six months' leave of absence for the purpose of asssisting Mr. Sprague in important and original work in the field of electro-motive power. Becoming enthusiastic at results, he resigned his army commission, and joined the Sprague Electric Railway & Motor Company, originally assuming the duties of superintendent at the factory, from which position he was promoted to the general managership of the company, shortly before its absorption by the Edison Company. In 1890 he undertook, for the Weems Electric Railway Company, important experiments at Laurel, Md., on high speed electric railroading, and these experiments have attracted wide attention as conveying to engineers the only definite knowledge even yet obtained with respect to atmospheric train resistance at speeds of 180 miles per hour or more.

In 1891 Mr. Crosby was offered by the Edison General Electric Company the position of General Manager of its Southern department, and for several months he conducted its business in the South with marked success. He was then offered and ultimately accepted the position of General Manager of the Thomson-Houston Company's railway department with headquarters at Boston, and for the past two years has been the active head of the important railway interests of the Thomson-Houston and General Electric Companies. His influence in the engineering, manufacturing and business departments of these companies has been marked, and the extensive and varied interests of the General Electric Company have put him into close relations with the street railway managers of



OSCAR T. CROSBY.

the country. The value of his work as Chairman of the Committee on Standards of the American Street Railway Association for the past three years is universally recognized.

Mr. Crosby's official position in the Crosby-White Company will be that of chief engineer, instead of president, as originally intended, the change being made in consequence of certain independent technical work which he desires to undertake in connection with special electrical developments, and which will make it impossible for him to conform to the original plan, by which he was to undertake equally with Mr. White the details of the company's business management.

In an action by a city to enjoin a street railway company from constructing its railroad within its jurisdiction, it was decided in the Supreme Court of Pennsylvania, case of the City of Allegheny vs. Milvale E. & S. St. Ry. Co.:

1. That under Article 17 of the Constitution, providing that no street passenger railway shall be constructed within the limits of any city without the consent of such city, a city, as a condition to the grant of franchise to a street railway company, may impose a tax on the dividends to be earned, and fix the maximum rate of fare to be charged by the company.

2. As a city is authorized (Sec. 9, Art. 17 Const.) to impose conditions on its grant of a franchise, a company to which a franchise has been granted on its acceptance of certain conditions must accept all the conditions imposed before it acquires any right under the grant.

EDITORIAL CORRESPONDENCE.

NEW ORLEANS—PART II, GALVESTON, HOUSTON.

New Orleans—Part Two.

FRANCHISES AND LICENSES.

The present ordinances of the City of New Orleans require that all franchises for street railway shall be advertised for three months and sold to the highest bidder. Previous to this ordinance, however, nearly all the street railway companies were required to pay a certain sum into the city treasury as a compensation for the use of the streets. In the case of certain of the lines, preliminary to the introduction of electric traction, an extension of franchise for fifty years from the expiration of the original franchise has recently been sold at public auction, although the original franchise has not yet expired, so that because of the fact that some companies are operating under an old franchise and others under newer ones, there is considerable confusion regarding this subject. The lines controlled by the New Orleans Traction Company are now operated under a franchise secured at public auction, the grant giving an extension of fifty years from 1901 for the lines of the Crescent City Railroad Company, an extension for the same period for the New Orleans City & Lake Railroad Company from January, 1906. In the case of the latter company the ordinance provides that the amount paid to the city for the franchise shall be expended "for the purpose of inaugurating and securing an improved system of drainage and public permanent improvements for the city." A condition also provides that the city may take over the franchises and property of the company on the expiration of the grant on the payment of a certain sum, to be decided by arbitration.



FIG. 1.—BIRDS-EYE VIEW OF JACKSON SQUARE AND ST. LOUIS CATHEDRAL—NEW ORLEANS, LA.

New Orleans & Carrollton Railroad Company.

As early as 1833 the enterprise was inaugurated which has culminated in the splendidly equipped electric railway system which is now being operated by the above company, and which embraces about ten miles of double track construction. Although this is not at present the largest street railway system in the city, it is the only one as yet operated by electric power. The franchise of this company is one of the most valuable in the city, the tracks being located on one of the most desirable avenues, contiguous to a large population, and the system enjoys a liberal patronage, and the cars are run faster and on a shorter headway than any other line of equal length with which we are acquainted in the entire country.

On securing the permit for electric traction, the franchise of the company was extended for twenty-five years from 1908, for which the company paid the city $150,000, or rather agreed to expend that amount for paving one of the roadways on St. Charles Street with gravel.

The company is required to pay both city and state an annual license of about $2,000, which is based on the gross receipts, the maximum being limited to $2,500.

The line starts from Canal Street and continues along Baronne Street for a considerable distance, then turns to the left and enters St. Charles Avenue at Lee Circle and continues along the avenue which runs parallel to the river past the north line of the Audubon Park to Carrollton, where it turns into Carrollton Avenue and terminates in a loop through the car barn on Jeannette Street, six miles distant from the starting point. There are two branches, one on Jackson Avenue and the other on Napoleon Avenue, which terminate at the river, the cars starting from Canal Street, the power station being located at the head of Napoleon Avenue, near the levee.

The tracks, with the exception of the portion on Baronne Street and Jackson Avenue and the street connecting the latter with St. Charles Avenue, are located on a reservation or neutral ground, as it is here termed, in the middle of the street, where it is not subject to vehicular

traffic except at the crossings. St. Charles Avenue is 120 ft. wide between the property lines, and the neutral track is forty feet wide with roadways on each side thirty feet in width and sidewalks ten to fifteen feet wide. The roadways are paved with asphalt or Rosetta gravel, forming excellent carriage driveways. Napoleon Avenue is laid

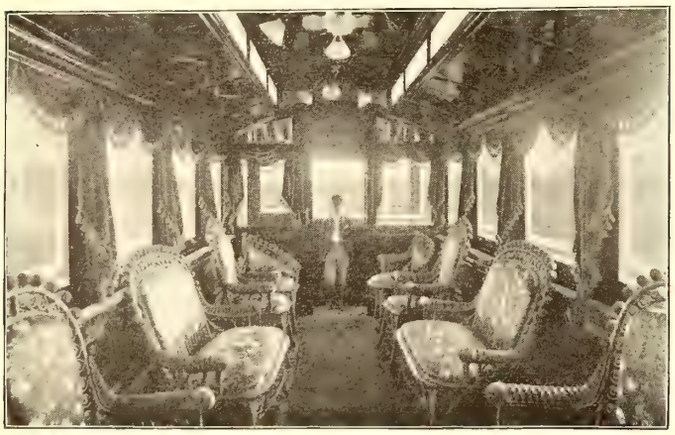


FIG. 2.—INTERIOR OF PRESIDENT'S PRIVATE CAR—NEW ORLEANS & CARROLLTON RAILROAD.

out in about the same manner. On some portions of St. Charles Avenue are lines of shade trees, and the neutral ground is cultivated as a grass plot, with here and there an attempt at ornamentation with palms and shrubs. The avenue throughout its entire length is bordered by beautiful homes and public institutions, which are surrounded with green lawns and shaded by magnolias, live oaks, crape myrtles, orange trees and ornamented by palms (of which there are said to be fifty varieties), shrubs and flowers to an extent equaled by no other avenue that we have ever observed, making the ride over the route in the way of a combination of beauty, architecture, tropical plants, rare flowers, well kept lawns and sunny skies, beyond all question one of the most delightful to be found in the world.

TRACKS.

Although the electrical equipment of the system was understood to be first class in every particular, the track construction on the neutral ground has proved inadequate to the service imposed upon it, owing to the spongy condition of the soil. A forty-eight pound T rail is principally employed (except on Baronne Street and Jackson Avenue). This is spiked to the ties, which were laid in the soil without ballast, two feet centers. The heavy traffic in wet weather causes the ties to churn to a degree seldom experienced in street railway practice, making the track very rough and necessitating constant repairs. The trouble is being partially remedied by tamping the ties with cinders and gravel. In our opinion it will require a heavier rail and a gravel or stringer foundation to produce a durable track under the existing conditions. On Jackson Avenue the Duplex type of rail, weighing sixty pounds per yard, was employed, and the ties are laid on a gravel foundation. Notwithstanding this fact, the rail has failed to a greater degree than the T rail construction. On Baronne Street a seventy pound, six inch girder rail was employed, which rests on four inch chairs, and which is standing up reasonably well. The bonding consists of No. 0 galvanized copper wire, fastened with channel pins, and the track return is supplemented by an overhead return wire.

The overhead construction is supported on tubular center poles.

ROLLING STOCK.

Seventy closed cars with eighteen and a half foot bodies, and one vestibuled palace car, named "President," comprise the rolling stock. The cars are all manufactured by the St. Louis Car Company and are very handsome, being finished in mahogany and cherry with bamboo cushions and ornamental deck lights. They are mounted on McGuire and Brill trucks, there being sixty of the former, and all the trucks have a seven foot wheel base and thirty-six inch wheels, which are principally of Griffin's make or the New York Car Wheel Company's make.

The propelling equipment consists of No. 30 and



FIG. 3.—INTERIOR OF POWER STATION—NEW ORLEANS & CARROLLTON RAILROAD.

No. 50 General Electric motors of the W. P. type, each car having only one equipment, this being sufficient as there are no grades in the line.

POWER STATION.

As noted above, the station is located near the river at the head of Napoleon Avenue, and is practically at the center of the system, resulting in an economical use of feed wires. The station is of brick with steel truss roof support and slate roof. The boiler room is 110 × 60 ft., and the engine room 90 × 200 ft. There are three iron smokestacks. The steam equipment consists of four Babcock & Wilcox boilers which at 110 lbs. of steam pressure are rated at 125 H. P. each. These are arranged

in two batteries, but only one battery is required to operate the system. On special days when traffic is heavy, a steam pressure of 120 lbs. is carried. A Stilwell & Bierce feedwater heater with Worthington and Knowles pumps and Buffalo jet condenser complete the steam equipment. Each battery has a duplex set of water and steam pipes.

Pittsburgh soft coal, known as first pool, is employed, and is delivered on the levee, about 800 ft. from the station, direct from the mines, coming down the Ohio and Mississippi Rivers. From the barges the coal is transferred to the storage yard of the station on flat cars, and is brought into the engine room by hand barrows. Coal is measured by the barrel, which contains 180 lbs., and costs, at present prices, twenty-nine cents per barrel, or about $3.22 per ton of 2,000 lbs. The daily consumption is from 170 to 190 lbs. for operating fifty-seven cars, the average number daily run, an all-night service being maintained. The feedwater is obtained from artesian wells, of which there are three, two being 300 ft. in depth, and the other 800 ft. From the latter there is a natural flow, but in the others the water rises only to within twelve feet of the top. Water for condensing purposes is drawn by pumps from the river, and when the water is high it is syphoned over to the station, the water in the river being several feet above the street level. The water of condensation is discharged into the surface gutters and run in a direction away from the river.

Three Lane & Bodley tandem compound engines supply the power. These have eighteen foot, nineteen ton flywheels, from which the power is transmitted by belts to a countershaft, from which, in turn, it is led by belts to the three General Electric M. P., 200 K. W. generators. The engines are run at sixty-eight revolutions, and during part of the day all three are in service. Underside tightening pulleys are employed with the engine belts. The switchboard is provided with General Electric instruments, and General Electric lightning arresters are also employed. The average voltage carried is 525, and the current is led out over nine feed wires, the positive pole being connected with the trolley. The loss in the current at the extreme ends of the line is about 12 per cent. The station also furnishes current for lighting the car barn and office, and for an arc light at the starter's station near the head of Napoleon Avenue. The station in its appointments, equipment and management is a model in many respects.

CAR SHED AND OFFICES.

The car barn or shed and all of the buildings, except the power station, are located at the Carrollton end of the route, as before noted. The shed is a fireproof structure and covers a ground space of 265 × 128 ft. The framework is of steel with slate roof and corrugated iron sides which terminate ten feet above the ground, giving ample ventilation for warm weather, but too much exposure for cold weather. There are ten storage tracks, five of which are provided with pits, and there is one cross pit near the front end of the shed. There is no transfer table, both ends of the barn being provided with special



FIG. 4.—CAR HOUSE AND REPAIR SHOPS—NEW ORLEANS & CARROLLTON RAILROAD.

track works to receive and discharge cars from each barn track. The pits are constructed with concrete walls designed to keep out the seepage water, but are not altogether successful in this respect. The cross pit, which is not as deep as the main pits, is kept reasonably dry.

There are two long, one story brick buildings located in the rear of the shed and at right angles to each end of it, in one of which are the offices of the company and in the other the repair shops and store rooms. The office building is 183 ft. in length and fifteen feet in width with a gallery or porch on the inside for the entire length, with doors and windows which provide for a free circulation of air, making them very comfortable in warm weather. The interior is finished in Georgia pine and divided into convenient offices with connecting doors. The receiver's office occupies the end next to the shed, and the others in order are for the secretary, directors, superintendent and electrician; there is also a store room and toilet room.

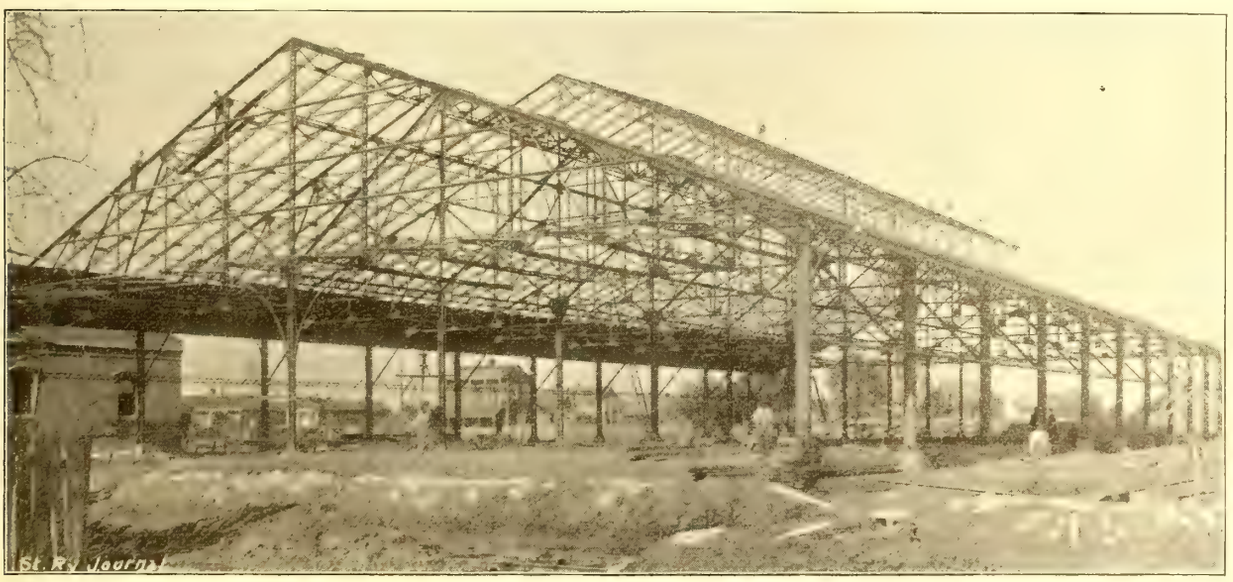


FIG. 5.—CAR HOUSE OF THE NEW ORLEANS & CARROLLTON RAILROAD IN PROCESS OF CONSTRUCTION.

The shop building is 175 ft. in length and forty-two feet wide for a distance of 100 ft., and enlarged to sixty-two feet for the balance of its length. The chief electrician or master mechanic's office is next to the car shed, and in turn come a store room, winding room, iron repair shop, wood working department, erecting shop, paint shop. The power for operating the tools is furnished by a fifteen horse power stationary motor which occupies a

small fireproof vault near one end of the building, and from which the power is transmitted by belt to an eighty-four foot shaft which connects with the repair shops.

The iron tool equipment consists of one sixteen and one twenty-four inch lathe, a five foot planer, a drill press, a ten ton wheel press, together with emery wheels and other small tools.

In the wood working department there is a moulding machine, a pony planer, one circular saw and one band saw and one wood lathe. The blacksmith shop occupies an iron building located in the yard between the repair shop and office building.



CHRIS. V. HAILE,

GENERAL MANAGER AND SUPERINTENDENT NEW ORLEANS & CARROLLTON RAILROAD.



WALTER V. CROUCH,

SECRETARY AND TREASURER NEW ORLEANS & CARROLLTON RAILROAD.

All motor repairs are made in the company's shops, including making of new commutators. For this purpose forged or cast bars are purchased, and in the process of setting up the bars and mica insulation are pressed firmly together by means of a stout iron ring which is forced over the commutator with a pressure of twenty-five tons by means of the wheel press. In the most recent construction of commutators cast bars are employed, which are made by a firm in New Orleans, and which are warranted to outlast two sets of drop forged bars.

The repair shop is very complete in all its appointments, and seems to be well managed. The scrap heap of gears, wheels and motor parts is the smallest that we have ever found for a road that has been operated for the same length of time.

In the large yard bounded by the shed and brick buildings, are several out buildings, including an elevated water tank with a capacity of 20,000 gals., from which the water is drawn for washing cars and other purposes. The base of the tower, which supports the tank, is occupied as an oil and waste room.

The water supply is obtained from an artesian well located in the yard, and which is bored to a depth of 800 ft., in which the water rises by natural pressure through an extension of the tubing about ten feet above the surface of the ground. The water is forced into the storage tank by means of an hydraulic ram located in a basin at the foot of the stand pipe, to which the water is led by a vertical pipe tapped into the top of the stand pipe.

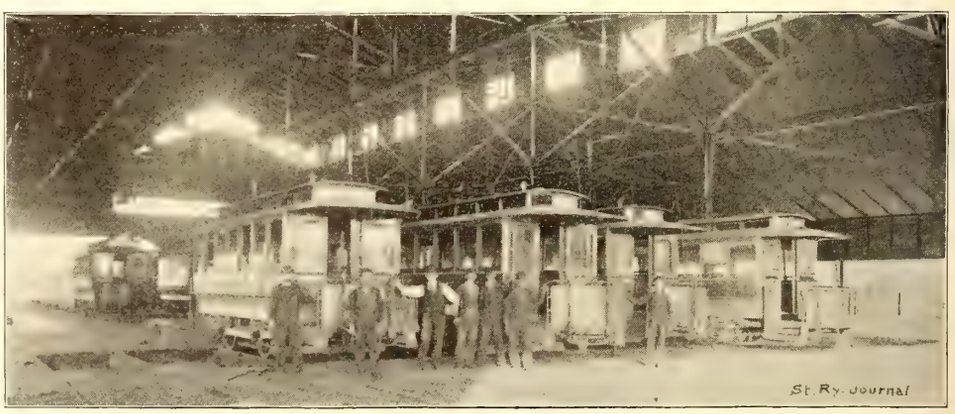


FIG. 6.—INTERIOR OF CAR HOUSE—NEW ORLEANS & CARROLLTON RAILROAD.

EMPLOYES AND FARES.

The regular car men number 160, and there are eighty-nine on the extra list. The power station force numbers fourteen, including chief engineer and assistants. The number of shop men is twenty-eight, including master mechanic, inspectors and laborers. There are twenty track hands, including foremen, and five line men. The starters, transfer agents and barn men number nine, and there are five office clerks besides the regular officers.

Motormen and conductors receive $50 a month, the master mechanic and chief engineer, $125 per month, laborers in repair shops from $40 to $75. track men (all colored), $1.25 per day. The fare is five cents, with transfers at Jackson and Napoleon Avenues, for which different colored tickets are provided at each station, and colors changed every day. The transfer tickets are issued by agents.

Policemen and employes ride on their badges, the latter as per the following rule which is copied from the rule book: "No. 12. Conductors and motormen will be allowed to ride free of fare when off duty, provided they are in uniform, and providing they render all assistance in their power in case of accident or trouble of any kind that may occur when they are on or near the car, and providing they are going to and from their work." City officials ard provided with a book of coupon passes.

The conductors and motormen are provided with a book of rules, which includes a folder containing a diagram of the entire route and branches, with all the cross streets named in their order.

Owing to the high speed allowed (15 miles an hour), but which is frequently exceeded, the cars make an unusual mileage, the average being 131 miles a day, while some make as high as 140 miles. The average for the month of September last was 131, and the receipts per car per day for the same month were $20.98; expenses per car, $11.58; receipts per car mile, 16.2 cts.; expenses per car mile, 8.11 cts. The headway on the Carrollton end is two and a half minutes, that on Napoleon Avenue four and a half minutes, Jackson Avenue three minutes. These cars con-

verge on St. Charles Street, on which the headway is one minute and less.

The coal consumption for the month of December, 1893, for operating an average of fifty-nine cars was $2.66 per hour, $64.92 per day, and $2,012.52 per month. The total power house expense for the month of December, including coal, oil and service, was $2,925. 52.

The conductors and motormen are employed and discharged by the president of the company. Until recently this duty was performed by a committee of officers; neither practice, in our opinion, conduces to good discipline.

It is proposed to extend the lines of the company in both directions in the near future; one extension will be on Canal Street to the river, and the other from the present terminus on a new avenue parallel with the river, a distance of 2,000 ft. This avenue is 180 ft. wide, with a neutral street ninety feet in width and thirty foot roadways.

A. Langstaff Johnson, of Richmond, was the chief engineer of the original electric construction.

HISTORY.

This is the pioneer street railway line in the city, having been organized in 1833, but not put in operation until 1834, only three years after the building of the Fourth Avenue New York Line, which was the first street railway proper in the world. The first section of the New Orleans & Carrollton Railroad open for traffic extended from Canal Street on St. Charles Avenue to the corner of Jackson Avenue, and the rolling stock consisted of double deck cars which were drawn by two horses driven tandem. In 1835 the road was extended to Carrollton, and in 1845 and 1846 the company operated a steam road over the same route from Lee's Circle to Carrollton, and from there to Lake Pontchartrain. The extension from Carrollton to the lake was abandoned after the war. In 1866 General Beauregard, then president of the company, invented an overhead cable system, and built an experimental line around two or three blocks opposite to what is now Audubon Park. In this experiment the rope was supported above the car on bracket poles, and was driven by two old locomotives placed at each end of the route. The grip was located on the roof of the car, and operated by means of levers from the front platform. The experiment, proving too expensive, was soon abandoned, although it served to identify the inventor as a pioneer in cable traction. Later General Beauregard became interested with Dr. E. Lamm in the development of ammonia motors, and soon after an attempt was made to operate a portion of the line with these motors. A printed prospectus was issued regarding this system, of which the following is a partial copy.

"Thermo-Specific Engine.

"Dr. E. Lamm, President of the Ammonia & Thermo-Specific Propelling Company, of America.

Estimate.

"Total cost of fifteen motors and machinery, $21,728.75. Total running expense of fifteen cars per year, $10,757.55; daily expense for fifteen cars, $29.47; daily expense for each car, $1.96. Emile Lamm, superintendent, G. T. Beauregard, president. Difference in cost per day in favor of new system, $3.13½; economy per annum $14,671.80."

During the experiment the inventor having discovered that the motor could be operated by stored steam, the ammonia experiment was abandoned and the motors were operated for a time with stored steam, primary boilers being erected at the main station. In 1889 the motors were provided with small furnaces and converted into regular steam dummies. Four years ago the dummy system was abandoned and the line operated by mule power until the introduction of electric power on February 9, 1893. The introduction of electricity was accomplished only after a prolonged effort and in the face of many difficulties. Soon after the opening of the Richmond electric road in 1888 the superintendent recommended the introduction of electric power, and the directors adopted the idea. It was not accomplished, however, until a committee of citizens, under the leadership of A. L. Abbott, undertook the work of securing the permits from the city authorities.

OFFICERS.

The system at present is under the management of Jos. Lennes, president, Walter V. Crouch, secretary, and Chris. V. Haile, superintendent. Mr. Lennes has recently succeeded to the presidency, following the resignation of John Numa Avegno. Mr. Crouch has been secretary and treasurer since 1877, and Mr. Haile entered the service of the company in 1872.



J. H. DE GRANGE,
SECRETARY CANAL & CLAIBORNE RAILROAD CO.



E. J. HART,
PRESIDENT CANAL & CLAIBORNE RAILROAD CO.

It will be noted from the above that this company was not only the pioneer street railway company in the city, but that it has always been in the front rank of experimenters for the development of electrical traction.

Canal & Claiborne Railroad Company.

The lines of this company run in a direction generally away from the river, while the lines of most of the other systems are on streets running parallel with the river. The two divisions of the system center on Canal Street, but diverge and penetrate the territory to the right and left of this street, passing through a thickly settled portion of the city, that to the right being mostly through what is known as the French quarter. The route is principally on neutral ground, and for a considerable distance on Claiborne Street there are two neutral strips, each shaded by a double line of live oaks. One of the drainage canals of the city is also on this route and lies between the neutral strips.

One of the most interesting features of the system is the economy which has been practised in track construction, the tram rails of which it is composed having been used in three positions, materially prolonging the life of the rail. On the neutral ground the rails, after being worn down in the ordinary position with the tram on the inside, were turned around and operated over in the new position until the outside of the head was worn down,

when the rails were taken up and set edgeways in iron chairs, which were cast with a groove to receive the fillet on the underside edge of the flange. The chairs were then slid into position from the end of the rail, and the rail being in position became virtually a girder rail, which made a better track than in either of the other positions. On the neutral ground two twelve inch planks are laid on the surface between the rails to provide a footing for the animals, but for a short distance each side of the crossings a cobble paving is provided to give a good foothold in starting. Only fourteen foot cars are operated, as noted in the previous article, but the headway is comparatively short, being five minutes during the principal portion of the day, and a very acceptable service is maintained.

The journal box employed on all the cars but one was invented and patented by the superintendent, Jos. H. De Grange, and is virtually a dustproof device which requires oiling only once in three or four months.

The average number of cars run is thirty-two, and the average daily distance traveled by each car is eighty miles. The live stock consists of 210 mules which are housed in two stables, one located at the terminus of one line on Lafayette Avenue, and the other on Tulane Avenue at the terminus of the second division. At the former station 120 animals are housed, and about ninety at the Tulane Avenue station. The stable and car house at the Lafayette Avenue station consists of long, story and a half, wooden buildings with slate roofs. There are also extensive sheds and yards into which the animals are turned at night in warm weather. The stalls of the stables are wide, have plank floors, and are kept in an exceptionally clean condition, no bedding being provided for the animals. An automatic hitching device is provided for each runway, so that in case of fire all the animals can be turned loose at once. Mules weighing about 1,100 lbs., and fifteen hands high, are generally employed, and their average life is five years. The daily mileage is from fifteen to eighteen, and in the stable economy each hostler grooms fifteen animals. The feed consists of Texas prairie hay, costing $12.25 per ton. This is cut and fed dry, but mixed with cracked corn and oats, the daily ration being ten pounds of hay, seven pounds of corn and seven pounds of oats, the proportion being varied in winter weather. Before the hay is cut, each bale is carefully weighed, as is also the grain, and the records returned to the company's office. A six horse power steam engine is employed for cutting the hay and grinding the corn. The hay cutter is provided with an endless chain elevator. The manure is sold for $80 per year.

The roofing of the stables is all steel, and every precaution is taken against fire, there being a number of water tanks in convenient positions and also Babcock fire extinguishers.

At the starter's stand is provided a time table, and near by a watchman's clock, on which the night watchman records his rounds.

The car repair shops of the system are located at the Tulane Avenue station, where are also the blacksmith's shop, harness shop and store room. Old cars are repaired, in some cases making them practically new, the posts and wood being purchased from the wood working mills.

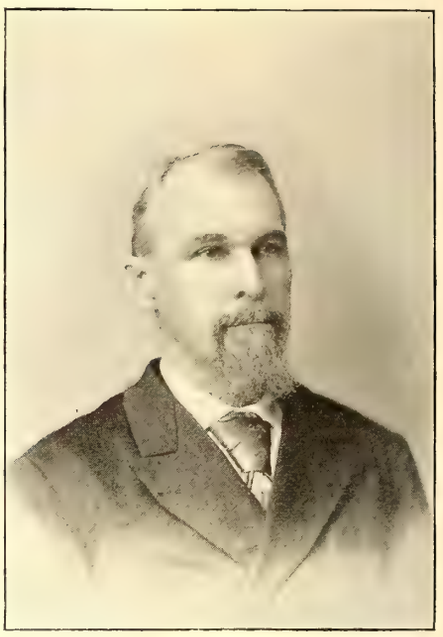
The financial and operating affairs of the company are controlled by E. J. Hart, president, and Joseph H. De Grange, who is secretary, general manager and superintendent, giving each department his personal attention. Mr. Hart is nearly eighty years old and apparently hale and hearty, and has been connected with the company a good many years, and president for twenty-five years, being one of the oldest street railway presidents in the country.

In the office duties the superintendent is assisted by his son. Mr. De Grange is prominently identified with the public affairs of the city, being president of the Board of Fire Commissioners and director of several financial institutions.

Although this is a comparatively small system, embracing only about thirteen miles of track, it is operated in an economical manner and apparently with good returns on the investment. The advisability of changing to electric traction is being discussed, and probably active measures will be taken looking to this end as soon as the lines of the Traction Company are put in operation electrically.

St. Charles Street Railroad Company.

This was the third street railway company to be organized in the city, following that of the New Orleans City Railroad Company, the charter having been obtained in 1865. W. H. McLellan was made president September 7, 1865, and the lines were put in operation in September, 1866. Alden McLellan, the present president, succeeded his father in 1871, having been secretary of the company from its organization. The present secretary is N. Riviere, who has also been for a long time in the employ of the company. The system is operated in three lines and embraces about twelve miles. The lines are nearly parallel to those of the other principal systems, but occupy the inside streets of the city or the streets farthest away from the river. The track construction is a side bearing, forty pound tram rail laid on stringers, and is maintained in excellent condition, being in this respect superior to any other line in the city.



ALDEN M'LELLAN,
PRESIDENT ST. CHARLES STREET RAILWAY CO.



N. REVIERE,
SECRETARY ST. CHARLES STREET RAILWAY CO.

In the original construction an English iron rail was employed, which cost $108 per ton. Stephenson cars only are employed, the company never having bought a car from any other builder. The sixteen foot bobtail cars in 1867 cost, f. o. b. New York, $1,211.96; this sum included the manufacturer's bill of $760 and premium on gold, which was then 51⅞, and the government tax of 5 per cent; to this should be added $100 for freight, all cars being boxed and shipped on sailing vessels. The line is noted as never having issued a pass nor a ticket. In regard to this matter the following rule is in force:

"No passenger, whether employe, director or other individual is to be permitted to pass over the road without

depositing fare, except the following named, who will be allowed to ride free: Firemen in uniform, going to fires; policemen (not to exceed one at a time) in uniform, on platform only; sisters of charity, not to exceed three at a time; the curve greaser of this company, when on duty with can and brooms."

The original incorporators of the company consisted of four persons who invested sufficient capital to build the road, and no stock was issued until the line was in operation. The present amount of capital stock is $1,000,000, and there are $105,000 of bonds outstanding. The conditions of the original franchise required the payment into the city treasury of nine sixteenths of a cent for each passenger carried. This the company found to be too large and it was afterwards reduced to one-eighth of a cent per passenger. In 1881, however, the franchise was extended for twenty-five years on the payment into the city treasury of $300,000 in cash. The conditions of the franchise require an annual license of $1,000, which is based on a certain amount of gross receipts. In the assessment for taxes the franchise is valued at $1,000,000. The company is also required to plank the streets between the rails and tracks and keep them in repair from curb to curb.

An application is now before the City Council for permission to adopt mechanical traction, and this will doubtless be secured. In this application no extension of the franchise is asked.

The average number of cars operated at present is fifty-four; two cars are run all night at intervals of sixty minutes, on which the fare after 12 o'clock is ten cents; the receipts on the owl cars, however, do not pay the expense of operation. The number of animals required for operating the system is 272, most of them being mules.

Drivers are paid $1.65 for twelve hours' work The drivers are required to carry $15 in change, which they purchase from the starters at either end of the route; the change is mostly nickels, and is put up in $1, 50 and 25 cent packets. For this purpose small envelopes are provided of different colored paper for the different amounts. The company claims to be the first street railway company in the city, if not in the country, to employ change envelopes, having been first used in 1866. The envelopes, as in the early days, were made in the company's office.

The secretary, with two assistants, acts as receiver and bookkeeper, and counts all the money received. The nickels, which are to be returned to the drivers in change, are first counted in dollar piles and placed in wooden trays or boxes having removable partitions, five piles of $5 occupying each position of the tray, and the tray holds $50. These are then passed to an assistant, a young man, who puts them up in envelopes, and at which he has become very expert. First he takes the dollar piles from the trays and places them upon the table with one nickel overlapping another, or in such position as they would assume by turning over the pile. He then takes up the envelope with the left hand and five nickels with the right, places them across the envelope, folds them over once and lays it on the table with others in parallel rows in such a position that the flaps can be moistened with a brush. He then seals two rows at a time, one with each hand, by closing the flap of the envelope. The packets are then tied in bundles of $50. The whole operation of taking the nickels from the trays and putting $50 in twenty-five cent packets, counting and tying the packets in bundles of $5 each, being completed in from ten to twelve minutes. From $800 to $1,200 of nickels are put up in this manner each day. The nickels that are to be deposited in the bank are first wrapped in $1 rolls, then put up in square packets of $50 each. In forming these bundles a three side wooden frame is employed, into which the wrapping paper, cut of a suitable shape and size, is first placed, then the packets are put in the frame, when the wrapper is fitted over and tied, making a neat, compact and convenient bundle.

The office and stables are located at the corner of Carondelet and 8th Streets, where the company owns two entire blocks, giving ample yard room for the stock and for other purposes. The buildings are chiefly of wood, one story or a story and a half in height, and are conveniently arranged. The stable proper, including the feed and care of the animals, is about the same as described for the Canal & Claiborne Railroad.

The water for the animals is obtained from an artesian well 800 ft. in depth, and is said to be medicinal in its effect, keeping the animals in excellent health; the condition of the animals bears evidence of this fact, and also that great care is exercised in the feeding and treatment.

The artesian wells of which we have spoken, in connection with the different street railway lines of the city, are usually from 700 to 800 ft. in depth and for the entire depth are said to be through an alluvial deposit until a bed of gravel is reached. In drilling some of these wells, logs of palm wood were encountered at great depths and there were other evidences that the entire region to a considerable depth had been formed from ancient flood deposits.

Orleans Railroad Company.

The lines of this company embrace ten miles of track, which are operated in four divisions, the longest run being five miles. They occupy an inside district of the city and connect with the city park and race tracks. A. Cassard, is president and P. Cougot, secretary. Twenty-one cars are regularly operated and the live stock consists of 155 animals, mostly horses, and the cars were built by Stephenson. Northern hay, costing $14 to $15 a ton, is employed for feeding. This is fed long with oats and corn, the latter being ground. The daily ration is fifteen pounds of grain and as much hay as animals will eat. The lines were built in 1867, and the franchise was extended for twenty-five years in 1887. Twenty-one regular drivers are employed and thirty men on the extra list. Drivers receive $50 per month. One of the cars is provided with a two blade propeller fan, located near the ceiling for the purpose of producing a circulation of air through the car. This fan is actuated by a belt from the front axle, which is lead up the front end of the car to a jackshaft, which passes through the end of the car and from which power is transmitted by a sprocket chain to the operating shaft, which extends along the ceiling to the middle of the car, where it is connected with the fan by means of beveled gear. We were not informed with what success this device was operated.

The switches on the lines of this company are operated by crank levers, which are located in a small house beside the track.

Nothing is being done regarding the introduction of electric traction on these lines.

Algiers & Gretna Railway Company.

The offices of this company are at the foot of Canal Street, New Orleans, but the line is located in Algiers, on the opposite side of the Mississippi River, and runs to Gretna, a distance of three and theee-quarters miles, where it connects with Jackson Street Ferry. Algiers has a population of about 8,000 and Gretna a population of 800. The towns skirt the river, and are protected by levees the same as New Orleans. There are extensive wharves which provide a landing for river and ocean steamers, and a considerable shipping business is conducted.

The street railway track is a narrow (three foot) gauge. Only four cars are run, and three are drawn by a single horse, and have fare boxes and fare conveyors. The stock consists of twenty horses, no mules being employed.

Drivers are paid $45 per month. The railway line is operated by the same company which controls the ferry privileges, and in connection with which nine steam ferry boats are employed, which are operated over six routes.

A. M. Halliday is president and general manager of the company and superintendent of the ferries; Capt. Thomas Pickles is vice-president, and Wm. Nagle, secretary.

Louisiana Electric Light Company.

The fact that this company is to furnish power to operate the lines of the New Orleans Traction Company

brings its operations into the street railway field, and makes it of interest in connection with these notes. The plant of this company is one of the largest lighting plants in the country, the total capacity being 2,000 arc lights and 21,000 incandescent, so that the city is one of the best lighted in the South, if not in the whole country.



FIG. 7.—EXTERIOR OF STATION—LOUISIANA ELECTRIC LIGHT CO.

The station is located near the river, on South Peters Street, between Richards and Market Streets, and consists of a two story brick building, the ground dimensions of which are 320 × 130 ft. The building is divided lengthwise by a brick partition, and the boiler plant occupies the side next to the river.

Water for condensing purposes is drawn from the river, but for feedwater it is taken from artesian wells.

The boilers are of the return tubular type, twenty-six of them being 72 ins. × 17 ft., and ten of them, 60 ins. × 16 ft., and were manufactured by the Bass Foundry & Machine Company, of Fort Wayne, Ind. A steam pressure of 110 lbs. is carried, and Alabama coal is employed as fuel; there are eight iron smokestacks, ninety feet in height, and sixty inches in diameter.

The total engine capacity is 6,000 H P., and is divided between four engines, two of them being cross compound, condensing Hamilton-Corliss engines, of 1,800 H. P. each, and the third a 1,200 H. P., cross compound, condensing engine, and one single cylinder engine which is also run condensing, and which was manufactured by the E. P. Allis Company, of Milwaukee. The latter engine was exhibited at the New Orleans Exposition in 1884. The flywheels of the large engines are twenty-eight feet in diameter, and weigh 110,000 lbs. The governors of these engines are run by sprocket chains instead of belts, as a precaution against slipping. The power is transmitted to the main shaft by means of a three-ply belt, six feet in width, the speed of which is 5,200 ft. a minute. The belt leads under a tightener which causes it to wrap the flywheel almost entirely around. The large engines are located at the extreme end of the station, and are belted direct to a main shaft which is 283 ft. in length. A second shaft on the opposite side of the building is also provided, which is 180 ft. in length, the shafts being belted together, and so arranged and equipped with clutches that either shaft may be driven from either engine, the clutches being of the Cuyahoga Falls and Beliot types. The belting was manufactured by Munson, Schieren and the Chicago Belting Company.

The lighting generators are located on the second floor, and consist of thirty-six sixty light wood machines, manufactured by the Fort Wayne Electric Company, and ten 1,200 light and three 3,000 light incandescent machines of the Slattery type, manufactured by the same company. There are also nine power generators of 500 H. P. Four new generators of the General Electric M. P. type are being installed for the railway work. These are located on the first floor, and two of them will be driven from one of the large engines by means of a jackshaft and clutches; an additional engine equipment of 3,000 H. P. will also be installed. Two of these new generators are of 200 K. W. capacity and two of 500. The installment has to be completed by June 1. The lighting circuit employs over 500 miles of wire, which is carried on 5,000 poles, the longest arc circuit being twenty miles. The service is so good and well managed that all the lights out will not average over 200 or 300 hours a month.

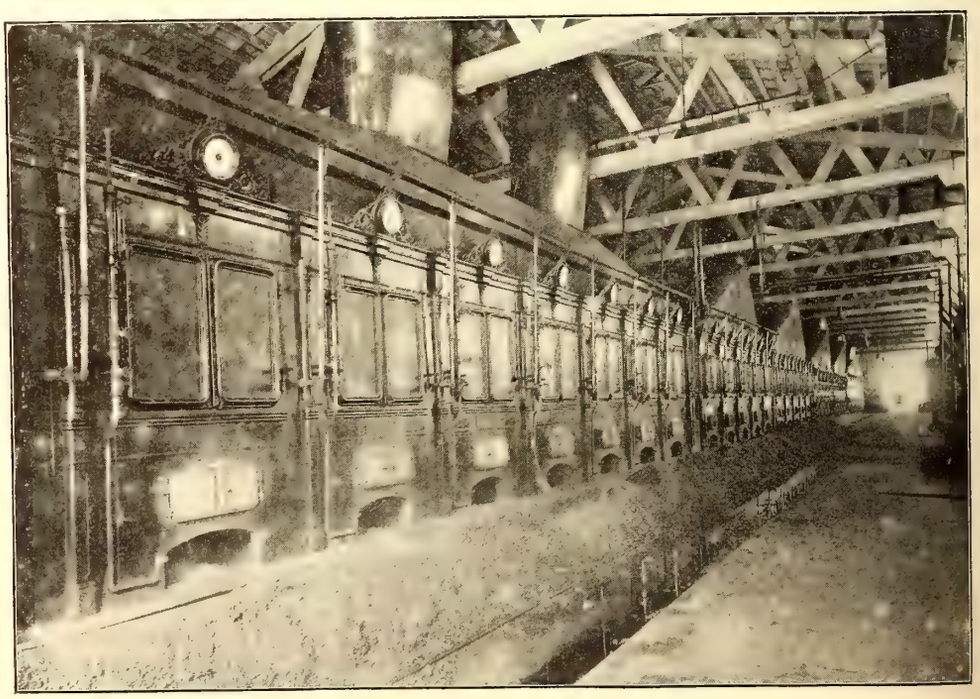


FIG. 8.—INTERIOR OF BOILER ROOM—LOUISIANA ELECTRIC LIGHT CO.

In connection with the generators there is a small air pump operated by a one horse power motor, by which air

is pumped into a receiver, from which pipes lead to different parts of the building, to which rubber hose can be attached for the purpose of blowing the copper dust out of the generators. About fifty feet of armored hose is employed, and the generators are cleaned once a day.



W. H. M'GRATH,

DESIGNER LOUISIANA ELECTRIC LIGHT PLANT.



W. H. HARDING,

GENERAL MANAGER LOUISIANA ELECTRIC LIGHT CO.

There are three switchboards, one for the incandescent, one for the arc and one for the power circuits. The incandescent lighting board is provided with revolving switches, as shown in Fig. 9.

In the office of the company and also in the engineer's office at the station a large blue print map of the city is

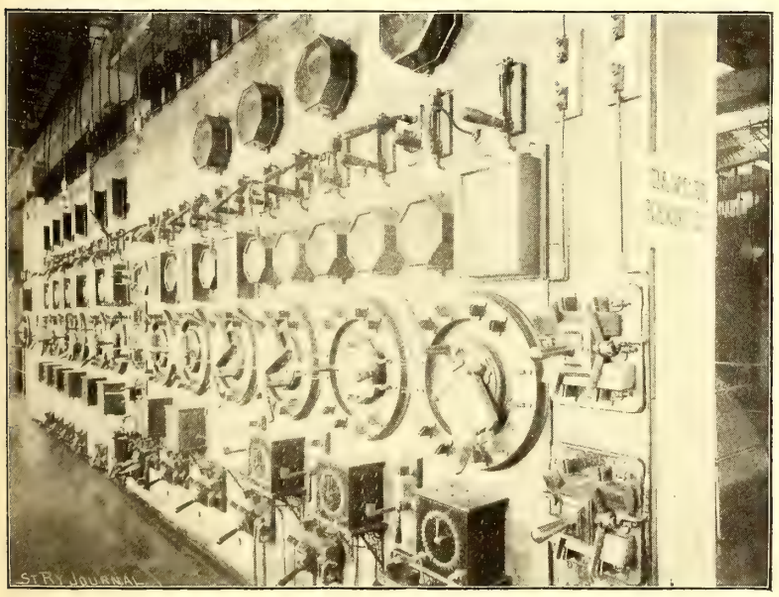


FIG. 9.—SWITCHBOARD—LOUISIANA ELECTRIC LIGHT CO.

provided, on which all the arc lights are located by means of head thump tacks or upholsterer's tacks, which are placed in position and numbered. The city is also divided into sections, so that the trimmers of each section can be located.

The affairs of the company are managed by the following officers: Brainard Rorison, president; Jos. Simon, vice-president; August Salaun, secretary and treasurer; Maurice J. Hart, general manager; W. H. Harding, general superintendent.

In the enlarging and construction of this plant, which was done about four years ago, very difficult engineering problems were met with. The soil being treacherous, a peculiar method of forming a foundation was resorted to. It being found by experiment that there was a layer of quicksand about three inches below the surface and that the formation was less and less dense as the depth increased, it was decided that the ordinary pile foundation would not answer for a support to the engine beds, consequently the surface was excavated to a depth of about three feet for about thirty feet square, when a foundation of four inch cypress planks in the layers pinned together was formed, the plank of each layer being laid in an opposite direction; upon this was placed a concrete bed of six inches in depth, and upon this the brick work for the engine frames, the foundation being so arranged that the principal weight of the machinery came in the center. After nearly four years of service the foundations are in perfect condition, showing that the construction was well planned.

The two M. P. 200 power generators will be run from one pulley, and will be direct driven from countershaft.

Texas and Some of Her Cities.

We left New Orleans on the morning of April 4, via the Southern Pacific Railroad, known as the Sunset Route, for Galveston and other Texas cities. The first day's ride brought us to Houston, where the night was passed. The next day a side trip was made to Galveston, after which by the same rail system Fort Worth was reached, then by the Texas & Pacific Railway Dallas and Texarkana.

On leaving New Orleans the river to Algiers is crossed via a steam ferry, and the traveler is landed beside the train which, should he wish, would take him to Portland, Ore. It was our privilege on another occasion to make a trip over one of the Western divisions of this system through the State of California, and it is in justice to the managers of the Southern Pacific Company to say that in all our travels we have never found a railway line seemingly better managed, or where the comfort of the passengers is more carefully studied, than by the employes of this extensive system.

The through trains are generally provided with buffet or sleeping cars, and even across the plains the eating stations are conveniently arranged, and in all cases a first class meal is provided at a very reasonable price. The roadbed is kept in exceptionally good condition, and in making a trip over the system one is treated to the greatest variety of scenery.

The route from New Orleans to Houston is exceptionally interesting, from the fact that it takes the traveler through the principal sugar region of Louisiana, and gives a fine opportunity for studying the method of cultivating and harvesting the cane and refining the products for market. One sees the typical Southern plantation home, surrounded by groups of negro quarters and shaded by magnificent magnolias and pecan trees. The plantations are seemingly boundless in extent, perfectly level, while the soil is black and apparently of wonderful fertility.

On approaching the Texas border, and for the remainder of the route to Houston, the line is through the most extensive rice fields to be found in the country, and the crop is cultivated very much as is the wheat crop in the North, the seed being sown broadcast and the crop harvested by reapers and threshing machines in almost the some manner as grain crops. The sluices and provisions for flooding the rice fields during the growing season are all interesting features of farming, which gives to the tourist visiting this region for the first time no end of entertainment.

We are accustomed to hear that Texas is the largest state in the Union, but this gives us little idea of its vast extent. It reaches, from north to south, a distance of 750 miles, and from east to west, 810 miles, and comprises 274,356 square miles, or 175,527,840 acres. Its vast area is better comprehended by comparing it with other sections of our country; for instance, it is 100,000 square miles larger than all of the Eastern and Middle States, including Delaware and Maryland, and more than six times as large as the state of New York.

The natural advantages of the state are unsurpassed, but there is no space to speak of her timber, mineral and agricultural resources. There are millions of acres of her

soil under a high state of cultivation, and millions more are awaiting the coming of enterprising and industrious settlers. All these conditions should be understood to obtain a correct idea of the state and its cities, and why they furnish such an excellent field for the growth and development of the street railway industry.

Galveston.

Galveston, now a city of about 50,000 inhabitants, is located on the extreme eastern end of Galveston Island, and contains in its area about six square miles.



FIG. 10.—VIEW OF THE WHARVES—GALVESTON, TEX.

Galveston Island, which is composed of sea sand, is about thirty miles long and has an average width of two and one-half miles, with an elevation, where the city is located, above mean low water of from three to nine feet, but at a distance the city seems to rest on the water. The business portion of the city is only about one mile wide. The island is situated in the Gulf of Mexico off the southeastern border of the state, from which it is separated by Galveston Bay, which is about two and one-half miles in width. Access is had to the island from the main land by means of two railway bridges and a wagon bridge, which are located near together some distance west of the city. The railway bridges are supported on piles, while the wagon bridge is of steel with substantial stone piers, and is said to be the longest wagon bridge in the world. Each of the bridges is provided with draws for the passage of vessels. The bay is bounded by the island, and on the east by a spit, twenty miles long, known as Bolivar Peninsula. The channel through which connection is had with the gulf is between the east end of the island and the west end of the peninsula, and was formerly obstructed by an inner and outer bar, with not more than nine feet of water, but this has been deepened by means of jetties, which when completed are expected to give thirty feet of water at mean low tide. An appropriation of $6,200,000 has been made by the government for the completion of the jetties, and work has progressed until the wall of the south jetty has been completed, and that of the north is now out about five miles, but will be extended a mile or two farther. The contract for these improvements provides that there should be two parallel stone jetties about 7,000 ft. apart, extending about six miles into the gulf. These are constructed of sandstone riprap, which is faced with granite blocks weighing from five to ten tons each. The jetties are fifty feet wide at the bottom, and slant gradually to five feet above mean low tide and are thirty-five feet wide on the top, with a railway track running the entire distance. Galveston Harbor is from thirty to fifty feet deep, and of ample area to float the fleets of the world. Along the bay front of the city there are extensive wharves, all first class and equipped with all modern conveniences for loading and unloading vessels, including a grain elevator with convenience for unloading 200 cars of grain per day, and of loading four ships at one time at the rate of 80,000 bhls. per hour. Should the thirty foot channel be obtained on the completion of the jetties, Galveston will doubtless become the principal shipping port for the products of what is known as the Central Northwest, and the port of entry for foreign vessels from which goods consigned to China and Japan can be shipped to the Pacific coast over the line of the Southern Pacific system. This company, anticipating such a result, has recently constructed extensive wharves extending out two miles or more from the shore at Santa Monica, near Los Angeles, Cal., from which goods will be re-shipped to vessels sailing the Pacific ocean. Time will doubtless see Galveston one of the largest cities of the Gulf coast. It is already an important port of entry for fruit vessels from the West Indies and South American ports, from which the cargoes are shipped by special trains to Chicago and other Northern cities. Wheat, flour and other products in turn are exported to the West Indies and South American ports.



FIG 11.—VIEW ON TWENTY-SECOND STREET—GALVESTON, TEX.

The streets and avenues of Galveston are broad and laid out at right angles; the former are numbered from one to fifty-seven across the island, from North to South, and the avenues are designated by the letters of the alphabet and run east and west lengthwise of the city and island. Avenue J, or Broadway, is 120 ft. wide, with a neutral strip or esplanade through the center, on each side of which the street car tracks are laid, while the roadways

are outside the tracks. The founders of the city in laying out the streets and alleys devoted, as a public park, every tenth block through the center of the city from East to West, and three separate sites for public markets, also blocks for schools and colleges, while they gave convenient and valuable sites for churches of every Christian denomination. The public school buildings, eleven in number, are as fine as any to be found in the country. Two of them cost upwards of $100,000 each, and are gifts to the city by two public spirited citizens after whom they have been named, known as the Ball High School and the Rosenburg School. The churches are also models of architecture and are generally built of stone and are very costly. The business blocks and residences of its principal citizens are especially fine, the latter being surrounded with well kept lawns which are ornamented with a great variety of shade trees and shrubs, including those of semi-tropical and native growth. We do not remember to have visited any city where the streets are so level, so straight and so trim as are the streets of Galveston.

The climate of the location is both semi-tropical and marine, and the city has a most flattering health record, and is claimed to be the most attractive, coolest in summer, warmest in winter of any of the Gulf cities. The average per cent. of moisture in the atmosphere is 77, and the annual rainfall is 54.48 ins. The maximum temperature for a series of years has been 98 degs., and the minimum 32.



SCENES ABOUT GALVESTON.

WHARF SCENE. SEALY HOSPITAL. BEACH HOTEL. VIEW OF BROADWAY. BALL SCHOOL.

Galveston City Railroad Company.

Having noted the above features, we are quite prepared to find a street railway system equal in every way to the requirements of such a growing and prosperous city.

The street railway lines embrace thirty-nine miles of track, and are all under one management, and are nearly all operated by electric power, there being one mule line, which will soon be electrified. The affairs of the company are controlled by Wm. H. Sinclair, who is president and general manager; H. Kellner is secretary and treasurer, and Wm. H. Griffin superintendent. The same company operates the lines of the Gulf City Railway Company. The lines of the system are advantageously laid out, so that they communicate with every part of the city, and extend west to the new additions which are being opened up, and which provide for the growth of the city towards the west, the only direction in which it can grow. The cars of one line run past the Beach Hotel, shown in the center of group, on this page. This hotel is located on the south side of the city, directly on the beach, and which is a large, handsome structure, is owned and controlled by the same parties who control the street railway company, and is

kept open the year round. In front of the hotel are extensive bathing houses, while the beach, which extends the whole length of the island on the gulf side, is said to provide the most perfect natural roadway to be found in world, the sand being so hard that the shoes of the horses or buggy tires scarcely leave a mark in passing. The tracks are constructed with forty pound T rails, which are laid on stringers which in turn rest on ties which are firmly embedded in the hard sand, the natural formation making a very excellent roadbed. The streets of the city are paved principally with oblong cypress blocks, which have proved very durable in this locality, some sections of the pavement being still in fair condition after seventeen years of service. The blocks are laid on a natural foundation. Several streets have recently been paved with vitrified brick as an experiment, but it is doubtful if any material proves as durable as the cypress blocks. On some of the business streets the tracks are so close together that



WM. H. SINCLAIR,
PRESIDENT GALVESTON CITY RAILWAY CO.

there is not more than ten inches of space between the hand rails of the open cars in passing.

The rolling stock consists of both open and closed cars, the open cars having been run as early as the first of April. The cars were manufactured by Stephenson, the St. Louis Car Company, and by the Laclede Company, and are mounted on Bemis trucks which are equipped with both Thomson-Houston twenty-five horse power and Westinghouse thirty horse power motors, single equipments only being employed, as there are no grades in the line. The original equipment of the lines consisted of Rae motors and trucks which were afterwards discarded, and twenty-one of these old equipments are still stored in the company's barns. With the present equipment thirty-six inch wheels were formerly employed; now, however, the thirty-three inch wheel has been adopted, and these are purchased, for the most part, from A. Whitney & Sons, Philadelphia.

The power station and car barn are located at the corner of I and Center Streets, a short distance from the business center. The car barn and station are of brick, and the barn is the same structure that was employed for storing the cars before the change was made to mechanical power. The power station is a new structure, adjoining the barn, and has a ground dimension of 80 × 120 ft., while the original barn was 280 × 120 ft., and two stories in height, the second story being employed as a repair and paint shop. In place of repair pits, two sections of track are elevated to provide access to the motors.

The boiler equipment consists of seven Cooper return tubular boilers, of 120 H. P. each, arranged in two batteries, and two vertical Buckeye boilers, of 225 H. P. each, the latter having recently been added to the station. The smokestack is 170 ft. high, circular in form, having a twelve foot base, and being nine feet at the top. It rests upon a natural sand foundation. The feedwater is derived from three artesian wells, which are, respectively, 500, 800 and 1,500 ft. in depth, from which a bountiful supply of pure water is obtained.

Slack coal from the Indian Territory is employed for fuel and costs $3.10 per ton delivered in the boiler room, and it requires eleven and a half tons per day to operate the twenty-six cars, which is the average number run.

The engine equipment consists of three machines, one of them being a 400 H. P., tandem compound of the Cooper-Corliss type, and two Buckeye engines of 350 H. P. each, the latter having been but recently installed. The power is transmitted to a countershaft from which the generators are driven; these consist of two Edison machines of 250 H. P. each, which are located between the countershaft and engines, and one Westinghouse M. P. generator of 400 H. P., which is placed beyond the countershaft. There are also two General Electric lighting machines and two Rae generators of 100 H. P. each, which are employed as occasion may require. The belting employed was manufactured by the Chicago Belting Company, and the belt tighteners are of the E. P. Allis make. Hill clutches are employed on the countershaft.

EMPLOYES.

A sliding scale of wages has been adopted in paying the motormen and conductors. For the first three months of service the pay is $45 per month, after that, according to efficiency, it is $50, $55 and $60 per month. The men work from fifteen to seventeen hours per day, but are allowed to lay off every third day, so that they are required to work two days, and are off the third, being required to report the third day only to relieve the men on duty at meal time. This arrangement is said to be very satisfactory to the employes.

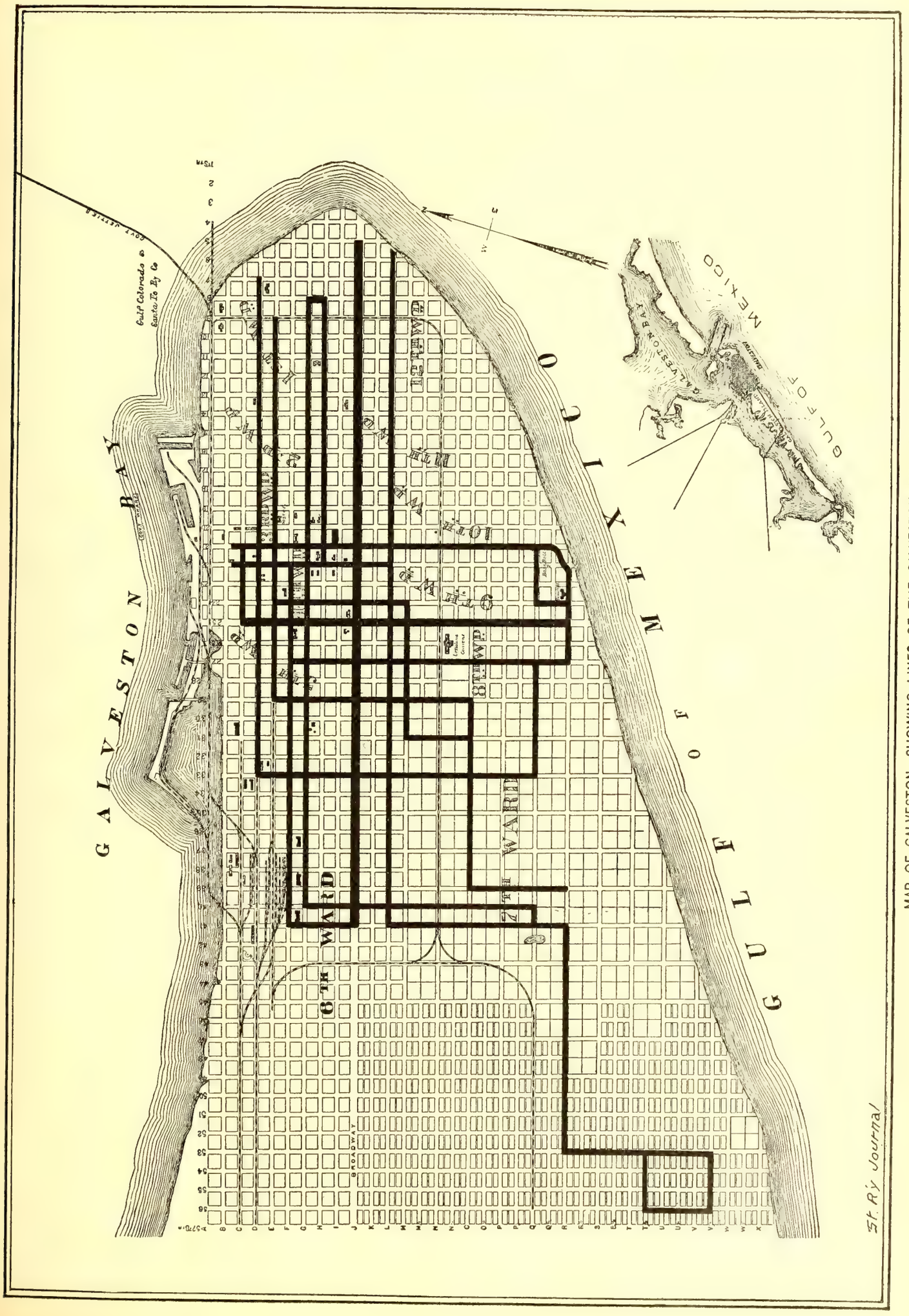
The fare is five cents and no transfers and no tickets. Coupon pass books are provided for city officials and newspaper men. During the summer months there are numerous excursions from all over the state to Galveston, conducted by the steam railways which offer special rates on certain occasions. This results to the advantage of the street railway company whose lines transfer them to the beach and other resorts, so that the lines carried last year over 4,000,000 passengers. We were treated to a run over the principal lines in a special car, which proved a very enjoyable trip, and were not surprised when we had seen the attractive features of the city that it was so popular with excursion parties.

Houston.

Houston is situated inland about fifty miles due north from Galveston at the head of the tide water of the Buffalo bayou, or river, a navigable stream for vessels and barges drawing not more than ten feet of water. It is the real tide water base of the Southwestern system of railroads, embracing thirteen lines, all of which connect here with the waterway. The city is an important manufacturing center, and the products from its mills include sash doors and blinds, brick in large quantities, while the city ranks first in the United States in the manufacture of cotton seed oil, meal and cake. There are also two refineries, and a half a dozen cotton compresses, one of them claiming to be the largest in the world, and three cotton pickeries. The water supply is obtained from artesian wells, twenty in number, ranging in depth from 200 to 850 ft. The water is clear and exceptionally pure and healthful. The pumping machinery is said to be the finest in the Southwest, and to have a capacity of 18,000,000 gals. per day. The streets of the city are laid out in a very irregular manner, although they are generally very wide and straight. The principal streets are paved, the material used being principally vitrified brick. Wooden block consisting of *bois d'arc* (Osage orange) are also extensively used, and there are many graveled streets. The soil is generally sandy, making a good foundation for the street railway tracks.

Houston City Street Railway Company.

This company controls all the street railway lines of the city, embracing thirty-five miles of track, the most of which was equipped with electric power three years ago.



MAP OF GALVESTON—SHOWING LINES OF THE GALVESTON CITY RAILWAY CO.

The lines are advantageously laid out, reaching over the settled portion of the city and extending to the principal suburbs, and the system is exceedingly well managed. One peculiarity of the system is that nearly every one of its thirteen divisions forms a loop, and all center at a given point at the corner of Travis and Prairie Streets, where are located the offices of the company, and by which all the cars pass.

The track construction of the street railway lines in the paved streets consists of forty-five pound T rail supported on chairs. On the Houston Heights division a thirty-five pound T rail is employed which is laid on 6×8 in. stringers having lapped joints and held to gauge by tie rods placed four feet apart; the stringers rest on 2×10 in. planks in place of ties, which in turn rest on a shell foundation of three or four inches in thickness, while the track is ballasted with the same material. The shells for ballast and for roadways are brought in great quantities from Galveston Bay.

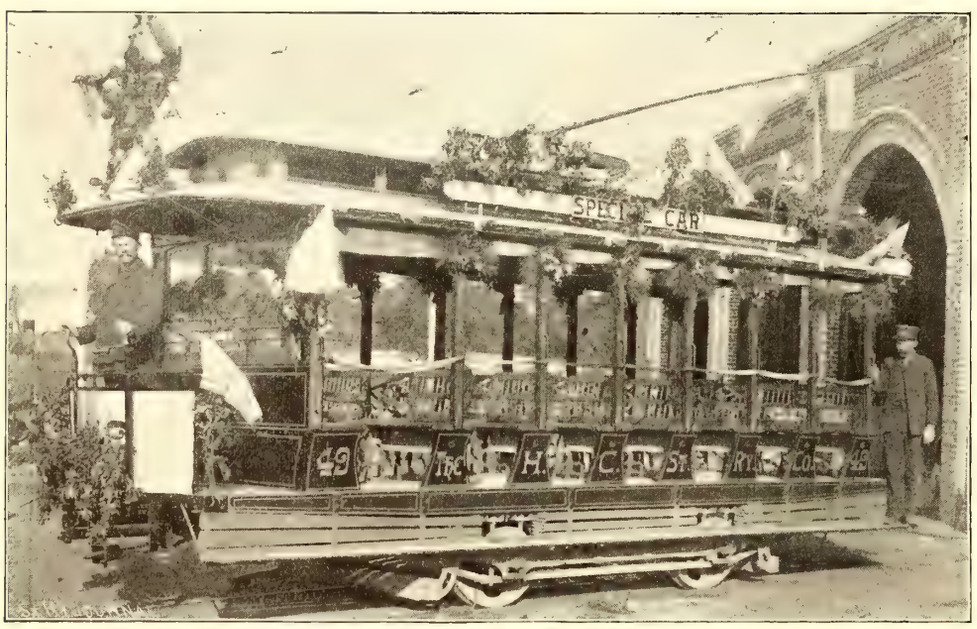


FIG. 12.—SPECIAL CAR—HOUSTON CITY STREET RAILWAY CO.

The power house and car house, which are of brick, are located on Buffalo bayou near Magnolia Street. The barn has a ground dimension of 250×100 ft. with a repair shop on one side 137×27 ft. The power station adjoins the car house and stands immediately on the bank of the bayou, from which water is obtained for the boilers and condensing purposes. The tracks make a loop through the car house so that all the cars come in at one end and pass through. There are a number of repair pits and other conveniences for the repair of cars and motors.

The machine shop is equipped with a number of iron working tools, including a wheel boring machine, a twenty-seven inch lathe, drill press and wheel press, all of Lodge & Davis make. A twelve horse power engine furnishes power for operating machinery. The company does its own armature winding, and also repairs and builds car bodies. The blacksmith shop occupies a detached brick building 24×40 ft.

The boiler equipment consists of three Babcock & Wilcox boilers of 160 H.P. each, which carry steam pressure of 140 lbs. The feedwater is so pure that no scales form in the boiler, and no trouble is had from this cause. There is one independent condenser and one jet condenser of the Reynolds type; there is also a Hoppes live steam purifier.

The fuel consists of Alabama and Indian Territory coal, costing delivered about $4.50 per ton, and it requires on an average seven tons per day to operate the thirty-three cars usually run. On Sundays and holidays from eight to sixteen extra cars are operated.

There are two compound, condensing Allis engines having cylinders 16 × 20–42, rated at 300 H. P. each, which are run at ninety revolutions. The power is transmitted by belts to a countershaft and back from the countershaft to the generators. Ordinarily but one engine is run, but on Sundays and other days when traffic is heavy both are employed.

The generator equipment consists of two General Electric M. P., eighty kilowatt machines and one M. P., 200 K. W. of the same make, also two eighty kilowatt machines of the Edison type. The switchboard is of marble and is provided with General Electric switches and meters. The station and machinery are kept in an exceptionally clean condition. Both open and closed cars, which are manufactured by the leading makers, are being run. Some new trail cars have recently been made which were manufactured in the company's own shops.

The cars are mounted on Bemis and McGuire trucks, there being thirty-five of the former and twelve of the latter. There are twenty-nine single equipments of General Electric 30 or S. R. G. motors, and twelve double reduction motors of the Edison type. Only six cars have double equipments, none of the grades being very heavy. A thirty-three inch wheel is employed, and these are purchased in the city from the Dixon Car Wheel Company, extensive manufacturers of steam car wheels. The home made wheels are said to be giving excellent satisfaction. The wheels are bored, fitted and pressed on in the company's shops. The motormen are provided with seats which consist of a circular stool attached by a hinge to a section of gas pipe which rests in a socket in the platform. The cars are equipped with the Meaker registers.

EMPLOYES.

From 120 to 130 car men are employed, and the pay is twelve and a half cents an hour for the first four months' service, after that fifteen cents an hour for twelve hours' work. In addition, a prize of $10 is given each month to the most efficient motorman and conductor, as an incentive to higher service, and is proving very satisfactory to both the company and employes. The prize is awarded at the end of the month by the three principal officers of the company, who watch the men while at work, and in granting the award efficiency, merit, promptness, neatness and freedom from accidents are the factors which govern. The parties receiving the prize cannot compete again until the third month. Trackmen receive $1.50 per day, aud the force consists of both white and colored men in equal proportions. The cars are run until eleven o'clock at night, except on Tuesday, Thursday and Saturday nights, when they run until twelve o'clock. The employes are furnished with a printed card, on which the routes and the headway are indicated. The headway is from nine to forty minutes, according to the importance of the route.

A NOVEL ADVERTISING SCHEME.

A plan for utilizing the trolley pole for sporting an advertising banner has recently been designed. The banner consists of a triangular frame formed of light strips of wood which is covered by canvass, being about eight feet long and two feet wide. The frame is supported from the trolley pole so that the lower edge is parallel with the roof of the car, and is left free to swing sideways.

Houston is the only city of which we have heard that has ever been treated to a street railway parade. Some months ago a parade of the street cars was improvised, the cars being collected from the different routes and moved one after the other over the different divisions of the line, one or two cars being left on each division for the accommodation of passengers. The cars were handsomely

decorated, the principal one having flags and a number of electric lights, one of the principal designs being a revolving star composed of colored lights. A bobtail car, in which a worn out mule was the only passenger, brought up in the rear, and which bore the legend "Our occupation is gone." The cars were crowded with enthusiastic patrons during the entire parade.

We were treated to a ride over nearly all the routes in the city, and must say that few cities present so many attractions of beautiful homes, fine lawns, ornamental shrubs and shade trees, and imposing business blocks as are to be found in Houston.

Officers of the company: O. M. Carter is president, H. F. McGregor, vice-president and general manager, C. A. McKinney, secretary and treasurer, and F. Mundes, superintendent. C. B. F.

Time Schedule for Running Cars.

We present herewith a time schedule for running cars, drawn up by James Bricker, of the Philadelphia Traction Company, which will be found explicit and compact. The form shows twenty-one cars, together with the starting time for each. The time per trip allowed is about an hour, and 325 trips are arranged for, the headway during the day being three minutes.

The conductor's trip card, or coupon, as it is known in Philadelphia, or way bill, as it is sometimes called, should be marked with the number of the runs before being issued. In this way the latter can find his cars and time as well as his relief for meals.

SCHEDULE.

Car Nos.	1	2	3	4	5	6	7	8	9	10	11	12	1	14	15	16	17	18	19	20	21
Time of Forenoon Cars	5.30	.....	35	40	.....	45	50	...	55	**6**	.....	4	8	12	16	20	24	28	32	36	39
	42	45 × 48		51 × 54		57 × **7**		3 × 6		9 × 12		15 × 18		21 × 24		27 × 30		33 × 36		39 × 42	
	45	48 × 51		54 × 57		**8** × 3		6 × 9		12 × 15		18 × 21		24 × 27		30 × 33		36 × 39		42 × 45	
	48	51 × 54		57 × **9**		3 × 6		9 × 12		15 × 18		21 × 24		27 × 30		38 × 36		39 × 42		45 × 48	
	51	54	57	**10**	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51
	54	57	**11**	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54
Time of Afternoon Cars	57	**12**	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57
	1	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	**2**
	3	6	9	12	15	18	21	24	27	30	**33**	36	39	42	45	48	51	54	57	**3**	3
	6	9 × 12		15 × 18		21 × 24		27 × 30		33 × 36		39 × 42		45 × 48		51 × 54		57 × **4**		3 × 6	
	9	12 × 15		18 × 21		24 × 27		30 × 33		36 × 39		42 × 45		48 × 51		54 × 57		**5** × 3		6 × 9	
Time of Night Cars	12	15 × 18		21 × 24		27 × 30		33 × 36		39 ×	42	45 ×	48	51 ×	54	57 ×	**6**	4	8	12	.....
	16	20	24	28	32	36	40	44	48	.....	52	56	.....	**7**	4	.....	8	12	.....	16	.....
	20	24	28	32	36	40	44	48	52	.....	56	**8**	.....	4	8	.....	12	16	.....	20	.....
	24	28	32	36	40	44	48	52	**56**	.....	**9**	4	.....	8	12	.....	16	20	.....	24	.....
	28	32	36	40	44	48	52	56	**10**	.....	4	8	.....	12	16	.....	20	25	.....	30	.....
	35	40	.....	45	50	55	.....	**11**	5	.....	10	15	.....	20	25	.....	30	35	.....	40	.....

RUN GUIDE TO SCHEDULE.

Early Runs.	Forenoon Cars.	Afternoon Cars.	Late Runs.	Afternoon Cars.	Night Cars.	Swing Runs.	Forenoon Cars.	Night Cars.
1	1	9	14	1	9	22	14	1
2	2	10	15	2	11	23	15	2
3	3	11	16	3	12	24	16	3
4	4	12	17	4	14	25	17	4
5	5	13	18	5	15	26	18	5
6	6	14	19	6	17	27	19	6
7	7	15	20	7	18	28	20	7
8	8	16	21	8	20	29	21	8
9	9	17						
10	10	18						
11	11	19						
12	12	20						
13	13	21						

If the trippers are put on they will run in the positions marked × and while running the headway will be two minutes.

Electric Railways for Brussels.

The managers of the Brussels Tramway Company have decided to install the electric system on two of its principal lines, having an aggregate length of five and a half miles. The work of construction will be pushed rapidly forward. These two lines have each a comparatively important traffic, are double tracked, and have grades from 4.6 to 4.8 per cent., extending a distance of from a quarter to half a mile. The trolley system will be used.

The central station will be located on Rue Brognitz. The current will be supplied by five dynamos of 100 K. W. each, furnished by the Union Elektricitäts Gesellschaft of Berlin, which will install the entire plant. The engines will be of 160 H. P., and of the McIntosh & Seymour type.

THE plan of an electric railway between Philadelphia and Harrisburg is being rapidly pushed forward under the direction of the Pennsylvania Traction Company, of which J. J. Patterson, of Lancaster, is president. The roadbed will be of the best construction, a seventy pound rail will be used, and there will be no grades exceeding 4 per cent. The company is now in consultation with the electrical manufacturing concerns, in reference to the question of installing a number of power stations or long-distance transmission of power plants with motor generators.

Organization of a Connecticut Street Railway Association.

Representatives of several street railway companies of Connecticut met at the Tontine Hotel, New Haven, on April 3, for the purpose of forming a state association.

The matter of forming such an association has been considered for several months. Among those present were H. Holton Wood, of Derby Street Railroad, Derby; F. S. Wardwell, of Edgewood Avenue Railroad, New Haven; M. R. Smith, George Terry and A. M. Young, of Waterbury Street Railroad, Waterbury; J. M. Townsend, of Lake Saltonstall Railroad; G. A. W. Dodge, S. H. Wagner and David Corey, of New Haven Street Railway Company; R. A. Fosdick, of Stamford Street Railroad; E. S. Goodrich, of Hartford & Wethersfield Railroad, H. S. Parmelee, of Fair Haven & Westville Railroad; Israel A. Kelsey, of Winchester Avenue Company, and E. B. Hill, of Norwalk Street Railroad, Norwalk.

H. Holton Wood presided and R. A. Fosdick acted as secretary. It was voted to form an organization which will be incorporated as the Connecticut Street Railway Association. By-laws were then adopted, and the purpose of the organization, as set forth, is as follows:

"The object of this Association shall be the acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of street railways, and the diffusion of this knowledge among members of this Association, with the view of increasing the accommodations of passengers, improving the service, and the establishment and maintenance of a spirit of fraternity among the members of the Association by social intercourse, and the encouragement of cordial and friendly relations between the roads and the public; also to harmonize the interests of the street railway companies of Connecticut and to secure uniformity in regulating the construction and operation of such companies."

It was then voted to hold the annual meeting of the Association on the third Wednesday in November, and the headquarters will be where the secretary resides.

The following named officers were elected for the ensuing year: H. Holton Wood, president; Henry S. Parmelee, vice president; E. S. Goodrich, of Hartford, treasurer; R. A. Fosdick, of Stamford, secretary; A. M. Young, of Waterbury, G. A. W. Dodge and I. A. Kelsey, executive committee.

THE Metropolitan Street Railway Company, of New York, on April 17, received permission from the State Railroad Commissioners to cable its Lexington Avenue line

Practical Notes on Rope Driving—Part II.

By M. E.

Strength of Ropes.—The strength of rope necessarily depends upon the tenacity of the individual fibres of which it is composed, but at least only a relatively small proportion of the aggregate fibre strength is realized in the finished rope. This loss is, in the main, occasioned by the "twist" given to the strands in forming the rope, and which causes the individual fibres to lie in spirals, in which form they are obviously in a less advantageous position to resist tensile stress than if laid side by side. It will be clear that the harder the rope is twisted, the greater will be the angle which the fibres form with the direction of the axis of the rope; consequently, the stress on the fibres becomes more of a bending and less of a direct tensile character, thus diminishing the ultimate strength of the rope. And here it may be said that it is desirable to clearly distinguish between "hard" and "lightly" twisted rope *of the same diameter* on the one hand, and those formed *of the same number of yarns* on the other. Thus, as mentioned in the first article, a "hard" twisted rope is materially stronger than a soft or "lightly" twisted rope *of the same diameter.* But by hard twisting a lightly twisted rope, its strength is reduced, for the reason just referred to. In the first case, although each fibre is weakened by hard twisting, the greater number of fibres contained in a rope of given diameter more than compensates for the weakening effect of the twist. In the second case there is no such compensating influence.

The reduction of strength due to twist will be greater in those fibres or yarns farthest from the center of the strand, for if a definite amount of twist be given to a bundle of fibres of uniform length, it is clear that the outer fibres will lie in a much longer spiral path than those near the center of the bundle. Consequently, they will be subjected to a considerable initial stress, while they will also be much less effective in resisting the working stress on the rope. The larger the rope, the more pronounced will this unequal distribution of stress become; this no doubt accounts, to a large extent, for the lower strength, per unit of sectional, of large ropes as compared with those of smaller diameter.

TABLE I.

ULTIMATE STRENGTH OF ROPES.

Diam. of Rope	Hemp.	Manilla.	Cotton.
½ ins.	2,100 lbs.	2,000 lbs.	1,750 lbs.
⅝ "	3,150 "	3,000 "	2,650 "
¾ "	4,400 "	4,200 "	3,700 "
⅞ "	5,750 "	5,600 "	4,950 "
1 "	7,350 "	7,000 "	6,200 "
1⅛ "	8,900 "	8,600 "	7,500 "
1¼ "	11,000 "	10,500 "	9,250 "
1⅜ "	13,000 "	12,500 "	11,000 "
1½ "	15,500 "	14,900 "	13,200 "
1⅝ "	18,000 "	17,100 "	15,000 "
1¾ "	20,300 "	19,400 "	17,000 "
2 "	26,200 "	25,000 "	22,000 "

Various endeavors have been made to minimize the loss of strength due to twist, and in some methods of manufacture this has been accomplished by spirally winding around a central core, successive layers of yarn, until the full diameter of the strand is obtained. In this way the lengths of the yarns gradually increase as the diameter of the strand augments, and each yarn is thereby enabled to approximately take its share of the load. Recent tests have demonstrated the fact that by this method of construction the strength of cotton rope is very materially increased. It is also claimed for interstranded rope that it lasts longer, since the wearing away of the outer layers still leaves a complete, though somewhat smaller, rope to do the work. This rope is somewhat more costly to manufacture than the older construction, but the material advantages gained would appear to far outweigh this objection.

The strength of hemp, manilla or cotton ropes varies considerably and no very uniform results are obtainable, while, as previously mentioned, the ultimate strength per square inch of section is less in the larger sizes than in the smaller. Table I gives what may be taken as fairly representative values of the ultimate strength of ropes as deduced from the results of a number of experiments.

The mistake is frequently made of assuming that cotton rope is considerably weaker than either hemp or manilla. It is certainly the weakest rope of the three, so far as ultimate strength is concerned, but as the working stress is only a very small proportion of the ultimate, the difference in strength becomes insignificant. In any case it is probably wholly neutralized by the more pliable nature and better wearing qualities of the cotton rope. Henceforth, therefore, we will consider hemp, manilla and cotton rope to be of practically equal strength and that the maximum working stress to which they should be subjected should not exceed $200d^2$—that is, about 3 per cent. of their ultimate strength—for durability and satisfactory working. The following table gives exact and approximate values of the working stress for the sizes of ropes usually employed:

TABLE II.

WORKING STRESSES FOR ROPES.

d= Diam. of Rope. Inches.	Maximum Total Stress in lbs.	
	Exact.	Approximate.
½	50	50
⅝	78	80
¾	112	110
⅞	152	150
1	200	200
1⅛	253	250
1¼	312	310
1⅜	378	380
1½	450	450
1⅝	528	530
1¾	612	610
2	800	800

Friction, Tension, Rates, etc.—The principles involved in rope transmission are somewhat similar to those underlying belt driving, but with somewhat important modifications which call for careful attention. Considering the tension in an endless rope stretched over two grooved pulleys, from one of which power is to be transmitted to the other, it will be seen that when at rest the initial tension in each side of the rope, is the same in amount. When, however, the driver commences to rotate, the tension in the driving side is increased, while that in the following side is diminished by the same amount, the *average* tension remaining unaltered. This action continues until, should the conditions be favorable, the resistance of the load is overcome and the driven pulley rotated. It is obvious, however, that unless there is sufficient adhesion between the rope and the pulleys, the former will slip in the groove of that pulley which offers the least frictional resistance.

Without entering into an elaborate mathematical investigation of this part of the subject, it may here be sufficient to state that the resistance of a rope to slipping in the pulley groove depends: (1) upon the coefficient of friction, μ, existing between the surface of the pulley groove and the rope. (2) on the angle, φ, of the groove; (3) upon the arc of contact or portion of the pulley circumference embraced by the rope; (4) upon the initial tension, and (5) indirectly upon the velocity of the rope.

Experimental data are wanting as to the coefficient of friction between manilla or cotton rope and cast iron pulleys. Its value will obviously vary greatly under different circumstances and as regards the condition of the rope, its greasiness, etc. With dry hemp ropes a coefficient as high as .28 has been experimentally determined, but under the conditions of practice, and with the ropes sufficiently lubricated, it would not, in the writer's

opinion, be safe to count upon more than one-half of this amount.

Pulley Grooves.—The action of the wedge-shaped groove has next to be considered. The primary effect of this is to increase the resistance to slipping, since the friction coefficient has now to be multipled by the cosecant of half the angle of the groove, so that, assuming a real coefficient of .14, the virtual coefficients of friction become:

For Groove-angles of	Virtual Coefficient of Friction=
30 degs.	.54
35 "	.46
40 "	.41
45 "	.36
50 "	.33
55 "	.30
60 "	.28

The most suitable angle of pulley groove is still, to some extent, a mooted point, but the consensus of opinion points to an angle of 45 degs. for cotton rope as giving the best results in practice. It appears scarcely reasonable to suppose, however, that the most advantageous angle for cotton is necessarily also the best for manilla rope. The less yielding nature of the latter material would suggest that a somewhat more obtuse angle (of about 40 degs.) would be found more suitable, so far, at least, as regards durability. The most suitable angle of groove is that which ensures the maximum frictional grip being obtained while necessitating the least expenditure of work in releasing the rope from the pulley groove and causing relatively the least injury to the material. It appears evident, therefore, that the compromise between these somewhat conflicting requirements will be met at a different groove-angle for materials which differ so widely in their nature as do manilla and cotton.

Another effect results from the employment of fibrous ropes in V-shaped grooves; and one which is often completely overlooked. As mentioned above, the tension in the following side of a rope transmitting power is much less—perhaps one fourth or one-fifth—of that in the driving side. Now that portion of the rope which is for the moment entering the groove of the driven pulley, is subject to the slack side tension; but as it passes round the pulley, the stress in the rope gradually increases until when it leaves the groove, the tension is that of the driving side. Were the rope of an unyielding substance, no effect would result, but with a fibrous rope, the natural result of this gradual increase of tension is to cause the rope to sink deeper into the groove, as the point of release is approached. The contact line of the rope and pulley surfaces is, therefore, a spiral of smali radial difference and it follows therefore, that before slipping can occur, not only the radial wedge effect of the groove, but also what the writer has called the *circumferential wedging effect*, must be overcome.

One other point deserves mention as being specially pertinent to the application of ropes to dynamo driving. Other conditions being equal, slipping will usually occur on the smaller pulley, since, in the absence of any arrangment to the contrary, it will have the smaller arc of contact. Two principal methods of increasing the resistance to slipping on the small pulley have been adopted in independent rope transmissions. The first is to increase the coefficient of friction by using other material than cast iron for the pulley surface. This has been done in some cases by using a cast iron pulley, the rim being covered with hard wood in which the grooves are formed. This affords a frictional grip about 30 per cent. greater than with iron pulleys, and the only objection to the device is the tendency of the timber to warp slightly, and also of the rope to wear the grooves to some extent. The second method consists in using more acute grooves in the smaller pulley than in the larger, thus increasing the frictional grip in compensation for the smaller arc of contact.* If the friction coefficient be taken equal in both cases, and α_1 and α_2 be the angles of the grooves of the large and small pulley respectively, while φ_1 and φ_2 represent the number of degrees in the corresponding arcs of contact. then

$$\text{Cosec } \frac{\alpha_1}{2}\varphi_1 = \text{Cosec } \frac{\alpha_2}{2}\varphi_2$$

Thus, if $\varphi_2 = \frac{2}{3}\varphi_1$ and α_1 is taken at 45°

$$\text{Cosec } \frac{\alpha_2}{2} = 2.613 \times \frac{3}{2} = 3.91$$

and the value of α_2 required is thus found to be 30°; this therefore, is the angle of groove suitable for the small pulley. In most respects the latter of the two arrangements appears preferable; in some cases a combination of the two may be found advantageous.

In "continuous rope transmissions"—in which one long, endless rope is employed wound in successive coils alternately around each of the two pulleys—the requisite amount of grip on the small pulley can be readily obtained by using a "winder" pulley. In this arrangement the smaller pulley is wider and contains more grooves than the other, and the rope—after passing successively over the two pulleys until all the grooves of the larger and a similar number of the smaller pulley have been filled—is then led over an idle "winder" pulley, thence back to the smaller pulley and back and forth over these two pulleys, until all the grooves of the small pulley are filled. The rope is then passed over a tension sheave and recommences its circuit. It is questionable, however, whether some such arrangement as that devised by Mr. Miller, is not quite as efficient as this somewhat complicated system, while the former certainly has the advantage of lower first cost and smaller space occupied—ever considerations of importance in the dynamo room. As will be readily understood, the resistance to slipping could be much increased by increasing the initial tension, *i. e.*, by stretching the rope more tightly over the pulleys. This plan, however, leads to a greater loss of power not only by reason of the increased axle friction, but also by causing the rope to wedge more tightly into the groove than is desirable. Evidently both effects tend to impair the durability of the plant and to increase the risk of breakdown.

One other method of diminishing slip is by using a "binder" pulley, which by increasing the arc of contact of the rope with the smaller pulley, augments the frictional grip. The use of this device in belt transmission is common, but with rope driving the objection is that it results in contraflexure of the rope, which it is always very desirable to avoid. With wire rope it is found that reverse bendings of moderate amount reduce the life of the rope by from 15 to 20 per cent., and it seems only reasonable to suppose that a somewhat similar, though possibly not so great an effect will be produced in the case of fibrous ropes.

Horse Power of Ropes.—In order to obtain a rational estimate of the power transmitting capabilities of driving ropes, it will be necessary to revert to the tensions existing in the driving and following sides, and which has already been briefly referred to. Representing by T and t the tensions on the driving and following sides, respectively, it will be seen that since these are opposing forces, the net tension available for power transmission is $T-t$, so that if R is the resistance overcome at the circumference of the driven pulley, then $T-t=R$. The ratio of the tensions, $r\left(=\frac{T}{r}\right)$ depends upon the frictional grip of the rope in the pulley groove, and at the instant when stopping is about to occur, it can be shown that

$$\log r = 0.007578\,\mu\,\varphi_2 \quad . \quad . \quad . \quad . \quad . \quad (1)$$

μ being, as before, the co-efficient of friction, and φ_2 the number of degrees in the smaller arc of contact.

The resistance overcome at the circumference of the pulley when a given amount of power is being transmitted is

$$R = \frac{H\,P \times 33{,}000}{V}$$

in which H P is the horse power transmitted, and V the velocity of the rope in feet per minute. Then as $\frac{T}{t} = r$

*The use, in continuous rope transmissions, of sheaves of different diameters having more obtuse grooves in the larger than in the smaller, forms the subject matter of a patent granted to T. S. Miller of New York, (U. S. patent No. 444,919, Jan. 20, 1891.)

and $T-t=R$, it follows that

$$R=T\left(1-\frac{1}{r}\right)=T\left(\frac{r-1}{r}\right) \quad . \quad . \quad . \quad . \quad (2)$$

To facilitate calculations of this kind, the writer has calculated from (1) the values of $\left(\frac{r-1}{r}\right)$ given in the following table.

TABLE III.—TABLE OF ROPE POWER CONSTANTS.

$$c=\frac{r-1}{r}$$

Smallest Arc of contact in degs.	Virtual Coefficients of Friction.										
	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70
80	.242	.290	.337	.382	.425	.465	.500	.535	.567	.595	.622
84	.253	.305	.354	.401	.444	.484	.519	.553	.585	.614	.640
88	.264	.319	.367	.415	.459	.500	.535	.569	.601	.631	.658
92	.275	.328	.382	.431	.473	.514	.553	.587	.618	.648	.674
96	.285	.342	.394	.444	.490	.530	.567	.601	.633	.664	.690
100	.295	.354	.408	.456	.502	.545	.583	.617	.649	.678	.705
104	.305	.363	.418	.470	.517	.559	.597	.632	.663	.693	.719
108	.315	.375	.431	.484	.530	.572	.611	.645	.677	.706	.732
112	.324	.386	.444	.497	.543	.585	.624	.660	.691	.720	.746
116	.333	.398	.456	.509	.555	.598	.637	.672	.704	.732	.758
120	.342	.408	.468	.521	.567	.611	.650	.683	.715	.743	.769
124	.350	.418	.476	.532	.580	.622	.662	.695	.727	.755	.781
128	.359	.428	.490	.543	.591	.634	.673	.706	.737	.765	.791
132	.367	.438	.498	.553	.601	.645	.683	.718	.748	.776	.801
136	.378	.447	.510	.563	.612	.656	.694	.728	.758	.785	.810
140	.386	.456	.519	.574	.624	.666	.705	.739	.768	.795	.819
144	.394	.465	.528	.585	.634	.677	.715	.748	.778	.805	.827
148	.404	.476	.539	.595	.644	.686	.725	.758	.787	.813	.836
152	.411	.484	.550	.604	.654	.697	.734	.767	.796	.821	.844
156	.418	.495	.556	.614	.663	.706	.743	.776	.804	.829	.851
160	.428	.502	.569	.624	.672	.715	.752	.784	.812	.837	.858
164	.435	.512	.576	.632	.681	.724	.761	.792	.820	.844	.865
168	.444	.519	.585	.641	.690	.732	.769	.800	.827	.851	.871
172	.450	.528	.593	.650	.699	.741	.777	.808	.834	.857	.878
176	.459	.535	.603	.659	.707	.749	.784	.815	.841	.864	.883
180	.465	.543	.611	.666	.715	.757	.792	.822	.848	.870	.889

The method of determining the horse power of a rope by means of the table is as follows: Find from the table the constant corresponding to the number of degrees in the arc of contact of the smaller pulley and the virtual coefficient of friction, the angle of the groove, condition and material of rope, etc., being taken into account in selecting the latter value. Multiply the constant so found by the maximum tension allowable in the rope, according to size and material (see Table II.). The product multiplied by the velocity of the rope in feet per minute and divided by 33,000, gives the maximum horse power transmitted. As will be seen later, the effect of centrifugal force requires to be considered when high speeds are employed. If it be required to determine the number of ropes necessary to transmit a definite amount of power, the constant taken from the table is to be multiplied by the velocity of the rope in feet per minute and divided by 33,000 H. P. This will give the required aggregate tension on the ropes, and their diameter d and number N may then be selected as circumstances may dictate.

The foregoing is an accurate method of computing the power of ropes, but for ordinary conditions the approximate rules subsequently given will be found sufficiently correct for all practical requirements.

(*To be Continued.*)

The Thomson Welding Company has shipped a motor dynamo car to Brooklyn, N. Y. It was built for the Johnson Company, of Johnstown, Pa., and will be used in Brooklyn by the electrical department of that company for welding rails for the Nassau Electric Railroad.

The promoters of the new electric railroad between Rockford (Ill.) and Dixon recently held a meeting in the latter city, at which it was decided to build at once between Oregon and Dixon. J. S. Ticknor, of Rockford, is president of the company.

Notes From England.

(*From our London Correspondent.*)

The question of the price to be paid by local authorities on purchasing tramways from the owning companies under the terms of the Tramways Act is still undecided, for conflicting decisions of different courts of law call for a speedy judgment by the House of Lords, which is the supreme court of appeal for the United Kingdom. Since the London Street Tramways Company obtained a decision in favor of rental value, the London County Council has taken the case to the English Court of Appeal, where it has been heard, but judgment has not yet been given. In whichever way the case is decided, it is certain that an appeal will be made to the House of Lords. In Scotland the case of the Edinburgh Town Council and the Edinburgh Street Tramways Company has been decided in a totally different way. The Outer House judge in the Court of Session decided in favor of the Town Council, namely, that structural, not rental, value should be paid for the lines. On appeal this view was affirmed. With the promptitude which distinguishes Scotch law from English, the Edinburgh case has already been appealed to the House of Lords, and just at the time of writing I see it intimated in the official records of the House of Lords that the time for the lodging of the printed case for the appeal is fixed for a date not later than May 24. Thus it is probable that the final decision in the Scotch case will be first after all. In regard to Leeds, the litigation has not yet been opened. Until these cases are finally settled, the tramway companies and the local authorities will not know how they are to stand in the future.

Tramway men rejoice that the Leeds Town Council has definitely decided not to work the lines itself, but to let them to a company.

The Liverpool Elevated Electric Railway has been attracting a good deal of attention lately, as two exhaustive papers upon it were read recently at a crowded meeting of institution and civil engineers, and at two subsequent meetings the whole subject was exhaustively discussed by many of the foremost civil and electrical engineers in England. The equipment and operation of the line were highly praised, and it was mentioned as showing the excellence of the electrical arrangements and workmanship that the leakage does not exceed two amperes. Since the company took over the working on January 1, from the contractors, it has found the traction charges to be only about 7.5 cents per train mile. Previously the contractor was paid 8 cents. The train, with passengers, weighs about thirty-eight tons. For the half year ending December last, the total expenses were twenty-seven cents, and total receipts thirty-six cents per train mile. The 5 per cent. preferred dividends were paid, and 1 per cent. on the common stock.

The City & South London Electric Railway is not yet improving its position, as for the past half year the ordinary shareholders have to be content with a dividend of only ⅝ per cent. against ¾ per cent. in the previous half year. It is gratifying, however, that this result is not due to an increase in the working expenses, but to a falling off in the number of passengers. This evil can only be temporary. The total working expenses per train mile were 31.62 cents, which is the lowest since the line opened. In the previous half year they were 33 cents, which was then the lowest on record. The receipts per train mile were 47.32 cents against 51 08 cents in the previous half year. The weight of the train is almost exactly the same as that on the Liverpool Elevated Electric Railway, so that it will be seen the advantage is with the latter so far as expenses are concerned, though on the other hand the receipts are also lower. The Liverpool line has the advantage, too, of having cost less than a third of the money per mile which was required for the London line with its deep tunnels.

Owing to a difficulty arising from the narrowness of the road at one point, it appears that the extension of one and a half miles of street of the Brixton cable tramway cannot be carried out. The extension will, however,

reach about three-quarters of a mile. It is probable that negotiations will be opened for widening the road so that the whole of the original scheme may be realized.

The issue to the public of preferred stock in the new Edinburgh & District Tramway Company, which has been organized by Dick, Kerr & Company, to supply capital for working the recently leased Edinburgh lines, has been a great success. The amount was £75,000 and though there was very little advertising, the second day the directors found that the capital had already been applied for twice over, and the lists were thereupon closed.

The prospectus has just been issued of the Hampstead & St. Pancras Railway, so that work may soon be started. This is one of the Greathead tunnel railways dealt with in the articles in the STREET RAILWAY JOURNAL on underground lines for London. It was expected that, as the grades are heavy, cable traction would be used, but the directors have decided to adopt electricity. The result will be interesting. The Waterloo & City Railway prospectus has also been issued, but not, I believe, to the public, as the stockholders of the London & South Western Railway Company, which is to work the new line, were prepared to take up the whole issue. A 3 per cent. guaranteed dividend is to be paid, with a proportion of any further profits to accrue.

All difficulties with the local authority in the way of adopting electricity on the Coventry tramways seem now to have been overcome, and it is expected that the work of conversion will shortly be commenced.

Gas Motors.

According to a report of United States Consul General Mason, at Frankfort, Germany, a great deal of attention is being paid at the present time by street railway engineers in Europe to gas motors. Practical trials have been made at Neufchatel, Switzerland, and at Dresden, with satisfactory results. Neufchatel cars run at an average speed of eleven miles an hour, at a cost for gas of 2 9 cents per car mile, with gas at $1.09 per 1,000 ft. Excellent results have also been obtained at Dresden.

Genett Improved Air Brake.

The desirability of having a more effective brake for street cars than that which can be operated by hand power showed itself early in the use of electric cars, and the greater weight of electric cars and the higher speed at which they are run, makes the question of stopping them an entirely different problem than when horse power was used as a motive power. The use of air for operating power brakes of this kind naturally suggested itself, owing to the extensive use of this style of brake for steam cars, and to the fact that it had shown itself superior to any other agent in many years of trial on these roads.

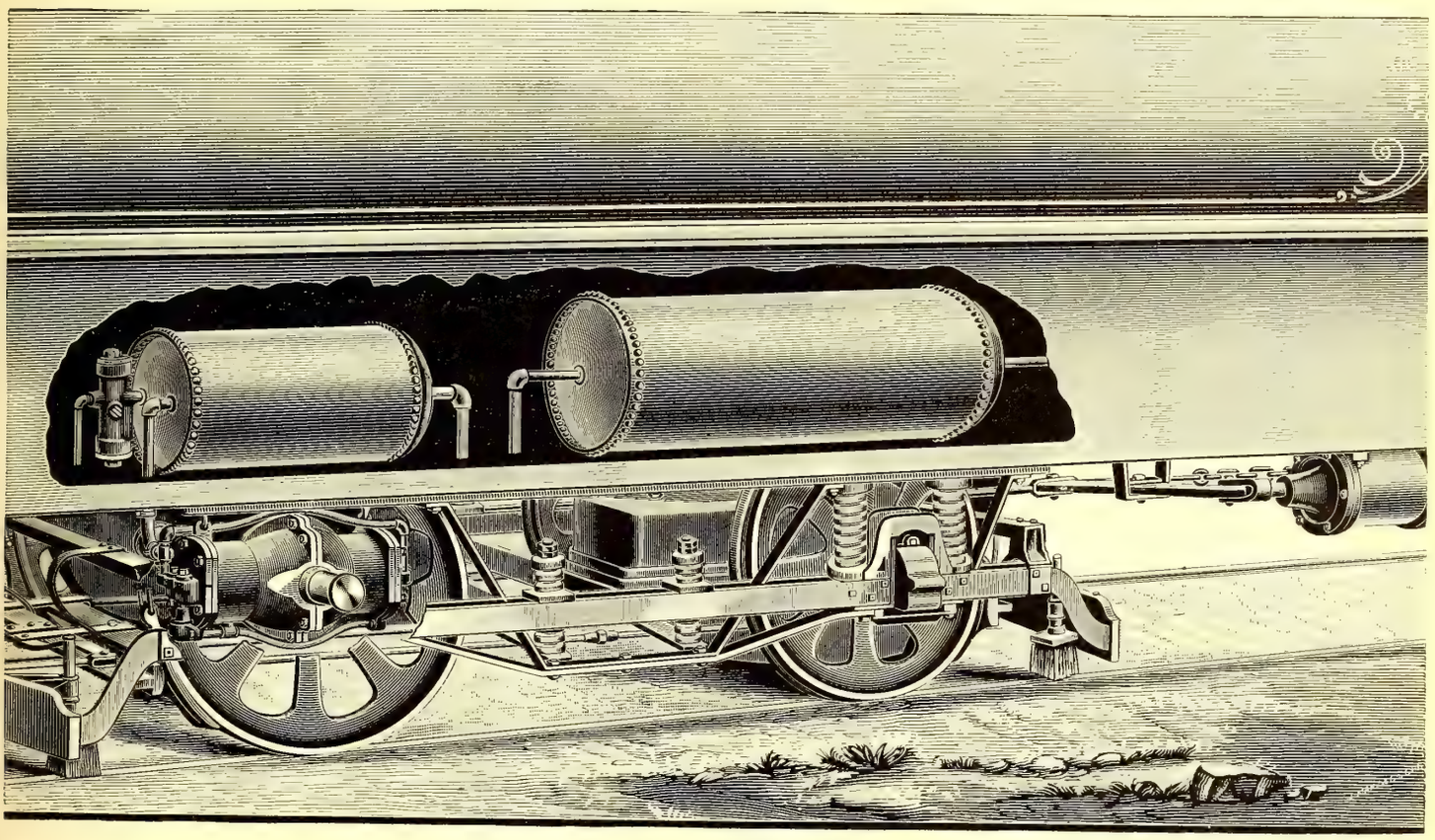


FIG. 1.—CAR EQUIPPED WITH GENETT DUPLEX AIR BRAKE SYSTEM.

Having these facts in mind, the Genett Air Brake Company of Chicago and New York, placed upon the market its system of air brakes, which has shown itself particularly well adapted to the exigencies of street car service.

We present on this page engravings showing the improved duplex system of air brakes of this company, which, for simplicity, durability and convenience commends itself to street railway managers. An important improvement adopted in this system is the encased air compressor (Fig. 4). The experience of electrical engineers in street railway work has demonstrated the desirability of encasing the electric motor and all moving parts located under the car. As will be seen, this idea has been closely followed in the apparatus illustrated.

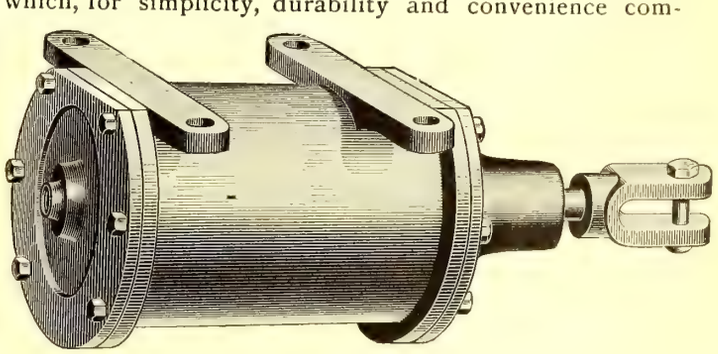


FIG. 2.—BRAKE CYLINDER—GENETT SYSTEM.

The compressor shown in Fig. 4 is just one quarter size, which makes the entire length less than twenty inches. It is double acting, is mounted directly on the axle, and is completely encased so as to entirely protect it from the dust and dirt of the street. This casing also makes the equipment entirely noiseless in its operation. The working parts of this compressor run in oil so that the amount of care required is reduced to a minimum, and the compressor will run without attention, except to keep a full oil supply. This type of compressor can be attached to all cable cars, and to any electric motor car where there is a free axle. Where the large type of motors are mounted on both axles, one of them can be shifted so as to get the combined axle space between motor and hubs of wheels. This has been done in a satisfactory manner on a number of lines which have been equipped. With the present tendency in building smaller motors, the required axle space on new equipments can be readily had.

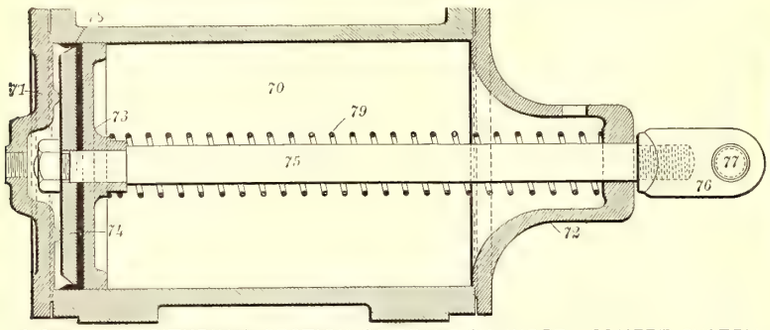


FIG. 3.—LONGITUDINAL SECTION OF BRAKE CYLINDER—GENETT SYSTEM.

In starting out, the compressor fills the reservoirs to a pressure of thirty pounds before the car has traveled 360 ft. In making a stop only two or three pounds registered pressure is required, and this the compresssor furnishes again before the car has traveled sixty feet. The reservoirs, however, have sufficient capacity so that they hold in reserve ten times the amount of air required to stop a car even without additional supply; hence the air reservoir is practically inexhaustible. After the reservoirs are filled to their proper pressure a regulator cuts off the connection between them and the compressor, so that no more air is pumped into them, and the compressor revolves without taking power from the axle. The regulator also operates so that the compressor does not commence to pump air into the cylinders until the car has attained a little headway. In this way there is no added load on the motors on account of the air brake at the time of starting the car.

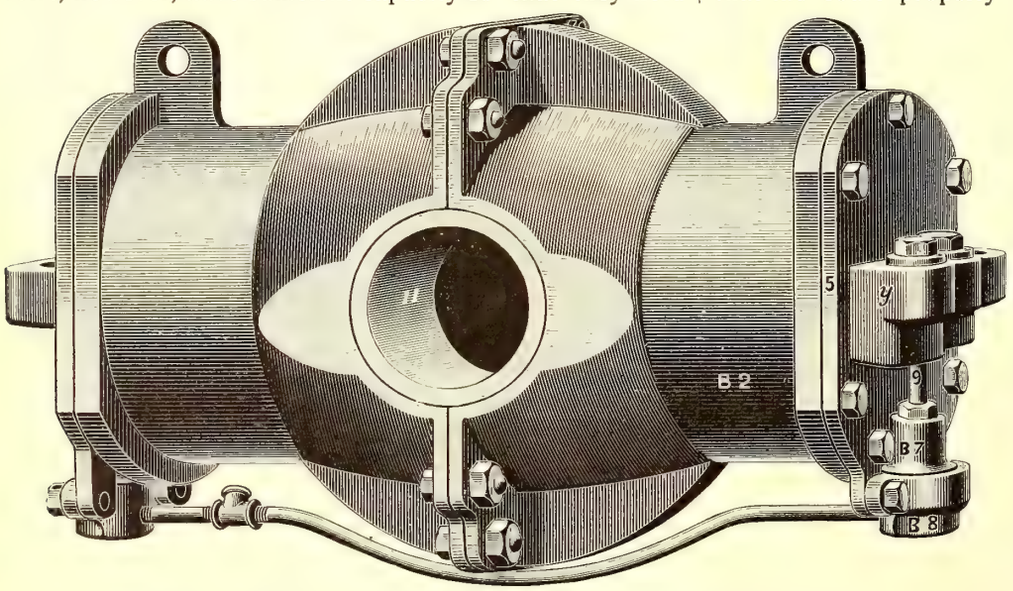


FIG. 4.—DUPLEX COMPRESSOR, ONE-FOURTH SIZE—GENETT SYSTEM.

A view of the controlling valve employed with the Genett air brake system is shown in Fig. 5 This valve is carried on the platform and completely places both the brake cylinder and air pump under full control of the motorman, and enables him to instantly apply the brake shoes either in a mild manner for slowing down the car or making a service stop or bringing the full pressure to the wheel when the emergency stop is wanted. The handle is detachable like the handle of the motor controller, so that when the motorman changes platforms at the end of a trip he can carry the handle with him and attach it to the controlling valve at the other end of the car. Where cars are operated in trains, the only apparatus required on the trail cars consists of the brake cylinder, hose coupler and the ordinary brake gear, the air being taken from the reservoir on the motor car. The brakes on the trail cars are set and released by the motorman simultaneously with the motor car, only one controlling valve being employed.

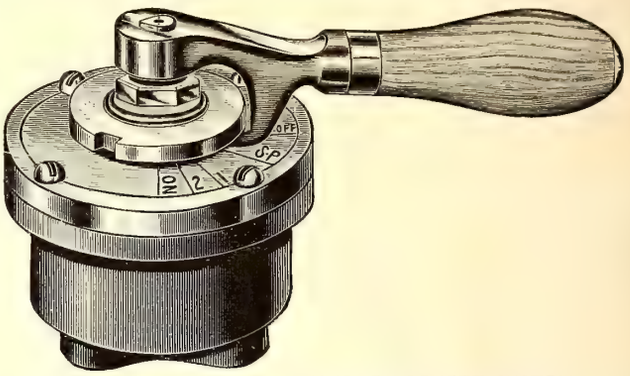


FIG. 5.—CONTROLLER HANDLE—GENETT SYSTEM.

In an action brought against the Little Rock and Augusta Street Railway Companies of Arkansas, February 10, 1894, for the death of a passenger, caused by a collision between a street car and a steam car, it was held that the court properly charged that the jury could find a verdict against the street car company from the mere fact of the collision, unless the presumption of negligence on its part was rebutted; but that, to justify a verdict against the railroad company, a preponderance of the evidence must show negligence on its part contributing to the accident.

Also, a request to instruct that the railroad men were justified in supposing that the street car driver would stop before going upon the railroad track, and unless they were guilty of negligence in not stopping their train quick enough after discovering the peril of the street car, the jury could not find a verdict against the railroad company, was properly refused, since the railroad men, before seeing the car, might have done or omitted some act which made it impossible or more difficult, to prevent the accident.

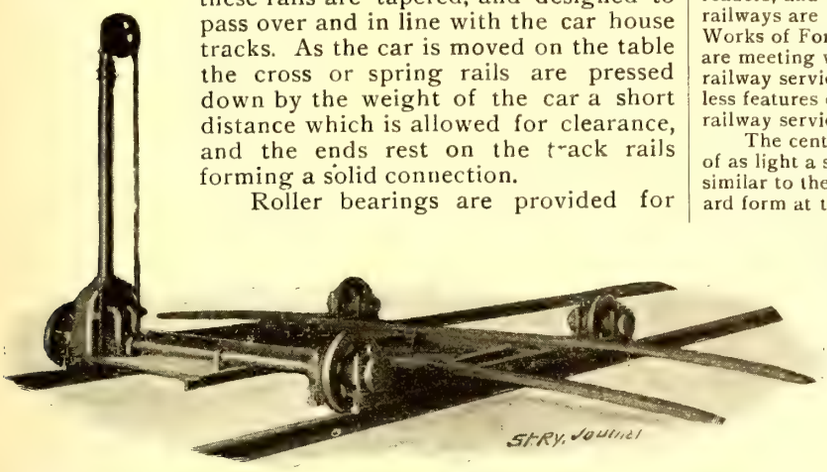
The two companies were sued jointly, resulting in a verdict for $25,000. Evidence that the street car driver had been guilty of negligence at other times when approaching this crossing was refused, because when a passenger on a street car is killed by a collision with a railroad train the negligence of the driver of the car will not be imputed to deceased. The judgment was modified and reduced to $20,000.

The electric railway between Bordeaux and Vousche, France, has proved so successful an enterprise that the company is extending its lines. American electric railway apparatus is employed.

Flush Transfer Tables at the Union Railway Car House, New York.

Our illustration shows a new flush transfer table recently constructed by the White Manufacturing Company, of New York, for the Union Railway Company, of that city. The transfer table is located on the second floor of the railway company's new car house at Boston and Woodruff Avenues. It is of special construction, and designed expressly for electric cars in places where it is undesirable to cut the floor. It is built of steel throughout; the cross rails are of spring steel about fifteen feet in length, and slightly convex in shape. The ends of these rails are tapered, and designed to pass over and in line with the car house tracks. As the car is moved on the table the cross or spring rails are pressed down by the weight of the car a short distance which is allowed for clearance, and the ends rest on the track rails forming a solid connection.

Roller bearings are provided for ease in movement. The table is mounted on T rails, but travels so close to the floor that it can be operated on ordinary center bearing rails.



FLUSH TRANSFER TABLE—UNION RAILWAY, NEW YORK.

An endless differential chain arrangement is provided for moving the table, and one man can easily and quickly shift a motor car to any part of the house, and readily stop the table at the exact point required, thus avoiding the backing and filling so common in the old style of transfer tables. This table avoids the building of expensive pits. All the tracks being flush, cars can be run in and out and across the transfer table tracks without using the transfer table. This gives more storage room, and in case of fire the saving of rolling stock makes it most desirable. With the use of this table insurance is reduced. These tables are in use at Scranton Traction Company, Scranton, Pa.; Union Railway Company, New York, N. Y.; North Shore Traction Company, Lynn, Mass.; Brooklyn City Railway Company, Brooklyn, N. Y.; Broadway Cable Railway, New York City.

Statement From St. Louis.

The reports of the various street railway companies in St. Louis were recently filed in the office of the City Register for the first quarter of 1894. They are as follows:

RANK.	ROAD.	TRIPS.	PASSENGERS.
11	Baden & St. Louis R. R.	5,620	95,450
5	Cass Avenue & Fair Grounds Ry.	153,000	2,192,323
7	Citizens' Ry.	134,000	1,598,776
10	Jefferson Avenue R. R.	45,000	298,792
2	Lindell Ry.	260,218	3,626,186
3	Missouri R. R.	281,570	3,311 403
9	People's Ry.	50,268	898,129
4	St. Louis R. R.	168,908	2,367,218
6	St. Louis & Suburban Ry.	27,009	1,714,489
8	Southern Ry.	77,400	1,024,079
1	Union Depot R. R.	265,332	3,826,986
	Total for 1894	1,446,615	20,953,831
	Total for 1893	1,469,513	21,485,054
	Decrease	22,898	531,223

The Baden & St. Louis Railroad, Cass Avenue & Fair Grounds Railway, and Lindell Railway are the only companies which show an increase over last year in passengers carried, amounting in the aggregate to 1,388,099. Of this number 737,169 were carried by the Lindell Company, which is in part explained by the fact that their new Compton Heights line was recently put into operation. The decrease in the total is, of course, due to the hard times.

Cushioned Car Wheels.

The principle of the cushioned car wheel is a familiar one to our readers, and wheels of this type which are in use on steam and electric railways are giving good satisfaction. The Bass Machine & Foundry Works of Fort Wayne, Ind., manufacturers of the cushioned car wheels, are meeting with an especially large demand for these wheels for street railway service, owing to the long life under severe service, and noiseless features of its wheels, qualities which especially fit them for street railway service.

The center of the wheel is constructed of either steel or cast iron, of as light a section as is consistent with safety, and in form somewhat similar to the ordinary spoke car wheel. The tire is of steel, of standard form at the tread, and is provided with the proper annular flanges for securing it to the wheel center, the connection being made by rivets. The cushion, which is interposed between the periphery of the center and the inner surface of the tire, is of dense combination rubber, and has its outer surface encircled with a shield of either sheet steel or No. 20 iron, which is provided for the purpose of preventing crimping of the cushion when pressing on the tire.

In point of safety it is found that these wheels are perfectly secure, as their extensive use on steam railway cars runningat high speeds shows.

The great merit claimed for the street car wheels, and especially for electric motors, lies in the fact that the cushion receives all the pounding and vibrations caused by low joints, crossings, uneven tracks, etc., and thus relieves the entire equipment of all jarrings and pounding. Moreover, by using these wheels tires can be renewed without the necessity of pressing on and off the center. A cushion steel tire wheel, it is claimed, will outwear five to six cast iron wheels, thus saving all this annoyance and expense.

Prizes Offered.

J. G. White, the well known street railway engineer and contractor, offers a series of money prizes for general descriptive designs of an inexpensive car barn for small electric roads owning from ten to fifteen cars; also for contributions detailing the best methods of developing excursion travel on electric roads by means of amusement parks.

There are two series, each consisting of eight prizes, the first prize in each series being $100, the second $50, the third $25, and the remaining five $5 apiece. The awards are to be made by a committee of five gentlemen who are well known in street railway circles, and whose experience will enable them to justly determine the merits of the various suggestions and plans submitted. The names of competitors will not be known to the awarding committee, and its decisions will therefore be absolutely free from any personal bias. The winning papers will be retained by Mr. White as his property. To insure their receiving consideration, competitive papers should be mailed on or before June 1, to Mr. White, 29 Broadway, New York. The awards will be announced in our July number.

Full particulars of the conditions governing the competition are printed elsewhere in this issue, or can be obtained from Mr. White's office in this city.

A Large Steam Heating Plant to be Constructed in Scranton, Pa.

The Economy Heat, Light & Power Company, of Scranton, Pa., has contracted with the American District Steam Company, of Lockport, N. Y., for the construction of a steam heating and power plant, with underground mains (Holly system), to cost $150,000. The officers of the company are: Wm. Connell, president; Lemuel Amerman, vice-president; Lieut. Gov. Watres, treasurer; I. H. Burns, secretary.

The Stanwood Manufacturing Company.

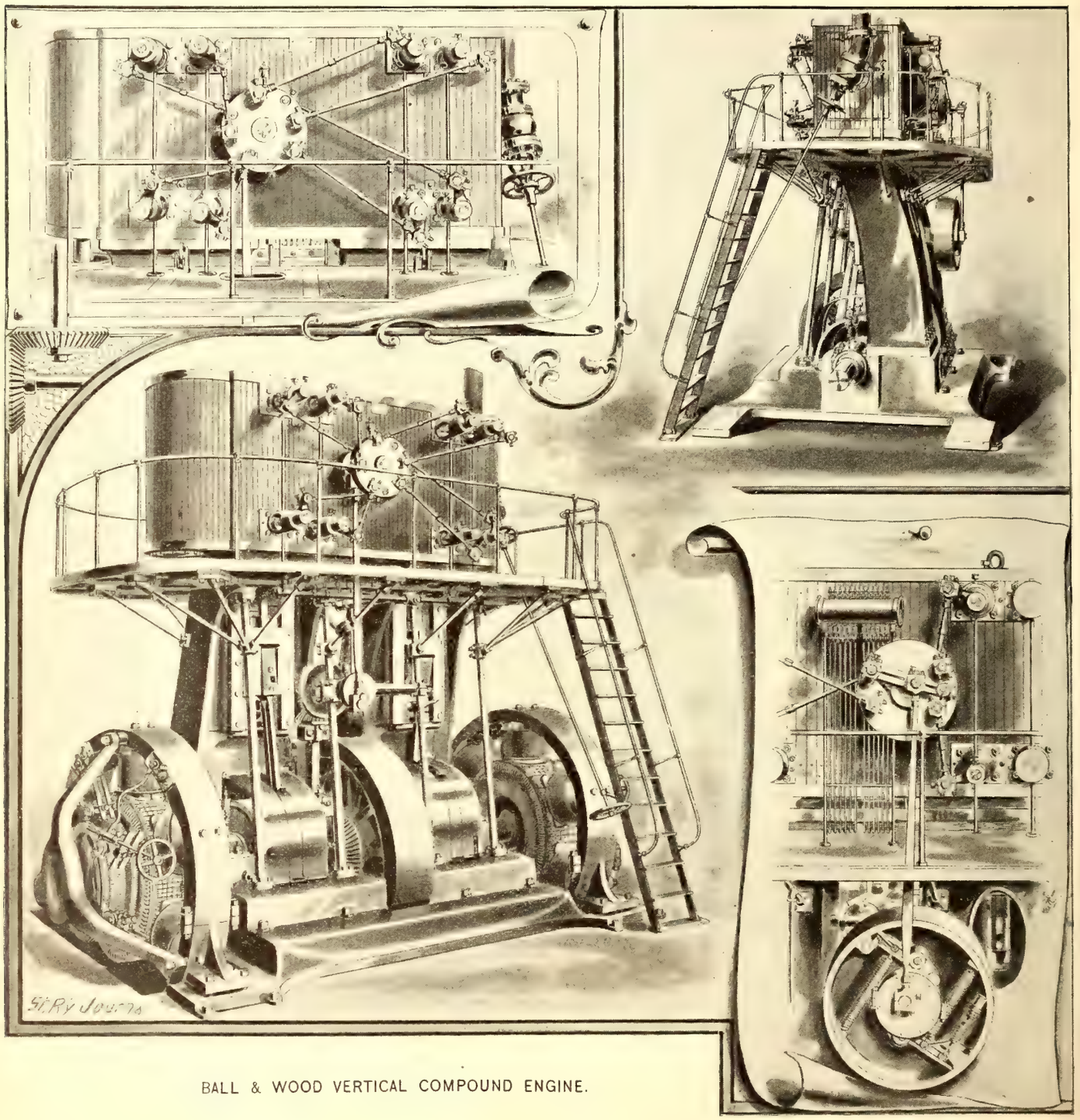
The Stanwood Manufacturing Company of 17th and Clark Streets, Chicago, has recently extended its business, and is now enjoying a large patronage. This company has been fortunate in securing the services, as superintendent of its electrical department, of Earl Atkinson, who has a wide reputation in electrical circles. Mr. Atkinson entered the service of the Edison General Electric Company in 1892, after having filled the position as foreman for three years of a department in the laboratory of Thos. A. Edison, at Orange, N. J. Mr. Atkinson is a good all-around electrical engineer as well as a thorough mechanic, having served an apprenticeship in the works of Inglis & Hunter.

The staff of this company also includes others of high mechanical and electrical reputation, and the company is well qualified to repair all kinds of electrical apparatus, which line of work is one of its specialties. The equipment of the company's shops is most complete, and all kinds of apparatus can be cared for.

A New Type of Vertical Compound Engine.

The development of the electrical industry has made repeated exactions upon the steam engineer. The first dynamos had to be run at prodigious rotary velocities, and required the utmost nicety of regulation. This demand was met by the single valve, high speed, automatic engine and shaft governor. The multipolar generator has made it possible to run the armature at a moderate rotative speed, so moderate that it can be attached directly to the shaft of a slow running, four valve, long stroke engine. Rotative speed, however, is still desirable as a means of decreasing the weight and cost of the directly attached electrical machinery. It is a fact, also, acknowledged even by the builders of the other types, that the four valve engine leads in economy, and there has been for some time a visible movement in the direction of controlling four valve engines through positive connections to a shaft governor instead of by means of the detachable connections which have been common to the type and which limit the number of revolutions which can be made per minute to about 100. Another property exacted by the variable nature of electric and cable railway work is the ability to cut off through a long range of the stroke instead of being limited to the first half with the alternative of carrying steam full stroke if cut-off does not occur during that time. In addition to the ever present demand for the highest efficiency, magnified in importance in electrical work by the relatively large proportion which the cost of power bears to the total operating expenses of an electric railway station, and by the increased size of the installations, has come a demand induced by the high cost of metropolitan real estate, upon which such stations must of necessity be situated, for the maximum amount of power in the minimum amount of space. Regulation, of course remains as important a factor as ever.

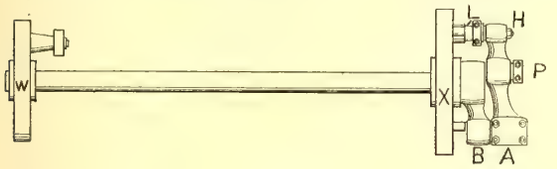
It is with a view of meeting these latest requirements that the engine under review has been designed by F. H. Ball, M. E., of the Ball & Wood Engine Company. It is an example of the tendency above alluded to, to avoid the restrictions placed upon the four valve engine by the releasing valve gear by bringing the steam valves under the control of a positively connected shaft governor; and it is in the original, ingenious and effective method by which this is done that the most distinctive feature of the engine consists. The general design and arrangement of the engine will be apparent from the accompanying engravings, for which, as well as for the data contained in this article, we are indebted to *Power*, New York.

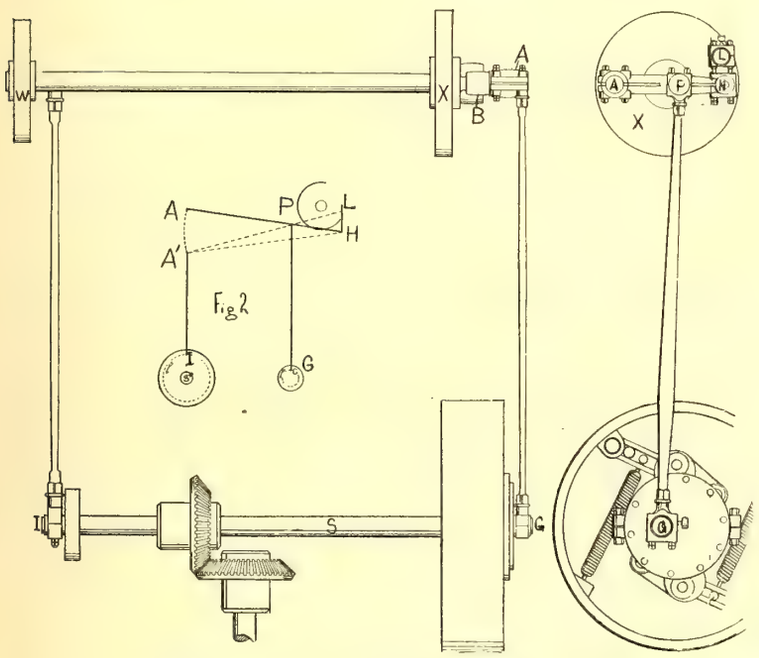


BALL & WOOD VERTICAL COMPOUND ENGINE.

It is a vertical cross compound with cylinders nineteen and thirty-one inches in diameter, twenty-four inches stroke, and designed to run at 150 revolutions per minute, at which speed it will develop 600 H. P., with 125 lbs. initial pressure, non-condensing. The valves are of the Corliss semi-rotary type, as will be seen by the section on the next page, all eight being driven from a single central wrist plate, as shown

in the front view. The situation of these valves in the cylinder heads reduces the clearance to between 3 and 4 per cent. Inside of the main steam valves are cut-off valves, operated by a separate wrist plate at the back of the engine, as shown in the lower right hand panel on the first page. The front of the main wrist plate receives its motion from the crank, *I* (see Fig. 1 on this page), upon a cross shaft, receiving its motion from the main shaft by gearing, as shown. All the connections between this wrist plate and the main shaft being positive, the steam and exhaust lead and time of closure for compression are constant, whatever the variations of load and pressure. The wrist plate, *X* (Fig. 1), from which the cut-off valves get their motion, is loosely mounted upon the same shaft as the fixed wrist plate, *W*, but at the back of the engine, and is connected to the governor in such a way as to receive a varying amount of motion in proportion to the





FIGS. 1 AND 2.—DETAILS OF VALVE GEAR.

load and pressure. Upon the back end of the cross shaft, *S*, is mounted a shaft governor so arranged that when the weights move outward they rotate the pin, *G*, about the shaft center, changing its angle with reference to the shaft and the crank pin, *I*, but preserving a constant throw or radius of eccentricity. The governor pin, *G*, is connected by a vertical rod to a pin, *P*, in the arm, *A*. The arm, *A*, is connected at one end to a pin upon the crank, *B*, which is keyed to the shaft, *t*, and is thus constantly vibrating through a fixed angle equal to that of the wrist plate, *W*, while the engine is in motion. The other end of the lever, *A*, is connected by a short link, *L*, to the variable wrist plate. Now in the little outline sketch marked Fig. 2, as the shaft, *S*, is rotated, the end of the lever, *A H*, is moved up and down through the arc, *A A'*, about the point, *H*, as a center, and there is no tendency to move the plate, *X*, about its center. This condition would continue if another connecting rod, *P G*, were attached to the lever, and the pin, *G*, moved in exact accordance with the pin, *I*, so as to make the upper end of its rod follow the movement of the point, *P*. If the pin, *G*, were held still, however, the lever, *A H*, would act over the point, *P*, as a fulcrum, and communicate motion to the plate, *X*, through the link, *L*, as shown by the dotted line in *A P L*. The same effect would occur if the angular position of the pin, *G*, with reference to *I*, were changed, so that the pin, *P*, no longer moved coincident with *A*, the amount of motion imparted to *X* depending upon the difference in the angular positions of the two pins. It is upon this principle that the cut-off valve is operated in the engine under review. The crank, *B* (Fig. 1), is constantly vibrating through a fixed angle, carrying the lever, *A*, with it, just as we have imagined it to move in Fig. 2, where the lever, *A*, is represented by *B H*. It makes no difference in the result that the motion from *I* is taken up through *W* and *S* and *B*, as these connections are all positive and the effect just the same as though the connection were direct, as Fig. 2 shows it. When the governor is in the right position to move, the point, *P*, in accord with the movement which the lever, *A*, receives from the crank, *B*, which is when the weights are in their home position, the wrist plate receives no motion, the cut-off valve is inoperative and admission continues until the main valve cuts off at three-quarters stroke. As the weights fly outward the pin, *G*, is rotated, moving the pin, *P*, in a different phase from that of the crank, *B*, and the reaction thus set up between *B* and *P* is effective in moving the end, *H*, of the lever, and through the link, *L*, the wrist plate and cut-off valves. As these valves are under an unbalanced pressure only during the short interval between the cut-off and the point at which the main valve closes the port, the governor has little to do in operating them, and promises to be very sensitive and effective.

The gears by which the entire valve and governing mechanism is operated are something of an innovation in American practice, although they are much used abroad. One gear of each pair is of fibre; they run very smoothly and quietly, and furnish a positive connection between the piston and valve movements which nothing short of the breakage of the heavy gears can interrupt. If the gears become deranged it is not as though the governor belt broke on the usual engine, for although the moving power of the governor would be destroyed, that of the valve motion would cease also and the engine would come to a stop.

The main shaft is ten inches in diameter in the bearings, and carries at its ends the armatures of two 200 K. W. generators furnished by the General Electric Company. Another interesting little detail is connected with the bearing, and shown in Fig. 3. Upon the shaft just outside of the bearing is shrunk a cast iron disk, tapering toward the

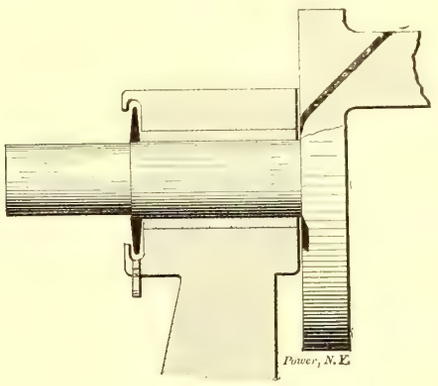


FIG. 3.—SECTION OF BEARING.

edge. The housing of this bearing is extended over the edge of this disk, forming a groove. When the oil working through the bearing and along the shaft reaches this disk it is carried outwardly by centrifugal force, and discharged into the surrounding groove, from which it is dripped as shown. The oil, which works out on the other side of the bearing, is caught in a similar groove cut in the crank disk, from which a channel leads it to the crank pin. The general oiling of the engine is accomplished from a tank at the back of the low pressure

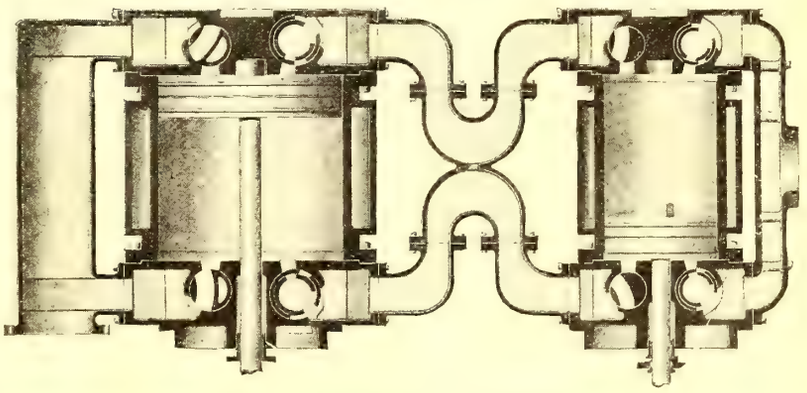


FIG. 4.—SECTION OF CYLINDERS.

cylinder, best shown in the panel illustrating the governor and cut-off wrist plate. This tank contains about two gallons of oil, and discharges through twelve sight feeds into oil tubes leading to the different points requiring lubrication.

Mr. Ball is a designer who is not content with following the highways of ordinary practice without exploring to an extent the openings which offer to lead to pathways of improvement and advantage. In the design of this engine he has struck such a trail, which promises to lead to some interesting developments. While some attention has in the past been necessarily paid to the momentum and inertia effects of the piston and its connections to the main shaft, it has not been considered what the effect of the momentum of the wrist plate and its connections might be on the quiet and easy running of the engine. With the heavy wrist plate and its eight connecting rods used on the engine under review, and at the rather high rotative speed contemplated, this factor assumes considerable importance, and Mr. Ball found by calculation that it involved a blow of more than half a ton on the wrist plate connections every time the direction of the valve mechanism was reversed. A simple means is at hand, however, to overcome the difficulty. Flat

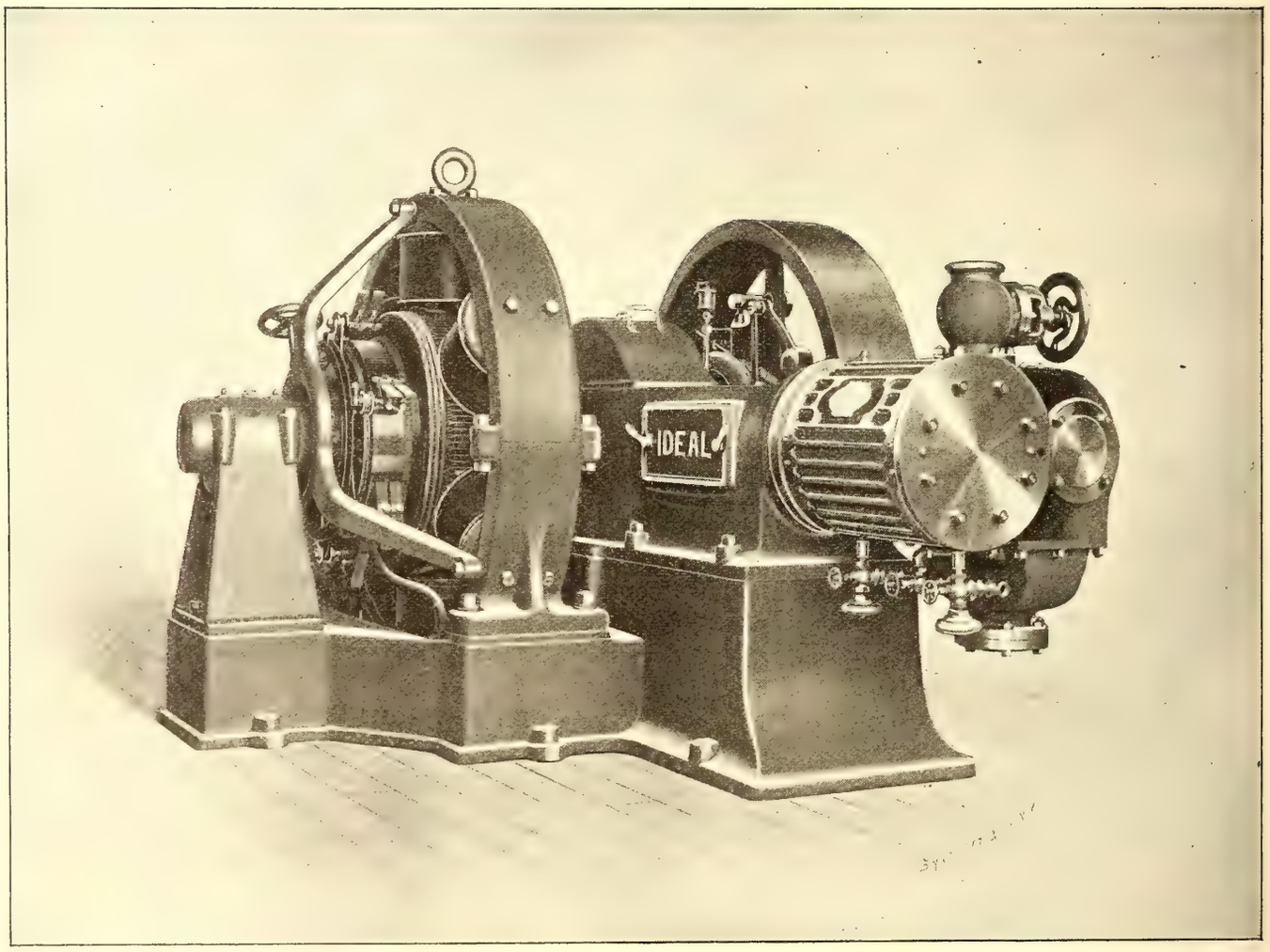
coil, or spiral springs are attached to the shaft which carries the wrist plate, one pair at each end, the springs forming each pair set so as to oppose each other and to hold the wrist plate naturally in its central position. As the wrist plate moves away from the center, its motion is opposed by the springs, whose increasing tension is thus made available to counteract the momentum of the system to bring it to rest and start it off on its return, the tension of the springs becoming zero when the wrist plate reaches the center, and the same action occurring on the other side. If forced to its extreme travel on one side and released, the wrist plate would vibrate back and forth under the action of the spring, like the balance wheel of a watch, until brought to rest by friction. The rod has simply to overcome this friction and keep the plate in motion, and is entirely relieved of the alternating and severe thrusts due to getting the heavy parts in motion and stopping them twice every revolution. The springs are beneath the lagging entirely out of sight. The engine, as a whole, presents a handsome and compact appearance. Heavy cast iron frames at the back and light steel columns in front support the weight of the cylinders and the thrust of the pistons. The cranks are set at 180 degs. apart, and a central flywheel is provided in addition to the weight of the armatures to insure steady running past the centers. The central bearing is vertically adjustable by wedges. No provision is made for detaching the wrist plate and working the engine by hand, as this would involve complications with the cut-off valve, which does not move with the main wrist plate, and the plate would move with difficulty against the action of the springs. Simple means are provided for barring the engine off the center, should it stop in this position. The style of guide and cross head is well shown in the large engravings. The exhaust valves are provided upon their back ends with relief valves of ample capacity, and all the valves have upon their front, or bonnet, ends gibs, by which the stems may be kept central and free from lost motion. This first engine is ordered by the Chicago Edison Company (Samuel Insull, president), for its Wabash Avenue and 21st Street station, and we anticipate that the reports of its performance will be interesting, and will confirm the good opinions expressed by engineers.

It is reported that an important consolidation has taken place in Kansas City, including the properties of the Kansas City Cable Railway Company, the Grand Avenue Cable Railway Company, and the Independence Rapid Transit Company. The new company will be known as the Kansas City Railway Company and will have a capital of $5,000,000. The officers will be Walton H. Holmes, president; Daniel B. Holmes, secretary; W. B. Clark, treasurer, and C. F. Holmes, general manager. The lines involved cover sixty miles of track.

Direct Connected Engine and Dynamo.

Almost every one directly or indirectly interested in steam electric engineering in these latter days is anxious to see the best combined arrangement of engine and dynamo showing most modern characteristics. We are pleased to be able to illustrate in our columns a direct connected steam electric combination which we feel sure will attract attention.

The engine is the "Harrisburg Ideal," self oiling pattern, cylinder twelve inches diameter by twelve inches stroke, manufactured by the Harrisburg Foundry & Machine Works, Harrisburg, Pa. The dynamo is the product of the General Electric Company, 50 K. W. capacity, speed 275 revolutions per minute, 420 amperes, 110 volts, and obviously of the multipolar type. There is an immediate impression of strength and solidity about this combination which at once strikes the eye, and simultaneously an appearance which a closer examination fully justifies, of compactness and simplicity.



DIRECT CONNECTED IDEAL ENGINE AND DYNAMO.

The self oiling, out-board bearing feature in the "Harrisburg" Ideal engine shown, is designed on a generous model, and has the latest arrangement of movable sleeve with ring oilers, being, except for increased weight and size, almost the same construction as the standard Edison bipolar dynamo bearings which have, by years of universally good service, proved the merit in them.

A test of the Ideal-General Electric combination made recently in New York City, in the presence of several gentlemen unusually well informed on steam and electrical matters, will be of interest to our readers: The engine, and of course the dynamo, was started in the usual manner under steam, and when running at the desired speed of 275 revolutions per minute, the brushes were adjusted and engine and dynamo prepared for undertaking the load. The switchboard was also arranged so that the entire current of power generated would pass through two switches side by side. A five cent nickel was balanced on edge on the outer end of the cylinder head, the engine running at "friction load." The two switches were then taken in hand and thrown in instantly, the meter showing 340 amperes. The switches were thrown out in seven seconds, then in and out again, thus throwing upon the engine practically the full load of the dynamo twice within fourteen seconds, during which the five cent piece remained balanced on the cylinder head, showing the combination to be operating absolutely without any vibration whatever.

There are now between thirty and forty Harrisburg Ideal electric direct connected combinations in successful operation, nearly every one of which was installed by the New York and New England representatives of the Harrisburg Foundry & Machine Works, W. R. Fleming & Co., 203 Broadway, New York, and 620 Atlantic Avenue, Boston.

An Anti-Concussion Motor Truck.

The accompanying illustrations give a good idea of an anti-concussion electric motor truck lately invented by Wm. Sutton, president of the American Car Company of St. Louis, and for which letters patent have been granted. A mere glance at the scheme of the truck will reveal the fact that it is the result of a great deal of thought and thorough experience on the part of the inventor. It has been built on independent lines with the idea of doing away with the oscillation of the car body without employing the familiar extended spring base feature.

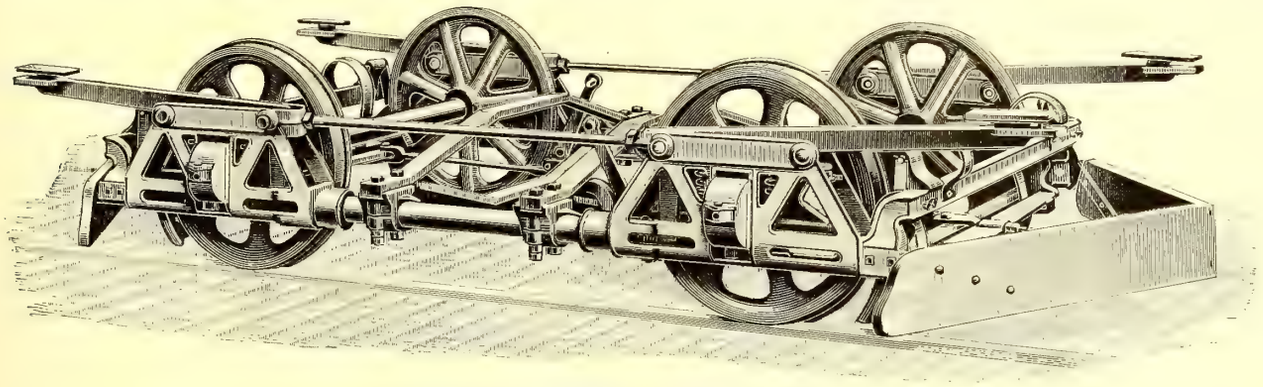


FIG. 1.—NEW TRUCK—AMERICAN CAR CO.

The car body rests directly on the four bellcrank, equalizing levers shown in the illustrations, a rubber cushion intervening between the end of each lever and the body, so as to ease off the lever action. The cushion has replaced a ball bearing which was at first employed. The fulcrum of each of the levers is on the inside of the pedestal and this is where the oscillation is prevented, and not by extending the spring base beyond the wheels, as in the ordinary non-oscillating truck. As the weight of the car depresses the levers, their vertical arms have a tendency to become horizontal, or, more properly, their motion is nearly horizontal, and thus they each press against a volute spring held in place by the heavy piece connecting the pedestals and supporting the motor hangers. There is a small spiral spring opposite each volute spring, and also joined to each vertical arm on the opposite side which takes up the recoil. When the front wheels of the car strike an obstruction the blow is thus changed from a vertical to a horizontal one by means of the horizontal motion of the vertical arm of each lever, as above described. In the ordinary extended spring base truck striking an obstruction is attended with complete lifting of the car body on account of the spring base being near the end of the car, while in the truck under consideration it is nearer the middle of the car, although the latter rests on the levers at its ends, the motion in encountering the obstruction being thus eased off gradually. The pedestals come in for strains from several directions, and are thus of the form shown. They are made of steel, and will stand a tensional strain equal to that of the best wrought iron.

The ends of the pedestals are circular, and bored for the pieces connecting the same. The pieces are nothing more than heavy gas pipe, and are filled with wood tightly packed under the same pressure as is used for pressing car wheels on to axles. The wood thus inserted deadens the vibratory sounds common to pipe. The motor hangers or carrying bars are clamped to the connecting pieces and held rigidly in place by strong brackets, which also serve to keep the truck square. The brake mechanism operates in the manner usual to motor trucks, but the brake beams and connections are hung to unusually heavy cross pieces, thus providing great strength. The fender has a tendency towards the cow catcher type without the height of the latter, yet possessing its advantages. The American Car Company's dust-proof box is used in connection with the truck.

In putting this truck on the market the inventor is not desirous of claiming the "earth" for it, but wishes the street railway fraternity to examine it carefully and intelligently in order to satisfy themselves as to its superiority. There are advantageous features in the practical running of the truck which we have not the space here to outline.



FIG. 2.—CAR AND TRUCK—AMERICAN CAR CO.

A New Fuel.

The following, according to C. W. Chancellor, United States Consul at Havre, is Maestracci's method of manufacturing petroleum bricks as fuel:

Mix one litre of petroleum, 150 grammes of triturated soap, 10 per cent. of resin and 333 grammes of caustic soda. Heat this mixture, being careful to stir it well meantime, until solidification commences—say about forty minutes. If the mixture should tend to boil over, pour in a few more drops of soda, and continue to stir until solidification has sufficiently progressed, then pour the semi-fluid material into moulds to form the bricks, and place these in a hot room or drying place for fifteen minutes; then remove them and let them cool. In a few hours they can be used as fuel.

To the three elements, which constitute the mixture, Mr. Maestracci recommends the addition of 20 per cent. of sawdust and 20 per cent. of clay or sand, which makes the bricks more solid and less expensive. Trials of these bricks as fuel have been made at Marseilles on several tugs, and it has been found that, weight for weight, they develop three times as much heat as the ordinary coal brick, and leave no ashes.

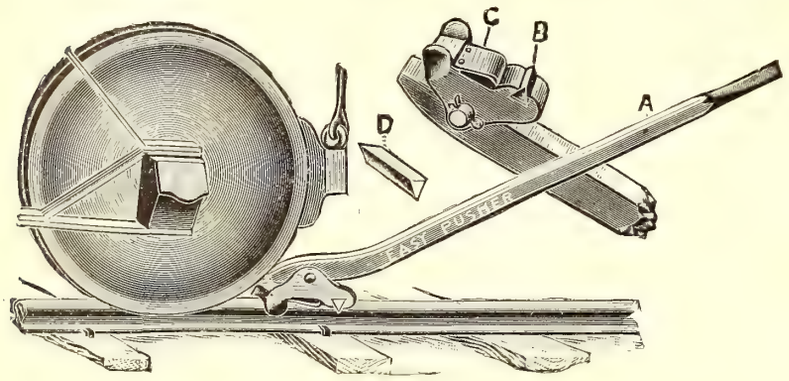
It is expected, with some slight changes in the furnaces, to arrive at still more perfect results, not only in the increased heat, but in the entire suppression of smoke, and on the most economical basis, one kilogramme of the solidified material being equal to four kilogrammes of coal. These experiments seem to be very interesting, and it is quite easy to understand that there is a double advantage in using such fuel, as they economize in both space and cost.

The Easy Car Pusher.

The car pusher shown herewith is manufactured by the R. Woodman Manufacturing & Supply Company, of Boston, Mass., and is in use on the lines of the Lynn & Boston Street Railway Company, the Erie Electric Motor Company, the Metropolitan Street Railway Company of Boston and other roads, as well as upon a number of steam railways. The bar is steel, and tempered at the point so as not to wear. The "heel" is malleable, and the triangular "bit" is made of the finest tool steel.

As shown in the cut, the heel has lugs extending downward on both sides of the rail so as to hold it firmly in position and prevent it slipping sideways, and the triangular bit or steel, marked "B," cuts into the rail when pressure is applied and prevents slipping backward, even though the rail is icy, greasy or wet. This bit can be inverted until the three points are dull and then sharpened. When the pressure is released the steel spring, marked "C," lifts the sharp steel bit from the rail, thus saving it from being dulled, by sliding over the rail when following the wheel.

The total weight of the pusher is twenty pounds.



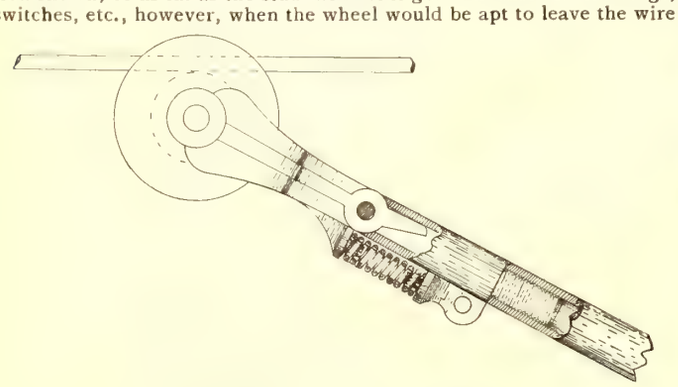
EASY CAR PUSHER

A New Trolley Head.

The trolley head shown herewith was invented by John E. Anger, of the Gilbert Car Manufacturing Company, and is intended to give a constant pressure against the wire, thereby preventing the trolley from jumping off. As will be seen, the harp is hinged at the top of the pole, the lower end of the harp being provided with a stud which moves inside a casing at the top of the pole. A small compression spring is carried at the top of the pole in the position shown.

When the pole is against the wire the regular trolley springs are so strong as to compress the small spring until the harp is in the position shown, or as far as the stud will let it go. In case of crossings, switches, etc., however, when the wheel would be apt to leave the wire on account of the trolley springs acting too slowly, the small compression spring will keep the wheel close to the wire, preventing its leaving the latter with consequent sparking.

The arrangement of the hinge, of course, keeps the upper part of the pole from vibrating sideways, while giving complete flexibility vertically.



SPRING TROLLEY HEAD.

Annual Meeting of the Brush Electric and Short Electric Railway Companies.

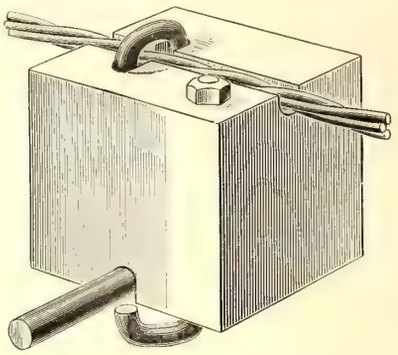
The annual meeting of the Brush Electric Company was held March 26, and the old board of directors elected. The officers elected were as follows: W. H. Lawrence, president; C. A. Coffin, first vice-president; S. M. Hamill, second vice-president (*vice* John S. Bartlett resigned) & general manager; B. F. Miles, treasurer; W. B. Bolton, general counsel; L. H. Rogers, assistant general manager; A. H. Hough, secretary, C. W. Phipps, superintendent; C. N. Black, assistant superintendent.

The Short Electric Railway Company the following day elected its old board of directors and the following officers: B. F. Miles, president; Bethune Duffield, Detroit, Mich., secretary and treasurer; S. M. Hamill, general manager.

Trolley Guard Insulator.

The accompanying engraving shows an insulator for trolley guard wires manufactured by the Hammond Cleat & Insulator Company, of Boston. This insulator is made of one piece of porcelain, and mostly for appearance's sake is japanned black. Of course, japan being also an insulator, it will be readily seen that the guard wire is thoroughly insulated. The illustration of this device shows it so well that further explanation of its uses is needless. It might be well to state, however, that the only metal part in connection with it, the hooks and nuts, are galvanized so as to withstand the weather. This insulator is made to serve the purpose of a strain insulator, if it should be necessary to put it to this use.

The managers of the West End Street Railroad Company, of Boston, Mass., have thought so well of this insulator that they have placed an order with the Hammond Cleat & Insulator Company for 1,000.

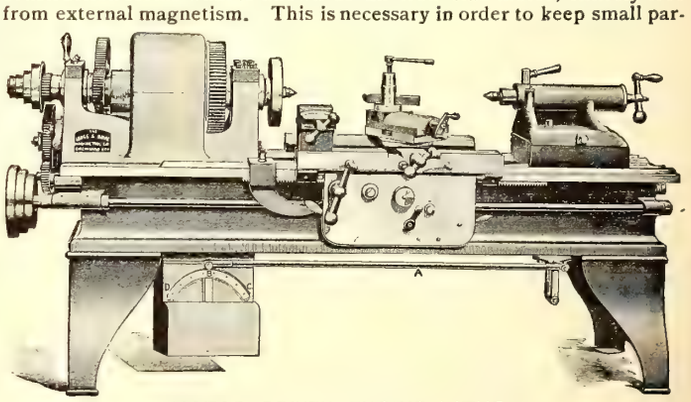


TROLLEY GUARD INSULATOR.

Motor Driven Engine Lathe.

We present herewith a view of a lathe, in which the design includes an electric motor, taking the place of the usual cone pulley. The lathe is reversed and the speed regulated by the movement of the rod, A. This with the back gears, arranged as usual, gives not only a much wider range of speeds than can be obtained by cone pulleys, but a much more finely graduated speed than can be obtained by cone pulleys; in fact, the speed may be anything from the highest to the lowest desired.

The armature is wound on a phosphor bronze spider with a carrier disk which revolves freely on a spindle as a cone pulley. It is surrounded by the pole pieces and entirely inclosed in housing. This construction forms what is known as an iron clad motor, entirely free from external magnetism. This is necessary in order to keep small particles of steel and iron from adhering to the lathe, and making it impossible to keep the same clean.



MOTOR DRIVEN ENGINE LATHE.

Among the advantages secured by the direct application of electric power are that tools may be placed independently of fixed conditions overhead, such as shafting, cranes, etc., and with regard to the arrangement best suited to handle the product most conveniently. The operator has also the best control of his machine, especially when a variable speed is necessary.

The lead screw is placed on the inside of the bed, directly under the front V, and is enclosed in a brass tube, protecting it from dirt and chips. In this position it takes hold of the carriage directly under the line of strain, and obviates that twisting tendency which is so common in lathes, where the screw is placed on the outside of the bed. All the feeds of the carriage can be thrown in and out or reversed from the front of the apron. This is a particularly desirable feature, inasmuch as the operator is not compelled to leave his work, and it does away with the complicated gearing in the headstock. The carriage is provided with a stop, which throws out the feed automatically, and may be set at any point along the ways. This is very convenient for turning or boring a given length, and also prevents the lathe from being damaged by any carelessness of the operator. The spindle is hollow and of large diameter; the boxes are made from the best phosphor bronze, and are provided for taking up wear.

The manufacturer, the Lodge & Davis Machine Tool Company, of Cincinnati, O., is giving special attention to equipping the various classes of machine tools it is building with electric motors.

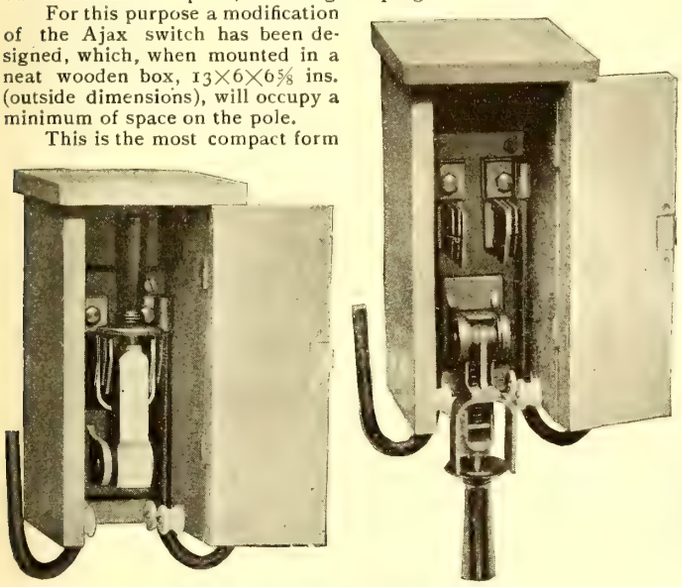
The motors, which are furnished by the Card Electric Motor & Dynamo Company, of the same place, are simple, substantial, and of sufficient capacity for maximum load, entirely free from complication and requiring very little attention in use.

Ajax Line Section Switch.

Many electric railways have been built and operated, without any means of disconnecting a part from the rest of the line, or of dividing the entire system into sections; but the operators have sooner or later discovered the convenience, or necessity of inserting section insulators and switches, so that certain sections of the trolley wire might be cut out of circuit for repairs, or during the progress of a fire.

For this purpose a modification of the Ajax switch has been designed, which, when mounted in a neat wooden box, 13×6×6⅝ ins. (outside dimensions), will occupy a minimum of space on the pole.

This is the most compact form



AJAX LINE SECTION SWITCHES.

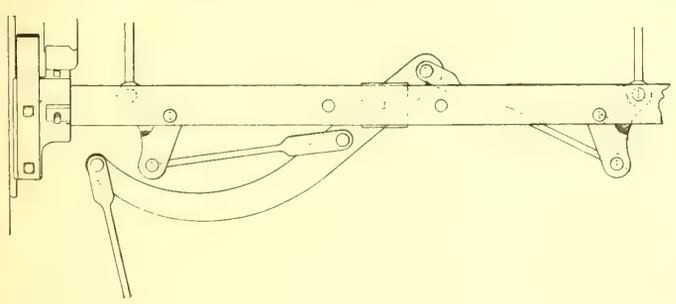
of the Ajax switch yet designed, and it is calculated to maintain the claims to superiority in conductivity and breaking capacity for which the Ajax switches are justly noted.

In some cities an ordinance compels the railway companies to so arrange their circuits that no section of trolley wire shall embrace more than two blocks of continuous conductor, and that each section shall be controlled by a switch placed within easy reach of the firemen.

Even where such provision for the convenience of the firemen is not compulsory, it often will be found an advantage to the railway companies to adopt such a system on thickly settled streets; for without the section switch at hand, the firemen will soon learn to use their clippers or axe to sever the wires, rather than work among heavily charged conductors, so that the section switch may be termed an economizer of repairs, as well as a preventative of delays to traffic. The types of line switches shown are manufactured by C. S. Van Nuis, of New York.

Floating Center Equalizing Brake.

The advantages resulting from equalizing the pressure of all the brake shoes on a street car truck have led to the adoption of the floating or sliding center shown in the accompanying engraving. This principle has been employed on steam railway cars, and by its means each



FLOATING CENTER EQUALIZING BRAKE.

wheel receives the same pressure as every other, regardless of the wear or thickness of the shoes, so that worn and new shoes can be used on the same brake. This brake, which has been brought out by J. E. Anger, of the Gilbert Car Manufacturing Company, has been in use for over a year on a number of trucks, with excellent results.

The brake head is also adjustable up and down, so as to bring the pressure square against the wheel. In this way the shoes are worn out equally, and for the full bearing of the shoe.

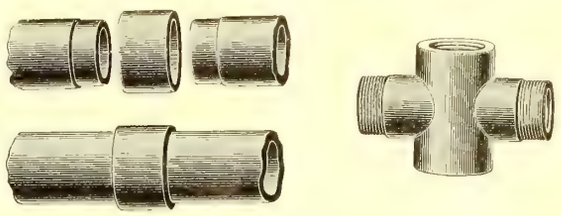
Fibre Conduits.

The Fibre Conduit Company, of New York, has recently constructed a mill at Orangeburg, N. Y., for the manufacture of fibre conduit for electrical purposes. All the machinery in the factory is operated by electric power, and the company intends to be able to supply promptly all the demand for material of this character.

Fibre conduit is made of wood fibre, treated with an insulating and preserving compound producing a hard and solid substance. It is made into tubes on a machine designed for the purpose by Prof. Henry Fairbanks and Howard Parker, of St. Johnsbury, Vt., the product and machines being protected by numerous patents. The tubes are completely saturated with a mixture which makes it acid and alkali proof.

The finished pipe is in five foot lengths, and is uniform in thickness, with smooth surfaces. Sections with connections are shown herewith. As the conduit is an insulator, there can be no danger of its decomposition by electrolysis, which has caused so much trouble in a number of cities where electric railways are in operation.

The conduit is also non absorbent, nor does it contract or expand with varying temperature; it is, therefore, free from the splitting and checking, corrosion and disintegration which injure wood and iron. It is also tough, elastic and strong. A standard three inch pipe will



PARTS OF FIBRE CONDUITS.

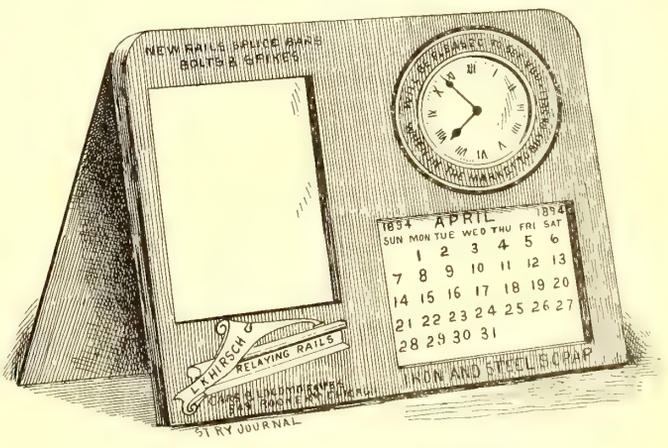
safely bear a crushing weight between two plane surfaces of 800 lbs. per lineal foot, and will stand a pressure of 450 lbs. at the center of a five foot length supported at both ends. Its bursting strength is over 125 lbs. per square inch. Its insulating properties are shown by the fact that a conduit seven-sixteenths of an inch thick has been tested on a 20,000 volt, alternating current without any perceptible effect.

Among the miscellaneous advantages claimed for it are that moisture does not condense on the surface as in metal pipes, and it will stand exposure to a temperature of 200 degs. F. without weakening, and will carry liquids at 150 degs. F. at considerable velocity without injury; it is easily cut with ordinary tools, and joints, fittings, etc., introduced at any point. The Fibre Conduit Company on May 1 moved to new offices at 257 Broadway.

A Calendar and Clock Combined.

A handsome souvenir in the form of a calendar has been issued by L. K. Hirsch, of the Rookery, Chicago, the well known dealer in rails, splice bars, cars, locomotives and all kinds of railway material

The souvenir is in the form of a desk tablet, covered with Russia leather, and containing a calendar, small clock and frame for a por-



CALENDAR AND CLOCK COMBINED.

trait. The calendar, of which we present an engraving, is stamped with Mr. Hirsch's name and address, and the request to correspond with him when in the market to buy or sell.

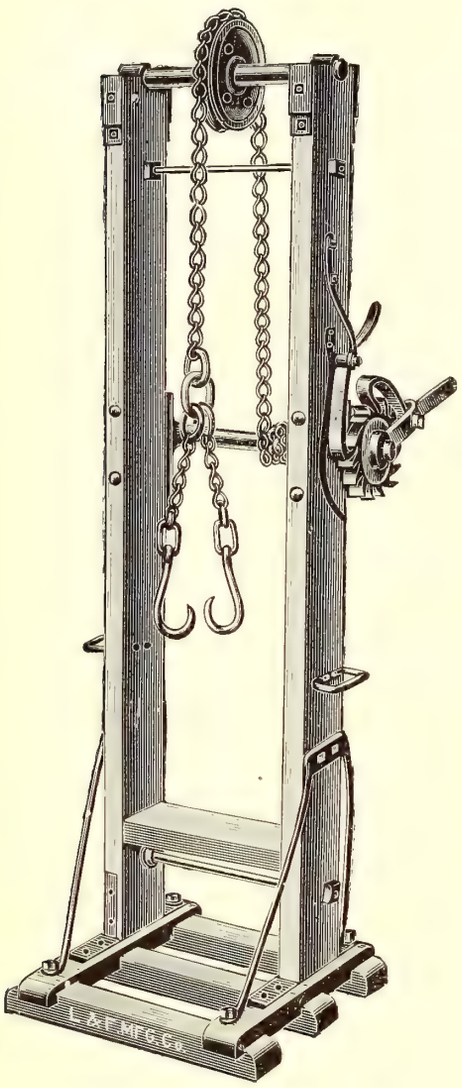
As a desk ornament and tasteful advertisement combined, this calendar is certainly a success.

AN officer of a Cuban street railway company, who was recently in New York securing bids for electric railway construction, was the shipper of the large cargo of arms and ammunition on the "Alert," intended for the Cuban insurgents. The ship was captured by the authorities of that island.

The "Acme" Car Jack.

A valuable part of the equipment of even the smallest street railway is a car jack, and repair shops of street railroads and hurry-up wagons are not completely equipped unless supplied with them. The jack shown herewith was manufactured by the Lewis & Fowler Manufacturing Company, for use in its own shops, and was found so very convenient that the company has decided to manufacture others for sale. They are equally well adapted for use in the shops, or anywhere along the line, and being capable of quick adjustment and action, they are time and money savers. The method of use is evident from the engraving.

The jacks are sufficiently powerful to lift the heaviest cars, yet are very easily operated, so that two men can raise a car quickly and safely with very slight effort. When raised, the jacks will hold the car firmly for any length of time required, without danger to those working under it. The construction is simple, and no part is liable to get out of order. Though easily handled and not unwieldy, the jacks are very strongly built.



"ACME" CAR JACK.

A Suspended Railway Bridge Across Niagara Falls.

There is a possibility of the construction of a suspended railway bridge across Niagara Falls. The bridge, if constructed, will be stretched between the Clifton House on the Canadian side and the Davis Museum. It will be built by the Gagnier-Griffin Suspended Bridge Company, of Chicago.

This company is the owner of the patents granted to Barney J. Gagnier, of Detroit, Mich, for suspended railways, which supply a long felt want under many conditions. The system can be used for the transportation of passengers, teams, wagons, and all kinds of freight. For pleasure resorts, climbing mountains with small power at very little expense, passengers can be handled with facility and dispatch, and the system specially recommends itself as a park attraction for street railways, river bridge at street railway termini, etc.

The James A. Trimble Car Works.

The name of James A. Trimble is closely associated in the minds of street railway men with the subject of cars, and Trimble cars and car woodwork have a wide reputation for excellence of construction, durability and fine finish. The Trimble car works were started in 1869, in a small shop next to the present building, and were originally devoted to the manufacture of street car woodwork. The present works of Mr. Trimble are located in the handsome six-story building, Nos. 218 to 222 East 28th Street, New York, shown on this page. The building is of buff brick with stone trimmings.

The mill is located in the first story of the building and occupies that entire floor with the exception of about 20×25 ft., which is devoted to offices. The mill is completely equipped with the latest and most approved wood working machinery.



THE JAMES A. TRIMBLE CAR WORKS.

The second floor is used as a drafting room and pattern shop, also for light iron work machinery. On the third floor all of the cabinet work is done, and on the fourth floor is located the body erecting shop. The fifth and sixth floors, respectively, are devoted to painting, varnishing and finishing the products of the works.

The building is lighted on four sides by large windows, and all the ceilings are twelve feet in the clear, giving plenty of light and ventilation. The building throughout is equipped with the most improved machinery and appliances for turning out first class work. As only thoroughly seasoned wood is used, the equipment of the works includes a large stock, which is carried from year to year, so that the wood employed is from five to eight years old, and thoroughly seasoned.

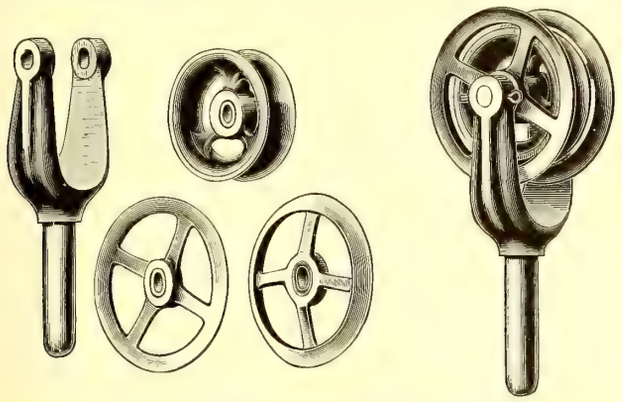
Mr. Trimble has been a prolific inventor, and has taken out patents for a number of improvements for street cars. Among these are a combination buffer and drawbar, a variable signal light, drop sash for high window cars by which a closed car can be made practically into an open car, a door sheave and a cam movement brake handle. All of Mr. Trimble's car work is interchangeable, facilitating its application.

Mr. Trimble is a native of New York, having been born in that city in 1847, and has had a large experience in street car building.

The McGuire Manufacturing Company, of Chicago, has decided to open a New York office.

The "Economy" Trolley Wheel.

We illustrate herewith a trolley wheel which has lately been put on the market by the Economy Trolley Wheel Company, of Chicago, Ill. These wheels have been in use for several years, during which they have gained a high reputation. The wheel is made in three parts, the hub and the two flanges, each of which moves independently of the other. The flanges are of steel and the center hub of brass. The latter of course receives the most wear, and can easily be renewed. When on the straight line nothing moves but the center pulley, which



THE "ECONOMY" TROLLEY WHEEL.

can be renewed for fifty-five cents, and four extra centers will last a year. The manufacturers state with confidence that this wheel will not spark.

It is now in use on the South Chicago Street Railway line, and also on the Calumet line, on both of which roads it is giving entire satisfaction. This company claims to save one third of the friction on the trolley wire by using this wheel, and that the wheel will wear three times as long as any other wheel in use; it contains a graphite bushing and is also a self oiler.

Second Annual Report of the General Electric Company.

The annual report of the General Electric Company for the year ending January 31, 1894, was presented to the stockholders of the company early in April. As was expected, the report shows a great loss during the year past in valuation of assets.

On January 31, 1893, the assets were examined and valued, and a report on the condition of the company was made to the stockholders at their annual meeting in April last. This examination was conducted under rigid instructions from the Board of Directors, that material on hand, stocks, bonds, customers' notes and accounts, etc., should be carefully scrutinized, and should be valued on a most conservative basis. The complex organization then existing, and the fact that the amalgamation of the various interests represented by the company had been so recent, made the task an especially difficult one at that time, but the statement made by those directly responsible to the board was that the instructions of the directors had been strictly carried out.

The company had inherited stocks of manufactured goods in the principal cities in which district offices were located, from Boston in the East and Atlanta in the South, to San Francisco and Portland in the West. Notes and accounts receivable, stocks, bonds and other assets were similarly distributed. Each district office had exclusive charge of, and was presumably familiar with, the value of its own assets, and was largely independent of the general office. This defective system, since abolished, rendered it exceedingly difficult to arrive at correct conclusions, and notwithstanding the efforts of the officers, it led to grave mistakes in the estimates of value of accounts, securities and inventories of merchandise.

The Edison Company, to a small extent, and the Thomson-Houston Company (the organization of which was mainly adopted by the company), to a greater extent, had been in the habit of doing more or less exploiting work, resulting in the acquisition of stocks and bonds of local lighting and railway companies. The Thomson-Houston Company had generally been very successful in marketing these securities at profitable figures. By the facilities which it had thus been able to afford to local enterprises, it was enabled to expand its business. The company at the time of its organization assumed a large number of such transactions which were in progress or contracted for. The general policy of the board, however, since the organization of the company, has been to curtail transactions involving the acceptance of stocks or bonds for anything other than license rights, except where for some special reason it has been deemed advisable to accept them, as in settlement of disputed or doubtful accounts.

Among the most important transactions of the character above referred to, were those with newly organized companies, and this class of business has been very extensive in the South and West. The financial and industrial collapse in these sections in the spring and summer of 1893 affected the company severely, and very many accounts, notes and investments assumed as good a year ago must now be recognized as of diminished value. The same is especially true as to the Northwest, where the company's output was sold through the Northwest General Electric Company, formerly known as the Northwest Thomson-Houston Company.

The Thomson-Houston Company had large interests in various construction and manufacturing companies, notably the above mentioned Northwest Company, the Fort Wayne Electric Company, the Brush Electric Company, and others; the whole standing on its books at about $5,500,000. At the time of the last annual report, statements were obtained from the officers of such companies, and it was estimated that something less than one-half of this investment was represented by patent rights and something over one-half by other assets. Unknown to the Board of Directors, some of these companies became unduly expanded during the winter and spring of 1892-3, and the stringency which began in April and culminated last autumn caused them to suffer greatly. The directors have reduced the company's entire holdings of Fort Wayne and Northwest stocks to a valuation of $1 each, exclusive of the amount carried in patents.

After protracted negotiations, the Northwest Company has been put in liquidation, and the territory controlled by it has reverted to the General Electric Company.

Reference is made in the report to the recent financial panic, and of the necessity for selling some securities to a syndicate, which organized the trust known as "The Street Railway and Illuminating Properties." An account is also given of the reorganization of the selling departments of the company, and its concentration at Schenectady.

The financial condition of the company has been greatly improved during the last six months, and the net amount of direct and indirect obligations, July 31, 1893, $8,734,000, was reduced by January 31, 1894, to $1,984,000.

While the liquidation of the debt has been going on, the company has also readjusted its basis for sales, either to cash or to short credits to desirable customers. In view of the extreme depression and the uncertainty as to the early future, the directors have not felt justified in any other course than that of adhering strictly to sales on this basis. It is believed by the directors that the company has lost little legitimate business in consequence of its curtailment of credit to customers. It intends to confine its business to this basis, and to accept smaller profits.

The directors state that they do not believe that it will be possible for some time to come to do as large a business as was done by the company prior to the panic, although a gradual improvement has been apparent during the last two months. The street railway business, which to a considerable extent was formerly done through syndicates and promoters, many of whom have become embarrassed, promises to be smaller than during the previous year. Arc lighting business is also reduced, largely because of the inability of local companies to secure capital with which to extend their business for the purpose of carrying out municipal contracts. The business of the company, with respect to incandescent lighting, which is to a great degree performed by strong and conservatively managed local companies, is in a more healthy condition, and has not suffered so severely. The business in plants for the distribution of electrical power is promising, and many important installations are in progress. The application of electricity to various mining purposes, such as hauling, hoisting, drilling, etc., is increasing. The future in this respect is promising. The increase in the number of local lighting and railway companies is shown by the following table:

	Feb 1. 1892.	Feb. 1. 1893.	Feb. 1. 1894.
Total number of local companies operating incandescent and arc lights	1,158	1,277	1,479
Total number of railway companies	214	435	541

PATENTS.

Substantial progress has been made during the year in the prosecution of suits against infringers of many of the more important patents belonging to the company. The "feeder and main" patent, which is of fundamental importance, particularly for the low tension lighting plants, has been sustained by the Circuit Court for the District of New Jersey.

The litigation on the incandescent lamp patent has been generally successful, although the most strenuous efforts have been made by infringers to defeat the patent or to devise some form of lamp that would be outside of it. In two instances the company has met with reverses in this litigation which have proved to be comparatively unimportant. In these instances they are advised there is a strong probability that they will ultimately prevail. The efforts to evade the patent by so-called "lamp repairs," and by injecting a harmless amount of inert gas into the bulb, have been defeated.

Owing to the inevitable delays of litigation, the important cases on patents for railway work, upon which the directors place great reliance, have not yet come to hearing. It is expected that many of these cases will be determined during the coming year.

No final decision has been rendered against the company on any patent. During the past year several such suits against the company have been decided in its favor, notably the suit on the patent for the hydro-carbon treatment of the filament of incandescent lamps, which has been disposed of in the company's favor by the decision of the United States Circuit Court of Appeals.

Upon the whole, the patent situation seems to be promising, and the directors believe that at the next annual meeting they will be in a position to report substantial progress.

All expenditures for patents and patent rights during the year under review, and all expenses of patent litigation, have been charged to operating expenses.

STATEMENTS OF ACCOUNTS.

The assets of the company include the following: Patents and franchises, $8,159,264.02; manufacturing plants, $3,941,128.98; other real estate, $323,685.23; stocks of manufacturing companies (schedule A), $2,767,470.58; stocks and bonds of local companies (schedules B

and C), $2,723,493.17; cash, $591,143.88; notes and accounts receivable (face value $14,984,697.42) $8,934,159.75; total, $9,525,303.63. Inventories; $4,834,792.62; work in progress, $1,198,343.58; profit and loss, $12,454,967 42; total, $45,928,449.23. The liabilities shown are: Common stock, $30,459,700; preferred stock, $4,251,900; total, $34,711,000; 5 per cent. gold coupon debenture bonds, $10,000,000; mortgages, $26,200; accrued interest on debenture bonds, $83,333.32; notes payable, $744 341.31; accounts payable, $323,084.82; sundry credits, $39,889.78; total, $45,928,459.23.

(SCHEDULE A.)

STOCKS OF MANUFACTURING AND OTHER COMPANIES.

CORPORATE NAME.	ADDRESS.	PAR VALUE.
Brush Electric Co. (Pref.)	Cleveland, O	$26,300.00
" " " (Pref. Guaranteed)	"	96,500.00
" " " (Com.)	"	1,995,200.00
Canadian General Electric Co	Toronto, Can	1,250,000.00
Electric Corporation (Subscription)	Boston, Mass	28,200.00
E. C. Morris Safe Co. (Pref.)	"	3,600.00
Excelsior Electric Co	Brooklyn, N. Y	387,000.00
Fort Wayne Electric Co	Ft. Wayne, Ind	1,921,850.00
Ft. Wayne Trust Securities (Series A.)	Boston, Mass	9,776.00
Ft. Wayne Jenney Electric Light Co	Ft. Wayne, Ind	365,000.00
Northwest General Electric Co	St. Paul, Minn	549,850.00
Otis Electric Co	Yonkers, N. Y	174,000.00
Pennsylvania General Electric Co	Philadelphia, Pa	468,000.00
Schuyler Electric Co	Middletown, Ct	50,000.00
Schuyler Electric Manufacturing Co. (Com.)	Hartford, Conn	84,000.00
" " " " (Pref.)	"	307,930.00
Swan Lamp Manufacturing Co	Cleveland, O	23,000.00
Shares of St. Ry. & Illuminating Properties	Boston, Mass	6,400.00
United Electric Securities Co. (Com.)		500,000.00
" " " " (Pref.)		23,100.00
Total (carried on balance sheet at $2,767,157.58)		$8,279,706.00

In addition to the above the company owns stocks of various other manufacturing, etc., companies of a total par value of $6,037,310.00, which are carried on the balance sheet at a total value of $313.00.

(SCHEDULE, B.)

STOCKS OF LOCAL COMPANIES.

CORPORATE NAME.	ADDRESS.	PAR VALUE.
Andover Electric Light Co	Andover, Mass	$2,000.00
Appleton Edison Electric Co	Appleton, Wis	15,000.00
Austin Electric Co	St. Paul, Minn	50,000.00
Buffalo General Electric Co	Buffalo, N. Y	260,000.00
Compagnie Francaise	Paris	20,072.12
Citizens' General Electric Co. (Pref.)	Louisville, Ky	12,300.00
Com. Anonima del Alumb. El de Puebla	Puebla, Mexico	15,000.00
Cambridge Electric Light Co	Cambridge, Mass	2,700.00
Citizens' Electric Light & Power Co	Dayton, O	1,790.00
Cleveland General Electric Co. (Com.)	Cleveland, O	200,000.00
" " " " (Pref.)	"	16,900.00
Chester Electric Light & Power Co	Chester, Pa	1,750.00
Chicago Edison Co	Chicago, Ill	2,666.67
Cooperstown Gas & Electric Co	Cooperstown, N. Y.	2,250.00
Canton Electric Light & Power Co	Canton, O	12,200.00
Columbus Edison Electric Light Co	Columbus, O	23,100.00
Dillon General Electric Co	Dillon, Mont	40,000.00
Eastchester Electric Co	Eastchester, N. Y.	$32,645.00
Edison Electric Illuminating Co	Paterson, N. J	31,500.00
" " " "	New York, N. Y	700,200.00
" " " "	Brooklyn, N. Y	8,300.00
" " " "	Cumberland, Md	8,500.00
" " " "	Newburgh, N. Y	29,650.00
" " " "	Altoona, Pa	10,000.00
" Electric Light & Power Co	Kansas City, Mo	14,200.00
" " " " " "	York, Pa	13,200.00
" " " " " "	Erie, Pa	14,400.00
Elgin City Railway Co	Elgin, Ill	40,000.00
Essex County Electric Co	Orange, N. J	5,000.00
Fargo Gas & Electric Co	Fargo, N. Dak	20,000.00
First Cincinnati Edison Electric Ill'g. Co	Cincinnati, O	8,700.00
Grand Rapids Edison Light & Fuel Gas Co	Gr. Rapids, Mich	29,000.00
Glens Falls Electric Light & Power Co., Ltd	Glens Falls, N. Y	550.00
Grinnell Electric Light Co	Grinnell, Iowa	1,000.00
Hackensack Edison Lighting Co	Hackensack, N. J	59,500.00
Hollister Light & Power Co	Hollister, Cal	250.00
Johnstown Electric Light Co	Johnstown, Pa	18,600.00
Kansas City Suburban Belt Line Railroad Co	Kansas City, Mo	4,080.00
Laramie, E. G. L. H. & Fuel Co	Laramie, Wy	16,500.00
Little Falls Electric Light & Power Co	Little Falls, N. Y	2,500.00
McKeesport, Light Co	McKeesport, Pa	8,900.00
Napa Thomson-Houston Light Co	Napa, Cal	33,500.00
Natick Gas Light Co	Natick, Mass	10,100.00
New Omaha T.H. Electric Light Co. (Com.)	Omaha, Neb	30,600.00
Newport Illuminating Co	Newport, R. I	36,700.00
Northwest Electric Co	Winnipeg, Man	20,000.00
Portland General Electric Co. (Com.)	Portland, Ore	527,800.00
Philadelphia Consolidated Co	Philadelphia, Pa	4,375.00
Roseburg Electric Light & Power Co	Roseburg, Wash	20,000.00
San Luis O. B. T-H. Electric Co	S. L. Obispo, Cal	800.00
Scranton Illuminating, Heat & Power Co	Scranton, Pa	42,000.00
Skowhegan Electric Light Co	Skowhegan, Me	4,300.00
Suburban Electric Ill'g, Heat & Power Co	Newport, Ky	16,415.00
Standard Light & Power Manufacturing Co	Montpelier, Vt	1,000.00
Stoughton Electric Light Co	Stoughton, Wis	1,200.00
Thomson-Houston Electric Light & Power Co	Quincy, Ill	2,200.00
Trenton Light & Power Co	Trenton, N. J	55,000.00
Union Elektricitats Gesellschaft	Berlin	163,000.00
Visalia Gas, Light & Heat Co	Visalia	14,700.00
Westboro Electric Light & Power Co	Westboro, Mass	1,620.00
Wilkesbarre Electric Light & Power Co	Wilkesbarre, Pa	10,100.00
Total (carried on the Balance Sheet at $1,362,294.62)		$2,750,313.79

In addition to the above the company owns stocks of various other local companies of a total par value of $3,713,717.03, which are carried on the balance sheet at a total value of $4,754.75.

(SCHEDULE, C.)

BONDS.

CORPORATE NAME.	ADDRESS.	PAR VALUE.
Asheville Street Railway Co	Asheville, N. C	$14,000.00
Atlanta Consolidated Street Railway Co	Atlanta, Ga	18,000.00
Bangor Electric Light & Power Co	Bangor, Me	64,500.00
Consumers' Light & Power Co	Little Rock, Ark	27,000.00
Chicago North Shore Street Railway Co	Chicago, Ill	94,000.00
Cumberland Electric Light & Power Co	Nashville, Tenn	100,000.00
Chattanooga Electric Light Co	Chattanooga, Tenn.	57,000.00
Chattanooga Electric Street Railway Co	" "	20,000.00
Central Market Co	Chicago, Ill	1,600.00
Columbian Intramural Railway Co	" "	250,000.00
Citizens' General Electric Co	Louisville, Ky	115,000.00
Charleston Light & Power Co	Charleston, S. C	25,000.00
Consolidated Electric Light Co	Birmingham, Ala	79,000.00
Covington Electric Light Co	Covington, Ky	7,000.00
Concord Land & Water Power Co	Concord, N. H	74,500.00
Dallas Electric Co	Dallas, Tex	1,000.00
Dayton Electric Light Co	Dayton, O	282,000.00
Georgetown Water Co	Georgetown, Ky	5,000.00
Greensboro Electric Light & Power Co	Greensboro, N. C	2,500.00
Hoosac Valley Street Railway Co	N. Adams, Mass	800.00
Jackson Light & Power Co	Jackson, Mich	83,000.00
Kingston Electric Co	Kingston, N. Y	7,000.00
Knoxville Street Railroad Co	Knoxville, Tenn	6,000.00
Lee Electric Co	Lee, Mass	11,000.00
Los Angeles Consolidated Electric Railway Co	Los Angeles, Cal	41,440.00
Metropolitan Street Railway Co	Macon, Ga	45,000.00
Manhattan Electric Light Co	New York City	52,000.00
Madison City Railway Co	Madison, Wis	22,000.00
Middleboro Gas & Electric Co	Middleboro, Mass	45,000.00
Milwaukee Street Railway Co	Milwaukee, Wiss	325,000.00
Monongahela Electric Light & Power Co	Homestead, Pa	15,000.00
Mobile Transportation Co	Mobile, Ala	100,000.00
Narragansett Pier Electric Light & Power Co	Nar. Pier, R. I	1,000.00
Natick Electric Co	Natick, Mass	17,500.00
North River Electric Light & Power Co	New York City	2,000.00
Ottawa Electric Street Railway Co	Ottawa, Ill	51,000.00
Ocala Light & Power Co	Ocala, Fla	10,000.00
Oskaloosa Edison Light Co	Oskaloosa, Wis	7,500.00
Oxford Lake Line	Anniston, Ala	175,000.00
Otis Electric Co	New York City	20,000.00
Public Works Co	Bangor, Me	35,000.00
Queen City Railway Co	Dallas, Tex	85,000.00
Queen City Electric Railway Co	Marion, Ind	5,000.00
Raleigh Street Railway Co	Raleigh, N. C	25,000.00
Sheffield Manufacturing Co	Saugerties, N. Y	900.00
Standard Plate Glass Co	Pittsburgh, Pa	1,600.00
Steubenville Street Railway Co	Steubenville, O	2,500.00
St. Cloud City Street Car Co	St. Cloud, Minn	5,000.00
Tacoma Railway & Motor Co	Tacoma, Wash	200,000.00
Town of Buena Vista	Buena Vista, Va	1,600.00
United Electric Sec. Co., 1st Series	Boston, Mass	1,000.00
" " " " 3d "	"	47,000.00
" " " " 7th "	"	41,000.00
Watertown Heating, Lighting & Power Co	Watertown, S. D	2,000.00
Weymouth Light & Power Co	Weymouth, Mass	39,000.00
Winona General Electric Co	Winona, Minn	20,000.00
Total (carried on balance sheet at $1,356,431.80)		$2,785,940.00

In addition to the above, the company owns bonds of various other companies of a total par value of $146,621.30, which are carried on the balance sheet at a total value of $12.

Theory vs. Practice on Electric Railways.

The following letter was recently received by a prominent manufacturing company of electrical apparatus:

GENTLEMEN:—Will you please excuse the liberty I am taking to address you. I am much interested in electric cars, and I have been surprised to see that PRACTICE does not always agree with THEORY.

I am a machinist, but devote my spare time and money to try to learn something more. I have bought a number of books on electricity and I find in one of them the following rules:

No. 5:—When ready to start, move the controller handle gradually but firmly.

No. 7:—In throwing the power on, move the controller handle step by step, allowing the car to gain headway under one, before advancing to the next step. Too sudden starting strains the machinery and wrenches the gears, etc.

No. 8:—In throwing the power off, move the controller handle gradually until nearly at the "off" stop, when it should be turned the rest of the way with a snap, and care should be taken that the power is off before setting the brakes.

No. 9:—The brakes should be set gradually, so as not to bring an undue strain upon the gearing.

No. 13:—Never stop a car on a curve, except in case of accident. Many breakdowns and troubles have resulted from unnecessarily stopping on curves. The extraordinary amount of current required to start a loaded car on a curve may endanger the insulation of the motors.

These rules seem to me very simple and very proper, and any man with a little conception of machinery will think the same. Any man with a little good judgment will know that we cannot start any machinery at full speed; the speed has to be gained step by step.

The motorman (at least the motorman of this city) is the only man trying to go against Nature's laws. Nature is advancing step by step. We don't see a tree covered with leaves, flowers and fruits in a few seconds. The child cannot run the first day. A racer cannot gain the full speed at the start. A sudden high flame in a lamp will break the chimney. To fill at once an overheated boiler means an explosion, etc. But the motorman is an exception, and he intends to start and stop his car at once.

I have paid much attention to the motormen of this city, and I see day by day that they pay not the least attention to the above rules. They throw on the power all at once and throw off the power with a single snap from the last step to the "off." As to curves, they pay no attention to them, and will stop on the middle of a curve as they would on a straight line. Putting the brakes on before the current is off, or throwing the power on before the brakes are released, are daily occurences in this city. It is well to add that many persons regret the old horse cars, as the new electric cars give us a very unpleasant ride, and with certain motormen and a car complete you reach home very sore.

I have tried to put me this question: Am I old and ignorant of any progress? It may be that in this age of wonders you have perfected the controllers in such a manner that the handle of the controller and the handle of the brakes are toys in the hands of motormen to play to suit themselves. Perhaps you have devised a new controller which will allow a sudden full power to flow to the motors without injuring the machinery. In purchasing the book I mention (second

edition 1893), I thought I had the latest, but it cannot be so. New improvements to go against laws of Nature must have found their way, otherwise the companies would put a stop to the reckless manner in which the motormen are running the cars.

It may be that the companies are more ignorant than I am, and don't say anything because they don't know any better. As I said, the companies must ignore these rules, or then I am of an old age, far away from improvements.

I come to you, gentlemen, merely to ask you if *the above rules are still good, or if since the publication of the book mentioned, improvements have been made to declare the said rules void?* If you can answer this question you will greatly oblige me; your answer would be an authority and much useful for a work I am preparing.

Destructive Effect of Electrical Currents on Subterranean Metal Pipes.

By ISAIAH H. FARNHAM.

Early in the summer of 1891, some lead covered telephone cable, removed from wooden ducts in Boston, showed some very marked, yet local, spots of corrosion. The cause of the corrosion was generally attributed to acetic acid contained in the wooden conduit which had, years before, caused corrosion on a few cables in certain sections of the city. In the case just mentioned, the corrosion was so severe, and located in spots only, that it led me to attribute the cause to electrolytic action from the railway currents.

Measurements were made between the cables in all manholes and the earth near the cables, for voltage and direction of current. It was found that within a radius of about 2,000 ft. from the Albany Street power house, cables were negative to the earth, ranging from zero to two volts, and that outside of this neutral line, they were positive to the earth from zero to twelve volts. This condition prevailed until a point was reached near the East Cambridge power house, when they again passed a neutral line, and became more and more positive as that power house was approached. The same conditions were found as the Allston railway power house was approached. On obtaining sufficient data, maps were drawn, showing voltage between cables and earth throughout all sections of the city. This is shown in the map (Fig. 1.).

In addition to the figures placed beside the several routes of cable conduits, showing the direction of current and its pressure, we have shaded such portion of the map where at that time we found the cables positive to the earth. We may call the shaded portion of the map the danger territory. These potential measurements, though taken for other purposes, incidentally furnished all the proof needed to convince one that the railway power was the source of the troublesome currents.

At the time the map was made, and previously, the railway was operating with the negative pole of the dynamo to the trolley, the positive side being to the rails.

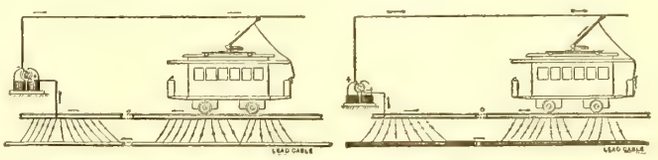
Fig. 3 is intended to illustrate this condition. It shows the passage of current from the dynamo to the rails, and the passage of a portion of the current from the rails to the cables within the neutral or zero line, and from the cables to the rails outside of this zero line. The danger of electrolysis is only where the current is leaving the cable or pipe through the moist earth; hence, the dangerous district was at this time outside of the zero or neutral line, as shown both on the map (Fig. 1) and in Fig. 3.

The remedies proposed were: First: To remove all cables from the wet bottom and sides of the so called manholes. It was found very difficult to place and retain cables free from the wet sides, and even could this have been accomplished, the action at the mouth of the ducts, and within them, would still have continued.

Second: To connect the cables to ground plates in the manholes, and so transfer the electrolytic action to these plates, and thus save the cables. This experiment was tried on an extended scale, but though many ground plates, having a surface of several square feet each, were connected with the cables over a large portion of the city, it was found that voltmeter readings taken between the cables and a point on the earth a short distance removed from the ground plate in any manhole, gave nearly the same pressure as before the ground plates were connected.

Third: Prof. Elihu Thomson suggested the placing of motor generators at different points along the railway line, wherever the cables and pipes are found to be in danger, the motor generators to be operated by the railway power current; the secondary current developed by these generators to be utilized to lower the potential in the cables and pipes to zero, with respect to the surrounding earth or rails. The motor generators would, so to speak, pump the current out of the cables, and force it into the rails whenever the potential of the former should rise above zero. This plan has not yet been put into operation, so far as I am aware.

Fourth: Insulating the cables and pipes from the earth was proposed. As some of the worst cases of corrosion of cables by electrolysis occurred where they were painted with asphalt, taped, painted again, and finally covered again with a heavy braiding, also saturated with asphalt, it was apparent that to insulate cables sufficiently to protect them would be difficult and expensive if, indeed, practically possible. To protect water and gas pipes by a sufficient insulating jacket was seen at once to be impracticable.

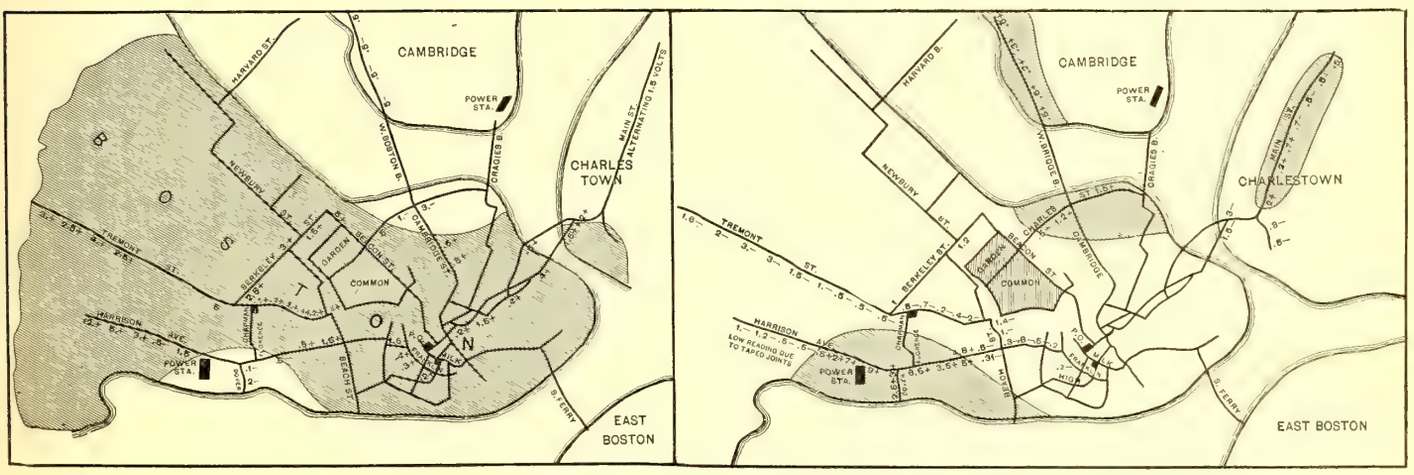


FIGS. 3 AND 4.—DIAGRAMS SHOWING DIRECTION OF CURRENT DURING BOSTON EXPERIMENTS.

Fifth: Breaking the metallic continuity of the cable sheath and pipes was proposed. From the fact that severe action is frequently found in comparatively isolated spots, where cables and pipes cross each other or pass near or across the rails, it follows that any system of breaking the metallic continuity, would have to be studied with reference to the entire complicated system of pipes, cables and rails ramifying through the streets of a city. There would also be a difference of potential between the several sections of cable or pipe, severed metallically, tending to cause electrolysis at one end of each section. In case of water pipes, treated in this manner, the action might be expected on the interior as well as on the exterior.

There appears to be some evidence of such an action as this in gas and water pipes where the electrical continuity is partially broken by leaded joints. An iron service pipe taken from the Cambridge gas system showed that the action is most severe at points immediately on either side of the coupling. The reason the corrosion appears on both sides of the coupling in this case is not clear; it may be due to reversal of current on the railway system.

Sixth: It was suggested that the railway current might be so frequently alternated, as possibly to prevent serious action on the pipes and cables. The theory was, that before the oxygen gas, liberated by the current, should have time to attack the metal, the reversal of the current would disperse it. A careful experiment was conducted, extending over a period of ten days, employing a pressure of current of from three to seven volts, and alternating its direction at regular periods of one minute, by specially devised apparatus. No material change had taken place in either plate during this period of time. We then considered the practicability of reversing the railway current frequently. It seemed possible to reverse it once each twenty-four hours, at a given time in the night when the load is comparatively light. To do this in a large system involving several power stations would require either a loss of current for a few minutes in order to guard against one station reversing before some other had opened or reversed its current, or would require some electrical system connecting the several stations together and operating the reversing apparatus simultaneously. We concluded it would be very difficult, if indeed at all practicable, to reverse such heavy currents during regular traffic.



FIGS. 1 AND 2.—MAPS OF BOSTON, SHOWING POTENTIALS OF EARTH DURING EXPERIMENTS.

*Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers, New York, April 18.

We then renewed the reversing experiment, giving twenty-four hour periods between each alternation, but found at the end of two weeks, to our sorrow, that the plates subjected to the action of the current were seriously electrolyzed. It seemed useless to pursue this line of work further at that time. When alternating current motors become practicable for use on street cars, advantage may be taken of the fact that such currents appear not to cause electrolysis to the extent of injuring pipes and cables exposed to them.

Seventh: Mr. Fred S. Pearson suggested that if the positive pole be connected with the trolley, the danger of electrolysis would be removed from the greater and more scattered portion of the city, and be brought near the power stations where it possibly could be more easily dealt with. This reversal was made and the expected potential changes between cables and earth followed. Fig. 2 is a map of Boston, showing the condition after the reversal of current. The shaded or dangerous portions in this map, correspond to the white or safe districts in the map, shown in Fig. 1, the only variation being, that by the reversal, the neutral or zero line was thrown out a little further from the Albany Street power house than it was located before. It was also noted that the cables near the power house which had been from one to two volts negative to earth before the change of current, were now one to nine volts positive to earth; that is, they were raised higher above zero than they had been below zero prior to the reversal. Fig. 4 is a typical representation of the current flowing through trolley, car, rails and cables at this time. It will be readily understood that with the conditions as illustrated in this figure, the electrolytic action would be confined to the territory comparatively near the power stations where the current is leaving the cables to reach the negative or rail side of the dynamo.

Mr. Pearson next suggested the plan of running out large copper conductors from the negative side of the dynamo and extending them through the dangerous district, connecting them at frequent intervals to the cables. On the principle involved in Professor Thomson's motor generators, this low resistance conductor connected directly to the dynamo, was to pump the current from the cables and so prevent its passage into or through the moist earth. This plan has been followed with most excellent results. The shaded patch which existed in the locality of the Albany Street station is now removed, and the cables are all negative to earth. The remaining shaded patches or dangerous sections have been corrected by taking similar means of reaching the East Cambridge power house.

The facts given above, with others similar, though not enumerated, lead me to these conclusions:

1. All single trolley railways employing the rails as a portion of the circuit, cause electrolytic action and consequent corrosion of pipes in their immediate vicinity, unless special provision is made to prevent it.

2. A fraction of a volt difference of potential between pipes and the damp earth surrounding them is sufficient to induce the action.

3. Bonding of rails, or providing a metallic return conductor equal in sectional area and conductivity to the outgoing wires, is insufficient to wholly prevent damage to pipes.

4. Insulating pipes sufficiently to prevent the trouble is impracticable.

5. Breaking the metallic continuity of pipes at sufficiently frequent intervals, is impracticable.

6. It is advisable to connect the positive pole of the dynamo to the trolley lines.

7. A large conductor extending from the grounded side of the dynamo, entirely through the danger territory and connected at every few hundred feet to such pipes as are in danger, will usually ensure their protection.

8. It is better to use a separate conductor for each set of pipes to be protected.

9. Connection only at the power station, to water or gas pipes, will not ensure their safety.

10. Connection between the pipes and rail, or rail return wires, outside of the danger district, should be carefully avoided.

11. Frequent voltage measurements between pipes and earth should be obtained, and such changes in return conductors made as the measurements indicate.

A Peculiar Electric Truck.

At the works of the McGuire Manufacturing Company, of Chicago, are four electric motor trucks building for the Johnson Rail Company, of Johnstown, Pa. The peculiarity of the construction is that the gauge is adjustable, that is to say, the wheels can be readily changed to run on any track varying from three feet six inches to five feet three inches. There is a thread cut in the hub and on the wheel fit of each axle. It is a thread three to the inch, sixteen inches long, and is cut at each wheel fit of the axle, and the hub of the wheel is cut to fit it. The keys are double jointed and so arranged that they can be changed and the gauge changed in a very few minutes when desired. There are two key ways cut in the hub, and two in the axle on the quarter, so as to get a quarter turn adjustment. It is a very fine and expensive piece of work and is only intended for the purpose for which it is built.

Within the last month the McGuire Company has also built seventy steel frame trucks for the Electric Traction Company, Philadelphia; fifteen for Memphis, Tenn.; five for Davenport, Ia., and twelve for the Cicero & Proviso Electric Railway, Oak Park, Ill. The company also has orders yet unfilled from the Derby Street Railway, Derby, Conn.; Buffalo & Williamsville Street Railway, Buffalo, N. Y.; Philadelphia, Neville Island & Coraopolis Railway, Coraopolis, Pa.; Hamilton, Grimsby & Beamsville Railway, Hamilton, Ont.; Sandusky, Milan & Norwalk Street Railway, Sandusky, O.; Philadelphia & Delaware County Railway, Philadelphia, Pa., and others.

The Pier Movable Sidewalk Purchased.

Visitors to the World's Fair, Chicago, will remember the movable sidewalk on the pier, which was extremely interesting from a mechanical standpoint, and which carried large numbers of people. This sidewalk has been purchased by L. K. Hirsch, of Chicago, who deals in old railway material, iron and steel scrap, etc.

The movable sidewalk, as will be remembered, consisted of a large number of cars, 351 in all, connected together. The cars were mounted on eighteen inch wheels, with axles of about one and seven-eighths inches in diameter, and with three feet nine inch gauge. Mr. Hirsch intends to sell these cars and trucks separately, and thinks that they will meet with a large demand for mining and other work. Mr. Hirsch has also secured a great deal of timber and a large supply of eight, twelve and sixteen pound iron and steel T rails, which he has for sale at immediate delivery.

Street Railway News.

Extensions and Improvements.

Boston, Mass.—Among the plans of the West End Street Railway Co. for this spring is the extension of electric lines of cars into all of East Boston, the uncompleted part of Brookline, Mt. Auburn Street and Huron Avenue in Cambridge, Malden and Medford, and minor extensions in Somerville and other suburbs.

The new Westinghouse motors for the West End Street Railway, are being delivered daily.

Brooklyn, N. Y.—The Brooklyn, Queen's County & Suburban Railroad Company is being equipped for electrical operation.

Dayton, O.—The City Railway Company writes that it will shortly place a contract for a number of cars and trucks.

Detroit, Mich.—Work will begin at once on Woodward Avenue for the extension of the Highland Park electric road as far north as Edson Avenue formerly known as the Six Mile Road.

Milwaukee, Wis.—It is stated that the Milwaukee Street Railway Company has decided to extend the Farwell Avenue electric line up Glen Avenue to the Lakeside Park, as soon as the Common Council will grant permission. The company is also considering a proposition to extend the electric line up Glen Avenue to Menlo Park.

The Milwaukee Street Railway Company has been given permission to extend its North Avenue line to Folsom Place.

Neenah, Wis.—It is contemplated to electrically equip the Menasha & Neenah Street Railway, and extend it to Appleton and neighboring towns.

New Haven, Conn.—The J. G. Brill Company, of Philadelphia, has received an order for cars for the West Shore Railway Company, which it is expected, will be in operation by June 5. The road will connect West Haven and Milford. The type of car adopted is a combination car with cross seats.

The hearing on the application of the Centerville Horse Railroad Company for permission to extend its lines from the city line to the center of Centerville will take place before the Selectmen May 17.

Oshkosh, Wis.—The controlling interest in the Oshkosh Street Railway Company has been sold to an Indianapolis syndicate. The sale is conditioned upon the granting by the Common Council to the new company of a franchise for an electric line. The purpose is to reorganize and install electricity and make large extensions. Representatives of an Ohio syndicate are also seeking a franchise.

Philadelphia, Pa.—Contractor McCaul commenced work April 5 on the large car house for the Germantown branch of the People's Traction Company on Germantown Avenue above Church Street. It is to be constructed of local stone, and is to be done by May 1.

Roxborough, Pa.—Mayor Stuart has signed the ordinance granting trolley privileges to the Manayunk & Roxborough Incline Plane & Railway Company. It is rumored that this company will extend the road to Norristown by the way of Marble Hall.

Washington, D. C.—The Belt Railway Company has applied for rights to make a number of extensions.

The Washington, Alexandria & Mt. Vernon Electric Railway Company contemplates an extension into the city of Washington.

New Roads.

Akron, O.—On April 4 there was incorporated the Akron Street Railway Company, of Akron, with a capital stock of $700,000.

Allegheny, Pa.—The Allegheny & Butler Railway Company was incorporated April 18, with a capital stock of $300,000 for constructing and operating an electric railway in Allegheny County, Pa. Wm. I. Mustin, of Pittsburgh, Pa., is the president of the company, and others interested are Charles K. Hill, of Ross Township, Allegheny County and F. Gwinner and Wm. R. Rhodes, of Allegheny.

The Etna & Glenshaw Street Railway Company was incorporated April 18, with a capital stock of $50,000 to construct and operate an electric railway in Allegheny County, Pa. F. Gwinner, of Allegheny, Pa., is the president of the company. Others interested are F. Gwinner, Jr., Edward W. Gwinner and Wm. B. Rhodes, all of Allegheny.

Champaign, Ill.—The Champaign Rapid Transit Company has filed a certificate of consolidation with the Urbana & Champaign

Street Railway Company, under the name of the Urbana & Champaign Electric Street Railway Company. The capital stock of the consolidated company is to be $50,000.

Chester, Pa.—A new organization, to be known as the Chester Traction Company, with a capital of $500,000, has secured control of all the railways centering in this city. Samuel A. Dyer will be the active spirit in the new concern, and it is rumored that the Philadelphia Traction Company is a party in the deal.

Chestertown, Md.—An electric road from Chestertown to Rock Hall is being considered.

Chicago, Ill.—The Chicago & Morgan Park Electric Street Railway Company was incorporated lately, with a capital stock of $500,000. The incorporators are B. Frank Deacon, Charles S. McCoy, Samuel H. Hubbard, Frank Foster and Ralph F. Bogle. The company contemplates the construction of an electric railroad between Englewood, Morgan Park and Blue Island, and eventually will extend the line to West Pullman and Harvey. It is proposed to connect with the cable and suburban lines of Englewood.

Chicopee, Mass.—The Chicopee Street Railway Company will organize with $100,000 capital stock to build an electric street railroad from Holyoke to Springfield. The directors are Charles C. Abbey of Chicopee, James E. Delaney of Holyoke, Selig Manilla of Springfield and others.

Delaware Water Gap, Pa.—The Mt. Minsi Electric Railway Company was incorporated April 3, with a capital stock of $125,000. A. B. Batchelder, of Delaware Water Gap, is president. Other stockholders are S. E. Overfield, H. W. Hauser, Eugene Brodhead and F. W. Eilenburger.

Detroit, Mich.—A Denver syndicate, composed of D. H. Moffatt, president of the First National Bank, J. C. Montgomery and J. B. Thompson, of Chicago, are negotiating for the purchase of the street railway franchise of the City of Detroit. The present franchise, granted thirty years ago, expires this year.

Fort Lee, N. J.—The company which, some time ago, began to build a trolley railroad from Fort Lee to Leonia is to be reorganized for the purpose of carrying out the project, which contemplates freight as well as passenger traffic.

Geneva, O.—An electric road from Geneva to Warren is talked of. The road would be forty-four miles long, and would pass through Bloomfield, North Bristolville and Champion.

Green Bay, Wis.—E. P. Morton, a New York capitalist, has organized a company here, and will complete the electric street railway upon which the construction was stopped last summer by a failure of the parties holding the franchise. The road is to be in operation in two months.

Houston, Tex.—A new corporation is the Houston & Suburban Street Railway Company. The capital stock is $100,000. The incorporators are A. Christeson, Wm. G. Wilson, Jr., and E. W. Cave.

Houtzdale, Pa.—The Houtzdale & Suburban Electric Railway was incorporated on March 30, with a capital stock of $100,000, for the purpose of constructing and operating an electric railway in Clearfield County, Pa. The president of the company is A. Markle, of Hazelton, Pa. Others interested are J. E. Giles, E. S. Doud, of Hazelton, and Chas. A. Bragg, of Philadelphia.

Hull, Mass.—The Hull & Nantasket Street Railway Company has been formed for building a new line from Pemberton Point to the division line of Hingham and Hull. It has a capital stock of $40,000, and the incorporators are Henry Norwell, of Norwell; Joseph O. Burdette, of Hingham; Z. Taylor Harrington, of Hull, and others.

Iowa City, Ia.—The subject of a street railway is being agitated here.

Kansas City, Mo.—Articles of consolidation were filed April 11 by the Kansas City Cable Railway, the Independence Railway Company, and the Kansas City & Independence Rapid Transit Railway Company, under the name of the Kansas City Cable Railway Company; capital stock, $4,300,000. The directors are L. C. Kurthoff, Webster Withers, Geo. W. Clawson and R. W. Hocker, of Kansas City, and Frank C. Warnell of Westport.

Lancaster, Pa.—The Lancaster & Lititz Electric Railway Company, and the Lancaster & New Holland Electric Railway Company, each with a capital stock of $100,000, were chartered April 4. John S. Graybill, of Lancaster, is president of both corporations. The directors of both companies are the following. John S. Graybill, S. H. Reynolds, Dr. Henry Yeagley, H. C. Hopkins, John Shaub and Carl F. Espenshade. The Lancaster & Lititz Company proposes the building of a line seven miles long to connect these two towns by way of Neffsville. The other company intends constructing a line thirteen miles in length, with terminal points at Lancaster and New Holland.

AT a recent meeting of the directors of the Lancaster & Philadelphia Electric Railway Company, the company decided to construct a line from Downingtown to West Chester.

Lock Haven, Pa.—The Lock Haven Electric Railway Company was organized April 14, with a capital stock of $100,000 for constructing and operating an electric railway in Clinton County, Pa. Luther M. Patterson, of Lock Haven, is the president of the company. Others interested are, Jacob B. Brown & Sons, A Simons' Sons and Moore Fredericks, all of Lock Haven.

Mohnsville, Pa.—The Mohnsville & Adamstown Electric Railway has been commenced.

Orange, Mass.—Arrangements have been made for the building of the proposed electric railroad between Orange and Athol.

Paterson, N. J.—There is a movement on foot to connect Paterson and New Brunswick by an electric railway, the route to be through Orange.

Philadelphia, Pa.—The Pennsylvania Traction Company, it is announced, proposes to construct a four track electric railroad, between Philadelphia and Harrisburg, running through Lancaster, Coatesville, West Chester and other places.

Philipsburg, Pa.—The Philipsburg & Suburban Electric Railway was incorporated on March 30, with a capital stock of $100,000, for the purpose of constructing and operating an electric railway in Clearfield and Centre Counties. The president of the company is A. Markle, of Hazelton. Others interested are John A. Seely, of Brooklyn, N. Y., E. S. Doud and J. Edwin Giles, of Hazelton.

Providence, R. I.—An act to incorporate the Narragansett Electric Railway has been introduced in the legislature.

Reading, Pa.—An ordinance has been introduced in Councils, granting permission to the Birdsboro Electric Railway Company to occupy certain streets of this city. The company proposes to construct a railway, nine miles in length, from Birdsboro to Reading. At Birdsboro it will connect with an extension of the Pottstown Electric Railway.

Rhinebeck, N. Y.—The incorporators of the Rhinebeck & Rhinecliff Electric Railroad Company have commenced the construction of the road. Robert H. Hunter of Poughkeepsie, is the president of the company.

Richmond, Va.—Application has been made by the Virginia Electric & Railway Company—John C. Robertson, president—for permission to construct a double track railway on Broad Street, the road to run from the Boulevard or the Exposition Grounds to Chimborazo Park.

Sanillac Centre, Mich.—Citizens of this town and Carsonville are trying to obtain an electric road between the two towns, a distance of eight miles.

Seattle, Wash.—The Council has been asked for a franchise for a street railway and an electric plant for supplying light, heat and power, by A. H. Gamel, a well known lawyer, who is supposed to represent a syndicate.

Tiffin, O.—It is reported that Amandus Betts and Nelson W. Miller will, in a very short time, commence the construction of an electric road from Tiffin to Melmore.

Thompsonville, Conn.—The project of an electric road between Thompsonville and Springfield is being discussed, and action is soon to be taken in the matter.

Trenton, N. J.—There was filed in the office of the Secretary of State, April, 13, an article of incorporation for the Central Jersey Traction Company, whose plan to connect New York and Philadelphia and intermediate points by trolley has already been mentioned in the STREET RAILWAY JOURNAL. The incorporators are J. H. Baldwin, of Orange; John H. Tingely, of Rahway, and George G. Crosby, of New York. The capital stock is $150,000, with power to increase to $10,000,000. The organization consists of Frank Magowan, of Trenton, president; Col. E. W. Hine, of Newark, vice-president; J. H. Baldwin, of Newark, secretary; J. H. Darrah, of Trenton, treasurer; George C. Crosby, of New York; John H. Tingely, of Rahway, and John C. McNaughton, of Philadelphia, directors. This road is to be operated independently of the New Jersey Consolidated road, but not in opposition, claiming friendly relations.

Warren, N. H.—There is a project to construct an electric railroad from Warren to the summit of Mount Moosilauke.

West Chester, Pa.—The newly incorporated Suburban Railway Company, of West Chester, will construct an electric railway between Philadelphia and West Chester. It is expected that work on the road will be begun some time this summer.

Westfield, Mass.—The contract for the building of the Woronoco Street Railway has been awarded.

Winnipeg, Man.—The incorporation of a company to construct and operate a bicycle electric railway from Winnipeg to the port of Louisburg, in Cape Breton, is among the measures to come before the next session of the Dominion Parliament.

Personal.

Mr. Wm. Sutton, of the American Car Works, St. Louis, was in the East during April.

Mr. W. B. Allen, of the Brownell Car Company, St. Louis, was a visitor at our office last month.

Messrs. John A. Brill and F. C. Randall, of the J. G. Brill Company, of Philadelphia, were in New York last month.

Mr. John G. Holmes, president of the Citizens' Traction Company, of Pittsburgh, Pa., spent a considerable portion of April in New York.

Mr. J. W. Cooper, treasurer of the J. W. Fowler Car Company, of Elizabethport, has resigned, and Mr. F. L. Heidritter has been elected to the position.

Col. Wm. H. Sinclair, president and general manager of the Galveston City Street Railway, of Galveston, Tex., was in New York last month on a business trip.

Mr. Ross McKenzie has been appointed manager of the Niagara Falls Park & River Railway Company, with headquarters at Niagara Falls, *vice* Mr. W. A. Grant, resigned.

Mr. George O. Manchester, formerly of the Atchison Topeka & Sante Fe Railroad Company, has been elected vice president and treasurer of the Sargent Company, Chicago.

Mr. F. Ruel Baldwin, a well-known engineer of New York, has been appointed Eastern manager of the Bass Foundry & Machine Company, with headquarters at 41 Cortlandt Street, New York.

Mr. E. I. Robinson, of the Laclede Car Company, of St. Louis, was in New York last month and closed an order for twenty-five cars with the Consolidated Traction Company, of New Jersey.

Mr. Gardner McKnight, Eastern representative of the St. Louis Register Company, of St. Louis, has been looking after trade in the New York field. His headquarters are Girard Building, Philadelphia, Pa.

Mr. Payson K. Andrews, who has recently been the Chicago agent of the J. G. Brill Company, will hereafter represent the American Car Company, of St. Louis, in that city. Mr. Andrews has a wide reputation as a most successful business man, and is well liked and popular in the street railway field.

Mr. P. F. Leach, of the Bass Foundry & Machine Company, of Ft. Wayne, is spending some time in New York. Mr. Leach reports a very favorable business outlook, and has recently made a number of important sales of both the Bass and the Cushion car wheels, which are also manufactured by the Bass Company.

Mr. Henry C. Payne, of the Milwaukee Street Railway Company and receiver of the Northern Pacific Railway, has been elected president of the Chicago & Northern Pacific Railroad, and the Chicago & Calumet Terminal Railway Companies. The roads comprise the Chicago terminals of the Northern Pacific, and are now the property of that company.

Mr. Alex. B. Allan, of Glasgow, Scotland, who was in this country last year as a representative of George Cradock & Company, of Wakefield, England, manufacturers of cables, has severed his connection with that concern. Mr. Allan is now engaged in constructing works for the manufacture of wire cables near Glasgow, and writes us that he will soon be in a position to supply orders.

Mr. H. M. Littell, general manager of the New Orleans Traction Company, spent a considerable time in New York City last month in arranging for new equipment. Mr. Littell is very much pleased with New Orleans as a residence city, and is very enthusiastic over the possibilities of electric traction in that city. His company has arranged for an excellent and thoroughly first class equipment.

Lieut. E. J. Spencer, who had charge of the installation, maintenance and removal of the exhibit and contract material of the General Electric Company at the World's Columbian Exposition, and who had been connected with that company for a number of years, has opened an office in the Security Building, St. Louis, and will practise as a consulting and contracting electrical and mechanical engineer. Lieutenant Spencer's experience in the corps of engineers of the United States Army extended over a period of over nine years.

Mr. E. P. Shaw, Jr., general manager and secretary of the Norwich and New London Street Railway Companies, is a native of Newburyport, Mass., and the eldest son of Hon. E. P. Shaw of that city, widely known as one of the most energetic and enterprising men in New England, in the founding and operating of street railways. Although the youngest general manager of a railroad corporation in New England, being about twenty-five years of age, he has gained the good will of the patrons of both the street railways whose affairs he conducts, by his efficient and clever management.



E. P. SHAW, JR.

E. P. Shaw, Jr., obtained a good, sound business education, first, in the public schools of Newburyport, and, later, at Bryant & Stratton's Business College, at Boston. After leaving school, he entered the employ of the Thomson-Houston Electric Company in its office in Boston, and subsequently was employed at the works of the company, Lynn, Mass. In 1887, he returned to Newburyport and entered the employ of the Plum Island Street Railway Company, as clerk, a road which did a large summer business. Upon the organization, in the fall of 1887, of the Newburyport Car Manufacturing Company, of which his father is president, he became a bookkeeper for the company. While acting in this capacity he was also identified with the management of the Black Rocks & Salisbury Beach Street Railway. Upon his assuming the management of the street railway of Norwich, a marked change for the better was speedily shown. Under his management the lines of the road have been, several times, extended, electricity has superseded horse power, and rapid transit has followed slow horse car transportation.

Mr. Shaw is well versed in street railway matters, including the makeup of the cars and the working of electricity. That he has proved an efficient manager of the road in this and other cities is conceded on all sides.

Obituary.

The death, on April 14, of Gen. Henry W. Slocum, formerly president of the Brooklyn & Coney Island Railroad Company, and father of the present president of that road, will be mourned by a large circle of intimate friends, of which he had a large number in street railway circles, and by everyone who is familiar with his brilliant military achievements and his sterling qualities as a citizen and a man. His end was sudden and quite unexpected. The immediate cause was heart failure, resulting from an attack of pneumonia.

General Slocum was born in Delphi, N. Y., on September 24, 1827, and at the time of his death was in his sixty-sixth year. He was educated at Cazenovia Academy and West Point, and served in the army as a second lieutenant until 1856, when he resigned his commission to practice law in Syracuse. When the war broke out, he immediately offered his services to the Government. They were eagerly accepted, and he went to the front as colonel of the Twenty-Seventh New York Volunteers. He served with distinction all through the war, and rapidly rose to the rank of major-general of volunteers. Taking part in nearly all the great battles of the East, he became known as the "fighting general."

At the close of the war, General Slocum made his home in Brooklyn, where he resided until his death. He took an active part, as a Democrat, in national politics, served three terms in Congress, and was at one time mentioned as a possible candidate for President. As president of the Coney Island & Brooklyn Railway Company, General Slocum was the first to adopt electricity as a motive power for surface cars in Brooklyn. The success of his undertaking was most gratifying, and resulted in the electric motor supplanting the horse on nearly all the street railways of that city.

Removal of the Central Electric Company.

The Central Electric Company has moved from its old quarters 116–118 Franklin Street, Chicago, to Nos. 173–175 Adams Street, where the company now occupies one of the finest electrical supply stores in this country. On account of the great increase in its trade the company had outgrown the old store, making it necessary to find more commodious quarters, and it is doubtful whether a more suitable place could have been found in all Chicago. The company occupies three floors, the main floor, the basement and the second floor. The basement is used for storage, the main floor and second story are used as sales rooms to conduct a large and constantly growing wholesale and retail trade. The offices are on the main floor, and are conveniently arranged, partitioned off in individual offices, with highly polished oak with brass trimmings, giving a substantial, solid, business like appearance through the whole establishment.

We extend to the Central Electric Company hearty congratulations, and wish the managers every success in their new quarters.

New Publications.

Tables and Formulas for Electric Street Railway Engineers. Compiled and arranged by E. A. Merrill. Published by W. J. Johnston Company, Limited, New York. Price $1.

This work will be found very convenient and useful by an electric street railway engineer in his practical every day work, as it gives the principal tables, data, etc., required in his work. The volume is of convenient pocket size, and substantially bound. The author, Mr. Merrill, is a well known authority on electrical engineering, and is conversant with the needs of a book of this kind.

Catalogue of the Vulcanized Fibre Company.

The Vulcanized Fibre Company, with factories at Wilmington, Del., and New York office, 14 Dey Street, has recently issued a new catalogue giving price list and description of the various forms in which its well known vulcanized fibre is manufactured. A glance over this catalogue will be a surprise to many, indicating the large number of uses to which this valuable product can be applied. Vulcanized fibre is supplied in sheets, tubings, washers, gibs, rollers, ferules, staples, and special shapes. Vulcanized fibre is not only used very extensively for electrical and mechanical purposes, as our readers well know, but for trunks, sample cases, etc. The insulating saddle staple manufactured by this company is meeting with a large sale.

The Catalogue of the Genett Air Brake for Cable and Electric Street Railways. Published by the Genett Air Brake Company of Chicago and New York.

The increased weight of electric and cable cars over the old horse cars early showed the necessity for some kind of power brake which should be more effective than that operated by hand. The success and rapid adoption of the air brake for steam railways suggested the importance of a similar application to street cars, and it is through working on these lines that the Genett air brake has been evolved. The catalogue before us is extremely attractive both in regard to typographical work and engravings, and the interesting information which it contains. The encased duplex compressor, the latest type for street car air brake service, is fully illustrated, both in details and in its application to different types of cars and trucks. The same careful attention is given to the other parts of the apparatus, and one engraving is given of method of attachment for a train of electric cars, by which the trucks on the trail car, as well as on the motor car, are set by the movement of one handle on the front platform of the motor car.

The Book of the Fair. 1,000 Imperial folio pages, 12 × 16 ins.; to be issued in twenty-five parts. Price $1 a part. Published serially by the Bancroft Company, of Chicago and San Francisco.

The remarkable exhibition of the world's progressive science, art and industry, as shown at the Columbian Exposition at Chicago, in 1893, so far exceeded in completeness, interest and extent anything which had ever before been attempted in the history of the world, that a book of the Fair, presenting its most important features, and worthy of the Fair, became a necessity. The Bancroft Company has undertaken the publication of a work of this description, and the first numbers issued form excellent evidence that the work will be in every way representative of the event which is to be treated. "The Book of the Fair" is written by, and published under the direct supervision of, Hubert Howe Bancroft, whose historical works on America have a deservedly wide reputation, and are a sufficient guarantee that the many interesting features of the Chicago Fair will be suitably presented. To those who visited Jackson Park last summer, the work will recall most vividly the wonders and delights of the Exposition, and to those who were unable to make the trip, the work will supply the deficiency so far as can be done. No efforts have been spared in time and money to make the publication interesting and attractive, and it will form a most handsome and valuable addition to any library.

Equipment Notes.

The Vose Spring Company, of New York, has moved its offices from 115 Broadway to 39 Cortlandt Street.

The Worcester Construction Company, of Worcester, Mass., reports business very good, in its particular line.

I. H. Randall, of Boston, Mass., has brought suit against the West End Street Railroad, for building and using for advertising purposes the Randall advertising rack.

The Electrical & Mechanical Engineering & Trading Company, of New York, has moved its offices from the Edison Building, 44 Broad Street, to 39 Cortlandt Street, New York.

The Davis Car Shade Company, of Portland, Me., has received an order from the Buffalo Street Railroad Company for 1,500 of its automatic shades. The shades of this company are growing in popularity.

W. S. Davis & Sons, of Concord, N. H., manufacture an excellent design of tower wagons. Its main points of advantage are familiar to railroad managers. This firm has been very successful in obtaining orders.

Neftel, O'Conner & Company, of New York, have commenced construction on the 135th Street line of the Union Railway Company, of New York, the first trolley line in New York City south of the Harlem River.

Julius Meyer, consulting engineer, has given up his offices in Temple Court, New York, and has removed to 44 Broad Street, Edison Building. Mr. Meyer has secured here more commodious and comfortable quarters.

S. E. Hartman, of Worcester, Mass., has put on the market an adjustable tower, for construction work, which can be mounted on any express wagon, or is supplied with a special wagon. When not in use, the tower can be lowered out of the way.

Westinghouse, Church, Kerr & Company, as mentioned in our last issue, have moved their New York office to 26 Cortlandt Street, The Chicago office of Westinghouse, Church, Kerr & Company is now located at 171 Lasalle Street, instead of 159 Lake Street, which was the old address.

The J. G. Brill Company, of Philadelphia, Pa., has received the orders for cars for the West Shore Railway, of New Haven, Conn. This road will be constructed and in operation by June 5, and will connect West Haven and Milford. The type of car adopted is a combination car with cross seats.

The United Columbian Electric Company, of New York and Kingston, has issued a pamphlet descriptive of its electric railway system. The pamphlet contains views of the company's apparatus, also the record of a test made of a motor equipment on the Union Railway, of New York, February 21, 1894, showing high economy.

The American Manufacturing & Engineering Company, of 143 Liberty Street, New York, is the sole owner of the "positive" electric car lighting system, for which a number of advantages are claimed. The company also manufactures a storage battery, which has given excellent results in service, and other electrical supplies.

Best, Fox & Company, of Pittsburgh, Pa., brass founders, iron pipe fitters and machinists, have opened an office at Room 600, Betz Building, Philadelphia, where their present large piping and bronze business will be carried on and somewhat enlarged. The general sales agent of the company in charge of this office will be W. K. Mitchell.

The Ames Register Company, of Boston, manufacturer of the Ames combined, portable and stationary register, has closed a number of orders for this appliance recently. It is the only one on the market combining the portable and stationary register, and full particulars of its valuable features were published in a recent issue of this periodical.

The R. Woodman Manufacturing & Supply Company, of Boston, Mass., the manufacturers of R. Woodman's celebrated cast steel ticket punches, which are extensively used on electric and cable roads for the cancellation of transfer and other tickets, tell us that the demand for these punches is constantly growing. The punches are giving universal satisfaction.

Thompson & Inness, dealers in railway equipment and supplies have moved their office from No. 115 Broadway to the Havemeyer Building, No. 26 Cortlandt Street, New York. This firm is general agent of the American Wire Glass Manufacturing Company, Philadelphia, Pa., and agent for A. Whitney & Sons Car Wheel Works, Philadelphia, Pa.

The Glazier Headlight Company, of Rochester, N. Y., is the title of a new corporation organized to manufacture locomotive and motor headlights, railroad lamps and lanterns, etc. The president and general manager of this company is E. C. Glazier, after whom the company is named. Mr. Glazier is a well known authority on headlights and well posted on the subject.

The General Electric Company, of New York, has just issued a handsome souvenir in the form of a blank memorandum book. It is handsomely bound and double indexed, and will prove a most useful present to business men. The front cover is stamped in gilt "With the Compliments of the General Electric Company," and the addresses of the different offices of the company are given on the back cover.

J. H. Herrick & Company, is the title of a firm recently organized, with headquarters at 44 Broad Street, N. Y., for the transaction of a general brokerage business in investment securities, loans and commercial paper. The firm is composed of J. Hobart Herrick, formerly of the General Electric Company, and Edward B. Camp. H. M. Vickers, consulting engineer, will have charge of the electrical securities department.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., manufacturer of the Crawford wheel guard and pickup fender, writes us that F. A. Lawson & Company, of San Francisco, Cal, have been appointed that company's agents for the Pacific Coast. This action has been taken by the Crawford Company to supply the large demand which has arisen for fenders on the roads in California and neighboring states.

The United States Steam & Street Railway Advertising Company, Messrs. Carleton & Kissam, proprietors, of Boston and New York, has removed its New York office to the Postal Telegraph Building corner of Broadway and Murray Street. This company is constantly adding to the list of lines which it controls, and the advertising service which it renders is growing more popular to advertisers and street railway companies.

A. B. Laurence, New York manager of the Shultz Belting Company, of St. Louis, has secured very commodious and central offices at 113 Liberty Street. Mr. Laurence will keep here a full line of Shultz patent sable raw hide belting, genuine raw hide lacing, and can also furnish pure oak tanned leather belting as required. The high reputation which the Shultz belting has achieved in the past is well sustained, and these belts seem growing in popularity among steam users.

The Gleason & Bailey Manufacturing Company, of Seneca Falls, N. Y., has received the contract from the Fire Commissioners of New York City for two large steel trucks and three hose wagons. The time specified for completion is 120 days. The same company has also received an order for a handsome hose wagon for Danville, N. Y., and its fourth order for a hose wagon from Mt. Vernon, N. Y. The emergency wagons of this company form a desirable part of the equipment of any railway.

The Breese & Mansfield Company, of Philadelphia, Pa., which has recently been appointed representative in that city of the Walker Manufacturing Company, of Cleveland, O., as mentioned in our last issue, is located at room 1,120 Betz Building, Philadelphia, and not 120, as printed in our last issue. The president of the company is C. P. Breese. We understand that the company is entering upon its work under the best possible conditions, and the outlook for the future is extremely bright.

Wm. E. Hooper & Sons, of Baltimore, Md., manufacturers of cotton duck, yarns, twines, rope, wicks, etc., are doing a large business in the manufacture of cotton ropes for power transmission in stations. Ropes manufactured by this company are employed by the New Haven Street Railway Company, for use in its new station, and are giving excellent satisfaction. The company also manufactures a high grade of cotton duck for car curtains and other purposes. The firm has offices in New York and Philadelphia, and large mills in Baltimore.

The Manhattan Construction Company, of New York, has secured the agency for the Fleming woven wire gauze brush. W. H. Fleming, the inventor, who was associated with the International Trading & Electric Company, has severed his connection with that company, and has made arrangements with the Manhattan Construction Company to act as selling agent for the brush. All orders and inquiries relating to prices and sizes of brushes in stock ready for immediate delivery should, therefore, be addressed to the Manhattan Company.

The American District Steam Company, of Lockport, N. Y., writes us that recent results from the exhaust steam heating plant of the Springfield Electric Light & Power Company, described in our last issue, show even better returns than in the preceding years. The company during the winter just past took in about $12,000 from the heating service, this being practically all gain. During the preceding winter the income was about $8,000, and not $3,000, as the types made us say in our last issue.

Jones & Laughlins, Limited, of Pittsburgh, Pa., have supplied many thousands of axles for street railways. Their customers include such concerns as the P. H. Griffin Machine Works, of Buffalo, the Baltimore Car Wheel Company, of South Baltimore, Md., Peckham Motor Truck & Wheel Company, of Kingston, N. Y., and other manufacturing companies, as well as a large number of street railway companies in Pittsburgh and other cities. A number of their oldest customers have never broken an axle, even under most severe conditions.

The Mica Insulator Company, of New York, manufacturer of the well known insulator "Micanite" has recently greatly improved the product "Micanite cloth," which is meeting with a large demand. This cloth is a most useful insulator for general purposes and is non-absorptive, at the same time is flexible indefinitely and contains a large amount of pure India sheet mica. It can be supplied in rolls thirty-two inches wide and sixteen feet long. The use of "Micanite" prepared in a variety of forms, such as taper and band rings, cylinders, tubes, washers, linings for rheostat boxes, ready for use, is constantly growing and it has proved its efficiency on a large number of roads.

Warren-Webster & Company, of Camden, N. J., manufacturers of vacuum feed water heaters and purifiers and oil and steam separators, report that the number of orders they have received for the above named specialties during the month of March was very satisfactory, and showed a marked improvement over the few former months. They say that the reason that their specialties sell during these hard times is on account of their goods being fuel saving devices. Rapid progress is being made upon the new extension of their wrought iron department, connected with the new works, which they just built last year. They visit steam plants at their own expense, and back their guarantees by a cash indemnity.

The New Process Raw Hide Company, of Syracuse, N. Y., some time ago sold a number of its raw hide pinions to the Watertown (N. Y.) Street Railway Company, of which G. W. Adams is superintendent. The Watertown *Daily Standard*, in a recent article about the railway, said in reference to these pinions: "Two raw hide pinions, purchased of the New Process Raw Hide Company, of Syracuse, N. Y., running about eight months in car No. 10 of the street railway company, have made a mileage of about 21,000 miles. These pinions make five revolutions for every time the car wheel moves around once, or on an average of about 400 revolutions per minute. In this 21,000 miles the wheels of car No. 10 have made 13,440,000 revolutions, and the armatures and pinions have made 67,220,000. The pinions are not yet worn out, and are still in service.

The Kotine Manufacturing Company, whose factory is at Hawthorne, N. J., and whose New York office is in the Central Building, manufactures a waterproof and dustproof paint termed "Kotine," which seems to have given good satisfaction. "Kotine" is a secret preparation. Its advantage over ordinary paint is that water does not affect it, and if, while painting a car barn or cars with Kotine, a heavy shower should come on, the company claims no harm will be done, nor will the drying of the paint be interfered with. This waterproof feature is likely to be of decided interest to street railroad men. It certainly should be an advantage to have cars painted with a material which will resist the action of the elements. The company claims also that the spreading capacity of Kotine paint is from 25 to 50 per cent. greater than that of ordinary paints. From the testimonials at the company's office it is evident that Kotine products are appreciated highly by some of the largest concerns known to the trade.

The Safety Car Heating & Lighting Company, of New York, has issued a neat and attractive circular entitled "Standard Light for Railway Coaches: A Few Opinions of the Pintsch Light." The pamphlet gives editorial expressions of the value of this company's system of lighting, together with the opinions of a number of the most prominent railway engineers of the country. The list of roads upon which this system has been adopted, together with the location given of different Pintsch plants, shows that the system has had a rapid and extensive adoption throughout the country. The company states that negotiations are now being completed for a supply in every prominent railroad center in the United States. The company has just received an order from the Third Avenue Cable Company for the equipment of 175 open cable cars with the Pintsch system of lighting. Over 200 cars of this company are already equipped with the Pintsch system, which is also the standard light of the Broadway cable line, of New York, and of the North Chicago Street Railway Company.

Chas. J. Mayer, of Philadelphia, has opened an office at No. 600 Betz Building, that city, and will represent the R. D. Nuttall Company, of Allegheny, Pa., as its general sales agent throughout the Middle States. Mr. Mayer has also arranged to represent in this territory the W. T. C. McCallan Company, of Boston, Mass., manufacturers of solid sheet mica insulators, and is prepared to quote prices on all the appliances required for trolley construction of any description. The merits of the productions of these companies are now so well established as to require no comment, and Mr. Mayer has good reason to expect a full share of patronage. He is also closing negotiations for the handling of several other street railway specialties of established merit, and will be prepared shortly to supply all wants in the line of car and station fixtures. Owing to his long practical experience in the electric railway field, to which he will devote his attention exclusively, he believes that he is in a position to thoroughly understand the requirements of electric railway companies, and well fitted to recommend the best grades of material obtainable for this service.

The Reliable Detective Agency, of New York, P. J. Saloschin general manager, has been compelled within three months to more than double its force. As stated in our February issue, this agency was in charge of the Bridgeport (Conn.) Street Railway Company's interests during the recent strike in that city. All operators are engaged by Mr. Saloschin personally. All operatives are bonded, and all reports made by them must be substantiated by affidavit, if required, this being one of the conditions previous to their engagement. The Reliable Agency writes us that among those who are well acquainted with its work are John Beaver, treasurer of the Third Avenue Railroad Company, of New York; George S. Hart, president of the Second Avenue Railroad Company, of New York; M. I. Masson, secretary of the Central Crosstown Railroad Company, of New York; Col. N. H. Heft, president of the Bridgeport Traction Company, of Bridgeport, Conn.; Andrew Radel, general manager of the Newark Street Railroad Company, of Newark, N. J.; A. C. Titus, president of the Newport Street Railroad, of Newport R. I.; Jas A. Powers, general manager of the Burlington Railroad Company, Burlington, Vt., and many others.

The Berlin Iron Bridge Company, of East Berlin, Conn., has a number of contracts for the last month. The new electric light and power station for the Brush Electric Light Company, at Baltimore, Md., will be one of the finest in the Southern states. The boiler room is 83 ft. wide by 129 ft. long. The dynamo room is 130 ft. square; the floor space in the latter is entirely free from posts. The roofs are designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn., and are made entirely of iron, covered with this company's patent, anti-condensation, corrugated iron roof covering. J. F. Rogers & Company, of New York City, have also placed the order for a new industrial school building, at Havana, Cuba, with this company. The building will be fifteen metres wide and forty-eight metres long, constructed entirely of iron and cement. Another recent customer is the McNeal Pipe & Foundry Company, of Burlington, N. J., which has placed the contract for two cleaning sheds with the company. Dr. Drysdale, of Philadelphia, has placed the contract for an iron roof over the new power house for the Hospital for the Insane, at Norristown, Pa., with this company. It was desired that the roof be fireproof, and ordinary corrugated iron could not be used on account of the drip, so that the roof will be covered with the Berlin Iron Bridge Company's patent, anti-condensation, corrugated iron covering.

The John Stephenson Company, Ltd., of New York, is busy turning out 100 new open cars for the Metropolitan Traction Company, the contract for which was awarded to it as mentioned in our last issue. These cars, which a representative of this paper had the pleasure of inspecting recently, are extremely handsome and are provided with eight benches each. They have Bombay roofs with two center lamps, spring roller curtains at the sides, and all mountings, handles, etc., are of solid bronze. The cars will be mounted on the famous Stephenson super-spring running gear. Thirty of these cars are destined for the Sixth Avenue line, ten for the 42d Street line, thirty for the Belt line, ten for the Seventh Avenue line, ten for the Avenue C line and ten for the Bleecker Street line. The cars are being colored differently according to the line for which they are intended. The Stephenson Company is also manufacturing some very handsome closed cars with mahogany finish and paneled ceiling for the 42d Street and St. Nicholas Avenue lines. Other orders, which have been received recently are for a number of cars for the Consolidated Traction Company, of New Jersey, a number of open cars for the 86th Street transverse line of the Fourth Avenue Railway, of New York, and a number of electric cars for Chattanooga and Mobile. The advent of peace in Brazil was welcome to this company, which has always enjoyed a very large trade in foreign countries, and was accompanied by an order for a number of electric cars from Rio Janeiro.

The Joseph Dixon Crucible Company, of Jersey City, N. J., is putting a cycle chain graphite on the market, which for purity of graphite and usefulness is claimed to be vastly superior to anything of the kind heretofore prepared. The graphite is not only of the choicest stock, but is ground to an impalpable powder and then reground with a high grade of lubricating oil. This company is also meeting with a large sale of its graphite for lubrication purposes. This company writes us that at a meeting of the stockholders of that company, held at its offices in Jersey City, N. J., April 16, out of 7,345 shares 7,215 votes were cast for the same board of managers that has conducted the affairs of the company through its many years of prosperity. The vote was the largest ever cast, and it was a decided compliment to the members of the board, as were also the remarks of some of the largest stockholders. The board consists of E. F. C. Young, John A. Walker, Daniel T. Hoag, Richard Butler, William Murray, Joseph D. Bedle, Jerome D. Gillett. In the organization of the board E. F. C. Young was elected president, John A. Walker, vice-president and treasurer, George T. Long, secretary. The Dixon Company was founded by Joseph Dixon in 1827, and organized as a stock company in 1868. Its manufactures are graphite products of all kinds, consisting of plumbago crucibles for melting gold, silver, brass, etc., blacklead retorts, stove polish, graphite for lubricating, electrotypers' graphite, graphite lead pencils, graphite paint, and graphite prepared in hundreds of ways for as many different uses. Graphite is one of the principal forms of carbon. It is not affected by heat or cold, acids or alkalies, and is therefore one of the most useful materials known to modern industry when rightly prepared.

WESTERN NOTES.

The B. E. Tilden Company, of Chicago, which manufactures railway replacing frogs, had its shops at Chicago entirely destroyed by fire April 9. The company writes us that it still has a supply of wrecking frogs and motor replacers at other points that it can supply patrons for the immediate future, and will arrange to supply all demands as soon as possible.

H. R. Keithley, of 107 Lake Street, Chicago, Ill., manufacturer of the Chicago rail bond, tells us that the demand for this bond is constantly increasing, and its value is being shown on a large number of roads. Over 10,000 bonds were sold last month. The bonds can be furnished at any length or size from 0 to 0000. Mr. Keithley has given us a very neat paper weight representing a portion of the web of a rail with the bond in position. This gives an excellent idea of the perfect contact made between bond and rail.

The McGuire Manufacturing Company, of Chicago, has closed a large number of orders for trucks recently. The company has been especially pushing its New England buisness, and among the contracts

received in this territory during the last month are orders from the Taunton Street Railway Company, Taunton, Mass.; Norwalk Tramway Company, Norwalk, Conn.; Dartmouth & Westport Street Railway Company, New Bedford, Mass., and the Norwalk Street Railway, Norwalk, Conn. All of these are for early delivery.

C. E. Loss & Company, of Chicago, whose reputation as a substantial and reliable contracting firm is well known, have been awarded the contract to construct and furnish complete equipment for five and a half miles of extension of the Hammond, Whiting & East Chicago Electric Railway Company. This order was certainly a flattering compliment to this firm, as C. E. Loss & Company have had charge of all previous work, proving conclusively that the company was perfectly satisfied with the work done on the previous contracts.

The Hoppes Manufacturing Company, of Springfield, O., manufacturer of the well known "Hoppes" feedwater purifier, has received the contract for the purifiers to supply the boilers with pure feedwater for the city electric light plant, now being built by the Public Lighting Commission, of Detroit, Mich., the Hoppes purifiers having been selected after very strong competition. The order calls for seven 300 H. P. purifiers to carry 165 lbs. of steam working pressure. Each purifier is required to heat and purify 9,000 lbs. of boiler feedwater per hour.

The Chas. Munson Belting Company, of Chicago, reports trade very much improved the past thirty days, having received a large number of orders principally from the saw mill trade. This company received orders for the equipment of belting for seven mills in six weeks, which is a very good record. The company's street railway trade has also picked up considerably, having received orders for quite a number of large belts the past three months. This company has been working full time all during the panicky times, and was even compelled to put on additional forces to insure prompt delivery.

The Genett Air Brake Company, of Chicago and New York, has met with very flattering results in the way of orders, and has shipped equipments as far away as Australia, where the brakes will be used on the King Street railway cars, at Sydney. Among the companies in this country which have recently ordered equipments are the Buffalo Railway Company, which will use the brakes on its large cars operating on Niagara Street, the Chicago North Shore Street Railway Company, and others. The Third Avenue Railway Company, of New York, is also using this brake on its summer cars, which have just been brought out.

The Louis K. Comstock Company, is the title of a new corporation which will carry on the business in the future of Louis K. Comstock, of Chicago, and which commenced operations April 1. The Louis K. Comstock Company will practice as electrical engineers and contractors, with offices at 1437-1438 Monadnock Block, Chicago. Louis K. Comstock is president and manager, F. S. Richmond, vice president, J. R. Allen, secretary, and J. H. Stahley, superintendent, making a very strong corps of engineers and contractors. It is the company's purpose to design, build and construct any plant in the electrical field, whether it be electric lighting or street railway constructions. We wish the new company all success.

The Mason Electric Company, of Chicago, reports a growing business in electric railway supplies. This company is agent for a number of prominent Eastern houses, including Holmes, Booth & Hayden, the Fiberite Company, of Mechanicville, N. Y., the Safety Clutch Brake Company, of Philadelphia, the Garton-Daniels Electric Company, the Partridge Carbon Company and others. The general manager of the company is W. R. Mason, who is widely recognized as being one of the best posted men in the country on electric railway supplies, and fully acquainted with the needs of street railway companies in this direction. Mr. Mason has purchased the entire stock of the Railway Equipment Company, and will continue its business. The offices of the company are located in the Pullman Building, Chicago.

The Stirling Company, of Chicago, has received the text of the award made to it by Department F— Machinery, at the Chicago Fair. The award speaks of the special advantages of the Stirling boiler, its extreme simplicity, low cost of construction and economy, and especially of its singular adaptability to situations requiring the use of impure feed water. This company has sent us an report of a interesting test by George H. Barrus, the well known expert steam engineer of Boston, on a 250 H. P. Stirling boiler at Portland, Me. This shows water evaporated per pound of coal, 10.54 lbs.; equivalent evaporation per pound of coal from and at 212 degs., 11.025 lbs.; equivalent evaporation per pound of combustible from and at 212 degs., 12.061 lbs.; moisture in steam while boiler was developing 380 H. P. or 52 per cent. above its rated capacity, .19 per cent.; moisture in steam while boiler was working at its rated capacity .06 per cent.

A. L. Ide & Son, of Springfield, Ill., report the following recent sales of Ideal engines: two 11 × 12 to the W. J. Lemp Brewing Company, of St. Louis; one 12 × 12 to the Franklin Electric Light Company, of Franklin, Mo.; one 15 × 14 to the Monett Electric Light Company, of Monett, Mo.; one 12 × 20 × 14 to E. T. Sykes, Waseca, Minn.; one 14 × 14 to E. B. Hillman & Company, Peoria. Ill., (this engine is equipped with one power transmitter); one 7 × 10 to the Griesidieck Artificial Ice Company of St. Louis, Mo.; one 8 × 10 to the Western Electric Company for the Stephens Building, Chicago, Ill.; one 8 × 10 to the United States Express Company, Chicago, Ill.; one 13 × 12 to the Chicago Edison Company, prepared for direct connection to an Edison armature for the Gottfreidt Brewing Company; one 13 × 12 to E. F. Pulsifer, Chicago, Ill.; one 6 × 6 to the Great Western Manufacturing Company for Leadville, Colo.; one 13 × 20 to the Western Electric Company for Rutland, Vt.; one 12 × 12 to the Haymarket Theatre Company, Chicago, Ill.; two 8 × 10 for the new Home Bank Building, Detroit, Mich. (each of these equipped with a power transmitter); one 12 × 12 to E. B. Hillman & Company, Peoria, Ill.; one 12 × 12 to Gardiner & Worthen, of Tucson, Ariz., (all of these equipped with power transmitters). One 9 × 10 for Belle Isle Park, Detroit, Mich, equipped with one power transmitter on each side; one 7 × 10 to the Western News Company, Chicago, Ill., and two 8 × 10 to the Peninsular Electric Company, for Fort Wayne, Mich.

The International Register Company, of 197 South Canal Street, Chicago, reports the closing of a contract with the Toledo Consolidated Street Railway Company to equip the entire system of the latter company with the International Company's well known Pratt portable registers. The adoption of this register throughout such a large system is an endorsement of its merits that is seldom accorded any device. Heretofore, the railway company has been using a stationary register, and was apparently satisfied with it until about fifteen months ago, when a sufficient number of Pratt machines were purchased to equip one branch of the system. The results obtained from the comparative tests which have been in progress during the past pear have been so entirely in favor of the Pratt registers that President Lang decided to adopt them altogether, and by May 1 there will be nothing but International registers in operation on the Consolidated lines. The total number in use will be 135. Manager A. H. Englund, of the International Register Company, is particularly jubilant over this contract, as it further demonstrates the excellency of his company's registers, and the high favor in which they are held by such practical railway managers as Mr. Lang.

The Buckeye Engine Company, of Salem, O., has sent us a list of recent sales which, although considerably smaller than last year, as might be expected, shows that the company has a good share of the engine trade. The list includes the following: J. T. Williams, New York City, 150 H. P., slow speed; Cleveland Milling Company, Cleveland, O., 125 H. P., slow speed; Alfred Ricker, Hartford, Conn., 125 H. P., slow speed; D. J. Murrag Manufacturing Company, Wausau, Wis., 70 H. P., medium speed; Bloomfield-Pearson School, Tufts College, Mass., 25 H. P., high speed; Minnesota State Public School, Owatonna, Minn., 50 H. P., high speed; Ellsworth Electric Illuminating Company, Ellsworth, Me., 180 H. P., high speed; Coplay Cement Company, Coplay, Pa., 600 H. P., slow speed, cross compound; Dayton Street Railway Company, Dayton, O., three 500 H. P., tandem compounds, medium speed, arranged for direct connection to Siemens & Halske generators; King Powder Company, Kings Mills, O., 500 H. P., medium speed, tandem compound; Diamond Match Company, Barberton, O., two 125 H. P. and one 90 H. P.; C. & O. Southwestern Railroad Company, Paducah, Ky., 150 H. P., medium speed; Blish Milling Company, Seymour, Ind., 600 H. P., medium speed, cross compound; McKeesport & Wilmerding Street Railway Company, McKeesport, O., 80 H. P., medium speed; the Snell Cycle Company, Toledo, O., 125 H. P., medium speed; Edward McDonald, McDonald, Pa., 90 H. P., high speed; Bakhaus & Kuenzels, New Bremen, O., 100 H. P., slow speed; J. T. Williams, New York City, 70 H. P., slow speed; Garland Chain Company, Rankin, Pa., 100 H. P., slow speed, cross compound; American Rubber Company, E. Cambridge, Mass., 60 H. P., high speed; Richmond Light, Heat & Power Company, Richmond, Ind., two 300 H. P., medium speed, tandem compounds. This company, on April 1, moved its New York office from 18 Cortlandt Street to 39 and 41 Cortlandt Street, New York. Here Mr. Porter, the company's sales agent, and Mr. Best, engineer, have larger and more commodious offices, where they will be pleased to see their patrons and friends at all times, and give any information or estimates they may desire. In addition to the company's regular line of plain, tandem compound, cross compound and triple expansion horizontal engines, Mr. Porter tells us that the company is having great success with its new vertical compound engines, for electric light and railway service, ranging from 150 H. P. to 1,200 H. P. and over. This engine is specially adapted for direct connecting to dynamos, and is guaranteed to work as economically as any compound engine on the market, and to run with superior regulation.

List of Street Railway Patents.

U. S. STREET RAILWAY PATENTS ISSUED MARCH 27, 1894, TO APRIL 20, 1894, INCLUSIVE.

MARCH 27.

ELECTRIC RAILWAY TROLLEY—Frank S. Church, Detroit, Mich., assignor of one-half to Wm. F. H. Edwards, same place. No. 517,028.

A trolley formed of two wheels having complementary grooved, beveled faces, the inner flanges of the groove contacting below the conductor and the outer flanges approaching each other above the conductor.

RAILROAD RAIL AND CHAIR AND PROCESS OF UNITING SAME—Maximilian M. Suppes, Johnstown, Pa., assignor, by mesne assignments, to the Johnson Company, of Pennsylvania. No. 517,075.

The combination of a railroad rail and support each having a single vertical web, the web in one terminating in a pocket, or jaws, fitted to receive the web of the other and said parts, connected altogether only by the jaws, being moulded by pressure against said web.

APPARATUS FOR SUPPLYING OR REMOVING STORAGE BATTERIES—William E. Worthen, New York. No. 517,134.

The combination with a main track and railway car, supported upon wheels, of a battery truck supported upon wheels and supporting

a battery and a motor or motors, and connected detachably with the body of the car, a movable track section, and a support for the track section whereby the same with the truck can be moved to and from the body of the car.

Trolley Catcher—Levi G. Momry, Buffalo, N. Y. No. 517,166.

A trolley catcher having swinging depressor rod, a holder for retaining the depressor rod in its normal position and a trip or releasing device operating on said holder and connected with the trolley.

Car Brake—Lloyd H. Cole, Pawtucket, R. I. No. 517,212.

A brake, car wheels, a rotatable cam, brake shoes carried by a rotatable support, and a device mounted on said support and acted upon by the cam.

Electrical Railway—Benson Bidwell, Philadelphia Pa., assignor of one-half to Chas. F. Bidwell, Indianapolis, Ind. No. 517,258.

An electric railway having a line of conductors in connection with a generator located at a station along the line of way, a branch or loop in said generator circuit having telephonic instruments and resistance coils, in combination with a car having traveling circuit and a loop or branch from the motor curcuit or loop, and including a telephonic instrument and resistance coils.

Railway Track Structure—Peter Hevner, Philadelphia, Pa. No. 517,277.

The combination in a roadbed for railways, of the opposite rails, foundation blocks of artificial stone or cement, clamping devices for securing the rails to said blocks, securing bolts immovably confined to said blocks and tie bars adapted to the inner clamp bolts, and serving as a means of spacing both the foundation blocks and the rails.

A Safety Guard for Open Cars—Wm. H. Hart, Chelsea, Mass. No. 517,339.

A street car having vertically sliding gates extending along the sides thereof, flexible supports extending transversely through and connected at their opposite ends to said gates, and guides for said supports.

Ratchet for Car Brake Staffs—August D. Gerbig, St. Louis, Mo., assignor to the Laclede Car Company, same place. No. 517,405.

A ratchet for a brake staff, comprising a ratchet wheel having a sleeve connected thereto, a staff mounted in said sleeve, and a ratchet wheel rigidly connected to said staff, and engaged by pawls connected to the upper side of the first mentioned ratchet wheel.

April 3.

Induction Electric Railway—Chas. E. Roehl, St. Joseph, Mo. No. 517,531.

Consists of a roadbed provided with a magnetically continuous iron core, separate from but extending parallel to the tracks, and a series of primary coils located upon said core, in combination with a moving vehicle carrying a secondary core and coil in inductive relation to said primary core.

System of Elevated and Surface Railways—Charles H. Barrows, Willimantic, Conn. No. 517,535.

Consists of an elevated track having the broad girders and central guide rail which accommodate flangeless traction wheels and flanged central wheels of a car, and a single surface rail adapted to receive the flanged wheels of a car provided with traction wheels.

Conduit Electric Railway—Willie C. Keithly, San Francisco, Cal. No. 537,549.

Consists of underground conduit wire, flanged hanger trolley arm, spring and means for raising and lowering said trolley arm.

Motor Car Truck—Wm. A. Dutton & Jacob F. Pfetch, Cleveland, O. No. 517,665.

Consists of side bars for car trucks having journaled yokes integral therewith, the ends of said bars bent inclinatorily upward for supporting elliptic springs on a higher plane.

Car Truck—Jas. L. Hardie, Chester, Pa. No. 517,571.

A car truck frame comprising side bars composed of two sections with a space between, the cross bars connecting the side bars and supporting the brake mechanism, springs located centrally of the frame, sills located above the side bars and levers pivoted between the sections of the bars having their outer ends connected with the ends of the sills and the inner ends with the springs.

Car Brake—Henry B. Cary, Los Angeles, Cal. No. 517,601.

Consists of shoe frames adapted to unitedly engage the track and the wheels, a crankshaft having cranks near the opposite ends thereof, which directly pass through the upper parts of shoe frames, and means for operating said crankshaft.

Car Fender—Carl P. Anderson, Boston, Mass. No. 517,638.

Consists of a horizontal slideway on the car and a fender engaging said slideway capable of vertical play, and having guides to tilt its forward end downward under a rearward movement of the fender in the slideway.

Girder Joint for Railroad Rails—James M. Price, Philadelphia, Pa., assignor to the Price Railway Appliance Company, of Pennsylvania. No. 517,660.

A girder joint for meeting rails consisting of a vertical plate with a raised center, a horizontal groove forming a jaw and feet, arches connecting the inner end of the said feet, and a bench depending from said jaw, said parts being combined.

Conduit Electric Railway—Herbert A. Gorham, Decatur, Ill. No. 517,692.

Comprises a trench, a conduit along the upper portion of the trench, a central rib, or upward extension in the conduit, supporting and insulated from the trolley wire, slotted grates covering the conduit and communicating with the trench, such grates being separated to form a slot for the trolley, and valves in the lower surfaces of the conduit.

Underground Railway—Wilton P. Jenkins, Richmond, Va. No. 517,749.

Consists of a conduit, yokes passing under same, longitudinal surface rails resting upon ends of the yokes at right angles, and a downwardly drawing screw clamp connection provided with double clamps for grasping both sides of the rail base, and adapted to be applied to the yoke for fastening the yokes to the rails at any point without the use of bolts.

Car Fender and Automatic Brake—William L. Fitzhugh, Baltimore, Md. No. 517,798.

Consists of a pilot board adapted to yield when engaged by an obstruction, a lever adapted to be positively operated from an axle of the truck, a releasing and clutch mechanism actuated by the yielding of the pilot board to operatively connect the said lever with the axle, connections between the said lever and the pilot board whereby the latter is thrown outward, a brake mechanism and motive power disconnecting devices actuated from the said lever, simultaneously with the outward movement of the pilot board.

Conduit Electric Railway—Wilton F. Jenkins, Richmond, Va. No. 517,804.

With a conduit, a horizontally projecting arm consisting of a metal core having its sides and end completely covered in a non-conducting material and bent to form depressions, and conducting wires laid loosely upon said arms within the depressions.

April 10.

Rail Connection—Theodore C. Paulsen, Chicago, Ill. No. 517,884.

The combination in an electrical connection of two rails with holes therethrough, caps inserted in such holes, said caps closed at one end and provided with a groove extending only part way through the metal, and a wire having one end in each of said caps.

Electric Railway—Henry S. Pruyn, Hoosick Falls, N. Y. No. 517,886.

A conduit, a sectional electric conductor located therein, insulators positively attached to and supporting the sections of said sectional conductor, the insulators being constructed to be freely removable from their mountings, whereby one or more sections with their attached insulators, may be bodily removed from the conduit.

Fender for Street Railways—Eldridge J. Smith, Washington, D. C. No. 517,894.

A flexible apron so made as to buckle up when a fixed obstruction is encountered, a flexible edge and hinged to the sill of a car in connection with hinged fingers and connecting rods.

Electric Railway System—Chas. D. Tisdale, Boston, Mass. No. 517,940.

Consists of a truck provided with two axles, each axle being furnished with one conducting wheel and one insulated wheel, the conducting wheel of one axle is arranged diagonally opposite the conducting wheel of the other axle, a motor attached to a truck frame and conductors connected with the brushes of the motor and directly with the axles of the truck, whereby the current flows from one of the track rails through one of the conducting wheels and axle, through the motor, through the other axle and the other conducting wheel to the other rail.

Method of and Means for Speed Regulation of Electric Locomotives—Charles E. Emery, Brooklyn, N. Y. No. 517,948.

The method consists in electrically connecting a generator, at will, with motors, singly or in series, which motors severally develop different counter electro-motive forces at like speeds of the car or apparatus to which they are attached, thereby operating such car or apparatus at different speeds for the same available voltage.

Electric Locomotive—William Lawrence, New York, assignor to the Lawrence Electric Company, same place. No. 518,006.

The combination of a commutator having contacts with forked brushes adapted to be engaged by said contacts, and means for moving either of said brushes into engagement with said contacts and side brushes.

Ice Cutting Trolley—Robert W. Thompson, Cleveland, O. No. 518,015.

In a combined trolley wheel and wire stripper, the combination of a hub provided with a central disk grooved on its edge, peripheral rings secured by radial arms to the disk and hub at either side of the disk but separated therefrom by annular openings, and cutting inner edges integral with the rings.

Trolley Wire Insulator—Louis McCarthy, Boston, Mass. No. 518,071.

Comprises an outer case, or receiver, having one or more arms, by means of which the insulator may be secured to the span wire, an insulated portion fitting within said receiver, a screw bolt passing through the top of the outer case or receiver, and entering the upper part of such insulated portion for securing said insulated portion within said receiver, and a screw connection for securing said insulator to the trolley.

Car Fender—William V. McManus, Baltimore, Md. No. 518,115.

A car fender comprising the guide frame, the receiving frame suitably supported at its upper edge and having a sliding connection at

its lower front edge with the guide frame, such sliding connection including a bearing inclined to the horizontal whereby the front edge of the receiving frame may be depressed as it is pushed rearwardly.

CAR FENDER—Benjamin Tranter, Brooklyn N. Y. No. 518,126.
Consists of a movable fender carrying frame, arranged horizontally at the front of the same, swinging hangers which pivotally connect its rear end with the bottom of the car, a pitman pivoted to said hangers, and a lever pivoted vertically at the front of the car and connected with the pitman.

ELEVATED RAILWAY—Lee Anderson, Paris, Tex. No. 518,170.
A car having wheels above and below the same, and adjustable connections for varying the distance between the upper and lower wheels.

APRIL 17.

ELECTRIC MOTOR CAR—Arnold P. Brown, New York. No. 518,221.
An electric motor car and mechanism for communicating motion from the motor to the car, an electric motor having field magnets furnished with both series field coils and shunt field coils, and an additional or choking magnet adapted to be placed in connection with the series field in starting the motor or car.

ELECTRIC RAILWAY SYSTEM—Chas. D. Tisdale, Boston, Mass. No. 518,293.
Consists of a truck provided with three insulating wheels, two upon one side and one upon the other, a motor mounted upon the truck and a trolley wheel arranged upon the side of the truck having two wheels and arranged to form an electrical contact with the rail upon the side of the truck supporting the two insulating wheels.

CAR STARTER AND BRAKE—Carl H. O. Lenerkus, Cologne-on-the-Rhine, Germany. No. 518,371.
A car starter apparatus, truck frame, a vertically movable frame carrying the car body, elevating means between the truck frames, driving connections engaging the car axle for operating the elevating means, a clutch for throwing the driving connections into and out of engagement with the car axle and the transmitting devices between the driving connections and the car axle for transmitting the falling movement of the car body and frame to the said car axle to start the car.

BOND FOR ELECTRIC RAILWAYS—Julius Meyer, New York. No. 518,414.
Consists of conductors, bonds connecting the same, a container attached to said conductors and insulating material in the container.

ELECTRIC RAILWAY CONDUIT—Paul B. Banholzer, Philadelphia, Pa. No. 518,540.
A conduit having openings in its sides in addition to the slot opening, conductors arranged in the conduit, a plastic material forced into the conduit through the side openings and securing the conductors in place.

RAILWAY TRACK AND CAR—Chas. C. Burton, Chicago, Ill. No. 518,565.
A track having supporting rails and external guides or bearing rails located above the same, a car provided with supporting wheels and with guide wheels mounted on inclined axes, and bearing upwardly and outwardly against the said bearing rails.

CONTROLLER FOR ELECTRIC RAILWAY CARS—Walter H. Knight, Lynn, assignor to the General Electric Company, Boston, Mass. No. 518,254.
The combination of an electrically propelled vehicle, a controller, therefore, means adapted to actuate the controller from a source of fluid pressure carried on the car, and an indicator upon the car platform adapted to show the position of the controller.

CONTROLLER FOR ELECTRIC MOTORS—William Cooper, Minneapolis, Minn. No 518,345.
The method of operating electric motors, which consists in first arranging the motors in series in an open circuit, then inserting a total resistance and closing the circuit through the same, then gradually cutting out a part of said resistance, then breaking or opening the circuit, and while open coupling said motors in multiple arc, and afterwards reinstating the remainder of said resistance, and finally gradually cutting out the same.

CAR BRAKE—Frank E. Gilling, Toledo, O., assignor of two-thirds to Francis M. Oliver and Frederick J. Shovar, same place. No. 518,401.
In a car brake, a friction drum upon the axle, a rope or cable coiled around the same, brake actuating mechanism connected with the rope or cable by flexible connections attached to the brake mechanism upon each side of the friction drum, and normally slack, and connections with the rope or cable and each brake rod upon the car.

FENDER FOR TRAM CARS—Franklyn S. Hogg, New York. No. 518,571.
In a tram car, a rock shaft, a fender secured to the forward face of the rockshaft, extending downwardly and forwardly therefrom, a second fender extending from the opposite side of the shaft, plungers connected with the main fender, and means for limiting the movement of the plungers.

APRIL 24.

CONDUIT ELECTRIC RAILWAY.—Chris. A. Maynard, Springfield, Mass. No. 518,695.
Consists of a metal conduit provided upon its inner wall with a longitudinal shelf, a metal cover having a triple bearing upon the conduit, and comprising a brace adapted to enter the mouth of the conduit and bear upon the shelf, a flange adapted to bear upon the outer wall of the conduit, a central portion integral with the brace and flange and adapted to be seated upon the top rim of the circuit and screw bolts through flange and the wall of the conduit.

ELECTRIC MECHANISM FOR VEHICLES.—Louis E. Freedley, Boston, Mass. No. 518,781.
Consists of a vehicle body, running gear therefor, a driving electric motor connected with said running gear, a brake mechanism comprising a brake shoe for operating against a wheel of said running gear, a supplemental motor connected with said brake mechanism, electric conductors connected with said motors, mechanism for switching the current alternately into the driving and supplemental motors, mechanism operative from the vehicle body for moving the switch mechanism, and automatic mechanism for breaking the current when the brake becomes set.

SAFETY CAR FENDER—August W. Stiefel, Baltimore, Md. No. 518,796.
Consists of a number of spring metal arms, each having at its upper end a forward, down-turned pendent which forms a spring buffer, below said spring buffer is a vertical part, the lower end of which has a rearward semicircular curve which terminates in a horizontal, forward pointing end, in combination with a cross bar, to which each spring metal arm is secured by its said vertical part.

DISTRIBUTIVE SYSTEM FOR ELECTRIC RAILWAYS—James E. Goodhand, Baltimore, Md. No. 518,782.
Consists of the feeder and working conduits; branch conduits arranged transversely to and connecting the feeder and working conduits; feeder wires in the feeder conduits, electrical conductors arranged in sections in the working conduits; a connecting block at the intersection of the branch and feeder conduits, and branch wires connecting the feeder wire with the working conductor.

CAR FENDER—Chas. F. Thomas, Buckeyestown, Md. No. 518,904.
Comprises a main fender frame adapted to be connected to the truck frame and held rigid therewith, brace bars pivoted at their lower ends to the said main frame, and having their upper ends formed for a detachable and sliding connection with the car dash.

FENDER FOR STREET CARS—Henry F. Roony, Randolph, Mass. No. 518,926.
A car fender comprising a stationary vertical portion supported by the car body in front of the dashboard, a pivoted portion or fender proper, having a hinged connection with the car body and provided with a rearward extension and a catch secured to the car under the control of the driver, which holds said arm normally in a horizontal position.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. THE STREET RAILWAY PUBLISHING COMPANY, HAVEMEYER BUILDING, NEW YORK.

A Modern Hotel.

One of the latest additions to the fine hotels of the country is the Hanover, of Philadelphia, which has recently been thrown open to the public, with John M. Sharp & Company, as proprietors. This hotel is located at the corner of 12th and Arch Streets, and is under the able and experienced management of that veteran in the hotel business, Wm. Whitney, who was for twenty years clerk of the Brigham House, and for eight years had charge of the United States Hotel, Atlantic City. The Hanover is located in the heart of the city, within half a block of the Reading Terminal and within three blocks of the Pennsylvania Depot. It is a massive structure of brick and stone, nine stories in height, with 250 rooms and accommodations for 350 guests. It is conducted on both the American and European plans.

California in Three and a Half Days.

From the snow clad regions of the East to the delightful semi-tropical climate of California is a matter of only a few days' journey if the Northwestern Line is used for the trip. Palace drawing room sleeping cars leave Chicago daily and run through to California without change, covering the distance in the marvellously short time of three and a half days, and all meals en route are served in dining cars. Daily Tourist Sleeping Car service is also maintained by this line between Chicago and San Francisco and Los Angeles, and every Thursday the party is personally conducted by an experienced excursion manager. Completely equipped berths in Tourist Sleepers are furnished at a cost of only $4 each from Chicago to the Pacific Coast, thus affording a most favorable opportunity for making the journey in a comfortable and at the same time economical manner. Variable route excursion tickets, taking in all principal points of interest, are sold at exceedingly low rates. Illustrated pamphlets descriptive of the Mid-Winter Fair and full information concerning rates, routes, etc., will be mailed free upon application to W. A. Thrall, General Passenger and Ticket Agent Chicago & Northwestern Railway Company, Chicago, if you mention this publication. ***

Playing Cards.

You can obtain a pack of best quality playing cards by sending fifteen cents in postage to P. S. EUSTIS, General Passenger Agent, C., B. & Q. R. R., Chicago, Ill. ***

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by Spencer Trask & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., April 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.	100	750,000	Q Feb.	1½	1890	113	115
Watervleit Turnpike & R. R. Co.	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort.	1865	40,000	J. & J.	5	1905	101½	.....
" " " 2d Mort.	1873	20,000	M. & N.	7	1893	101½	.....
" " " 3d Mort.	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort.	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort.	1888	50,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102½	.....
" " " Debenture.	1891	200,000	M. & N.	6	1901	112	.....
Watervliet Turnpike & R. R., 1st Mort.	1889	350,000	M. & N.	6	1919	112	115
Watervliet Turnpike & R. R., 2d Mort.	1889	150,000	M. & N.	6	1919	110	115

BALTIMORE STOCKS AND BONDS.—Corrected by Hambleton & Co., Bankers, 9 South Street, Baltimore, Md., April 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	1,000,000	Quart.	3	.....	85	90
City & Suburban Ry. Co.	50	3,000,000	.....	1	.....	30	33
Central Pass. Ry. Co.	50	300,000	.....	...	.....	60	65
Balto. Traction Co. (Cable).	25	5,000,000	Quart.	1	.....	16½	17

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort.	1892	500,000	.....	5	.....	108½	109
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	105½	106
Balto. Traction Co. (Cable).	1889	1,500,000	M. & N.	5	1929	108	109
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	101	101½
" " "	1891	1,250,000	M. & S.	6	1901	101½	102½
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	112	112½

BOSTON STOCKS.—Corrected by R. L. Day & Co., 40 Water Street, Members of Boston Stock Exchange. April 19. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.	50	$6,400,000	J. & J.	4	1887	75	76
West End Com'n.	50	9,085,000	J. & J.	3	1890–1892	46	48¼

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. Staples & Co., 215 Montague Street, Brooklyn, March 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	178	.....
Brooklyn Traction Co., pref.	100	3,000,000	.....	...	1893	67	.....
" " common.	100	6,000,000	.....	...	1893	18	.....
Coney Island & Brooklyn R. R. Co.	100	500,000	Oct. 1.	4	.....	.....	155
Long Island Traction Co.	100	30,000,000			1893	22	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co.	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds.	.....	300,000	J. & J.	5	Jan. 1909	.....	102
Coney Island & Brooklyn R. R. Co., certificates.	.....	300,000	J. & J.	6	July, 1894	.....	.....
South Brooklyn Central R. R. Co., 1st.	.....	125,000	F. & A.	7	Aug. 1897	104	.....
South Brooklyn Central R. R. Co., 2d.	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	.....	109

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. Kaufman Charleston, S. C., April 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.	50	$100,000	J. & J.	a	.....	.....	65
Enterprise Ry. Co.	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co.	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by William B. Wrenn, 167 Dearborn Street, Chicago, Ill., April 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City.	100	$9,000,000	Q.—J.	3	.....	322	325
Chicago Passenger.	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City.	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street.	100	5,500,000	J. & J.	4	.....	246⅛	247½
West Division City.	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street.	100	13,189,000	Q.—F.	1½	.....	152½	153

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City.	.....	4,619,500	J. & J.	4½	.....	101	.....
Chicago Passenger.	1883	400,000	F. & A.	6	1903	102	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	106	.....
" "	.....	1,850,000	M. & N.	4½	1927	98	100
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	102	103
West Chicago Street.	.....	4,100,000	M. & N.	5	.....	102½	102¾
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	.....	98
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	103	103¼

CINCINNATI STOCKS AND BONDS.—Corrected by Geo. Eustis & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, April 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati.	50	$6,750,000	Q.—J.	5	.....	106	106½
Mt. Adams & Eden Park.	50	1,600,000	Q.—J.	5	.....	107½	108
Mt. Auburn Cable.	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry.	100	500,000	.....	...	.....	60	65
" " " Pref.	100	100,000	.....	6	.....	96¾	98
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	.	.....	19	19½

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street.	.....	50,000	J. & J.	7	July, 1894	100	.....
" "	.....	50,000	J. & J.	7	July, 1895	101¾	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	98	99¾
" " extended	.....	150,000	J. & J.	5	.....	100½	101½
Mt. Adams & Eden Park.	.....	50,000	A. & O.	6	July, 1895	101	103
" " " "	.....	50,000	A. & O.	6	July, 1900	107¾	110
" " " "	.....	100,000	A. & O.	6	July, 1905	110¾	111½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	104¾	105
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	106½	108
" " " "	.....	300,000	J. & J.	6	Jan. 1914	103	104
Mt. Auburn Cable.	.....	200,000	J. & D.	5	June, 1907	.....	.....
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati.	.....	250,000	M. & S.	6	Mar. 1912	113	115
S. Cov. & Cin. 2d Mort. gold 6's	.....	250,000	J. & J.	...	1932	113	115

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. Hayes & Sons, Bankers, Cleveland, O., April 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co.	100	12,000,000	.....	....	1893	48½	49½
The Cleveland City Ry. Co.	100	8,000,000	.....	....	1893	57	60

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	101	102¾
" " City " "	1893	2,349,000	.....			95	96

DETROIT STOCKS.—Corrected by CAMERON CURRIE & Co., Bankers and Brokers, 82 Griswold Street, Detroit, April 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. April 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	200	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	125	150

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., April 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	84	85
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	39	40

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	99	99½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	114	115
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	114	115
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. April 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$400,000	J. & J.	4	.....	55	57½
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	.....	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Aug. 1, 1894	104	.....
New Haven & W. Haven R. R. Co	1892	500.000	M. & N.	5	Nov. 1912	100	102
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 188 Common Street, New Orleans, La., April 20. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.....	100	1,200,000	Quart.	1½	1867	126½	130
Crescent City R. Co.....	100	1,150,000	"	3	.866	74	90
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	40	43
New Orleans City & Lake Co.	100	1,500,000	Quart.	2¾	1860	110	115
Orleans R. R. Co.....	50	185,000	"	2	1868	45	55
St. Charles Street R. R. Co..	50	600,000	"	2½	1866	55	59

Bonds.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	.....	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	100	.....
do do new	1886	40,000	M & N	6	1896	100	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	113½	117
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	95	.....
St. Charles Street R. R. Co...	1881	120,000	J & D	6	'93-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, April 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (old stock)	50	$2,000,000	M. & N.	4	May, '91.	143½	144½
" " (new stock)	50	2,000,000	.....	...	May, '94.	134½	135

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by JAMES MCGOVERN & Co., 6 Wall St., New York, April 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	25	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	184	187
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	145	.....
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	140	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	120	124
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4	.....	295	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	40	48
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	240	260
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	132	135
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	190	200
Third Avenue.....	100	5,000,000	Q.—M.	4	.....	176	177
23d St.....	100	600,000	Q.—F.	2½	.....	290	.....
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	132	.....
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	108	111
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	103	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	104	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	100	.....
Broadway Consolidated.....	.....	8,500,000	J. & J.	5	 1943	104¾	105
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	112	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	117	120
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	105	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	99	100
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	50	57
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	103	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	114½	115¼
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	.....

PHILADELPHIA SECURITIES.—Corrected by HUHN & GLENDINNING, 143 South Fourth st. (Bullitt Building), Philadelphia, April 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	265	270
Continental.....	50	1,000,000	J.—J.	6	1873	127	130
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	331	335
Germantown.....	50	1,500,000	Q.—J.	2¾	1858	110	112
Green & Coates...	50	500,000	Q.—J.	3	1858	123	125
Hestonville...	50	2,050,000	.....	...	1859	38	39½
Lombard & South.....	25	500,000	A.—O.	8	1861	90	90
People's Traction Co.....	50	10,000,000	.....	...	.....	28½	29
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	155	160
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	80	85
Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	114¾	115
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	230	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	207	210
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	230	240
Union.....	50	1,250,000	J.—J.	9½	1864	199	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	200	210
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	120	121
Baltimore Traction.....	25	5,000,000	.....	1	1889	16¾	16½
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	13	13½

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	107¼	108¾
" " Imp.	1892	1,250,000	M.—S.	6	1901	101	102
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100¾	102
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	103½	.....
" "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., April 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	**Date of Issue**	**Am't Outstanding.**	**Inter'st Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 306 Times Bldg., Pittsburgh, Pa., April 20. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	...	.....	20¾	20¾
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	61¾	62
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	13⅜	13½
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	...	.....
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	21¼	22
Pittsburgh, Allegheny & Man	50	3,000,000	.....	1¼	.....	42½	43
West End R. R. Co.	50	200,000	J. & J.	...	.....	.....	.....
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	...	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	28¼	22½
BONDS.	**Date of Issue**	**Amount Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O.	5	1927	107¼	110
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	105	110
Pitts. & Birmingham Traction Co.	1892	.....	.....	5	.....	96	96¾
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	102¾	103¾
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	100¾	.....
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	101	103
Central Traction Co.	1889	375,000	J. & J.	5	1919	102	103
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1922	.....	.....
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	.....
Suburban Rapid Transit.	.....	.....	.....	6	.....	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Inc'e PlaneCo. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Inc'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS, Bankers, Providence, April 17.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	..	.....
BONDS.	**Date of Issue**	**Amo'nt Outstand'g**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	98	100
Newport St. Ry. Co.	.....	50,000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, April 19.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	34	38
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	60	62
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	13	20
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	39	40
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	60	80
do do Common.	100	4,000,000	.....	...	1892	15	18
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	68	80
do do Common.	100	3,000,000	.....	...	1892	15	20
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	37	40
BONDS.	**Date of Issue**	**Amount Out standing.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid**	**Ask'd**
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	93	95
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	99	99½
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	85	95
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	94	96
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	90	95
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	87	90

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., April 10.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	5	.....	.....	100
Geary St., Park & Ocean R. R. Co	100	1,000,000	.....	1	.....	.....	110
Market Street Cable Co.	.....	17,892,000	.....	...	.....	37½	38
Metropolitan Electric	.....	.....	.....	...	.....	25½	.....
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	.....	18
Sutter St. R. R. Co.	.....	.....	.....	...	.....	90	.....
Bonds.	**Date of Issue**	**Am't Outstanding.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Cal. St. Cable R. R.	.....	.....	.....	5	.....	.....	104
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	105	.....
Geary St., Park & Ocean	.....	.....	.....	...	.....	101	101½
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	119½	.....
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	.....	114
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	114	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	103	.....
Powell Street R. R.	.....	700,000	M. & S.	6	1912	107½	111
Sutter St. Cable Co.	.....	.....	.....	...	.....	103	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., April 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	50	60
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue	100	112,000	Dec. '88	2	1885	125	150
Lindell	100	2,500,000	.....	...	1890	74½	76
Missouri.	100	2,000,000	Q.—J.	2	1891	190	210
People's.	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis.	100	2,000,000	J. & J.	3½	1890	157	160
Fourth Street & Arsenal.	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban	100	2,500,000	.....	...	1891	30	40
Southern, Pfd.	.....	800,000	.....	...	.....	15	25
" Com.	.....	700,000	.....	...	.....	15	25
BONDS.	**Date of Issue**	**Amount Outstand-ing.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	96	98
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	102	104
Fourth St. & Arsenal	1888	50,000	J. & J.	6	1898–1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895–1910	100	102
Missouri Cable	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	98	100
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable	1889	800,000	J. & J.	6	1889–1914	90	95
St. Louis Cable	1890	1,500,000	M. & N.	5	1900–1910	100	102
Union Depot	1890	4,000,000	A. & O.	6	1900–1910	104	105
Southern	1884	200,000	M. & N.	6	1904	103	105
Southern	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban	1891	1,400,000	F. & A.	5	1921	95	97
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	70	80

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., April 21. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	295	315
Metropolitan R. R.	50	750,000	Q. J.	2	1864	85	91
Columbia R. R.	50	400,000	Q. M.	1	1870	60	65
Belt R.R.	50	500,000	Q. J.	...	1875	2›	.....
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	25	.....
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	.....
Rock Creek R. R.	100	401,700	.....	...	.....	.....	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	**Date of Issue**	**Amount Out-standing.**	**Interest Paid.**	**%**	**Principal Due.**	**Bid.**	**Ask'd**
Wash'tn & Geo'tn conv't. 1st.	'83–'99	3,000,000	J. & J.	6	1899-1929	135	139
" " " 2d.	.....	500,000	J. & J.	6	1903–1943	.....	.....
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	90	.....
Belt	1921	240,000	J. & J.	6	1921	84	94
Metropolitan R. R. convert.	1901	200,000	J. & J.	5	1901	102	108
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	80	.....

Financial.

THE New England Street Railway Company on April 16 paid a quarterly dividend of 1 per cent.

$ $ $

THE Sioux City Street Railway, of Sioux City, Ia., will be sold on May 3. The receiver is J. C. French.

$ $ $

THE receiver of the Tampa (Fla.) Street Railway & Power Company, T. C. Taliaferro, has applied to Judge Phillips for an order of sale for the entire plant, including the electric railway.

THE directors of the Winooski (Vt.) & Burlington Street Railway Company have voted to increase the capital stock of the company to $200,000. The line of the road will be extended this spring.

$ $ $

THE United Electric Railway, of Nashville, Tenn., was sold April 18, pursuant to a decree of the United States Court, to Nathaniel Baxter, Jr. It is understood that the road has been bought for the bondholders.

$ $ $

THE mortgage of the Nassau Electric Railroad Company, of Brooklyn, N. Y., for $6,000,000, was filed April 19, in the office of the Clerk of Kings County. The Hamilton Trust Company, of Brooklyn, is trustee of the mortgage.

$ $ $

JAMES H. MAURY has been elected president of the New Orleans Traction Company, *vice* James W. Henning, resigned, and the board of directors is somewhat changed. Among the firms principally interested in the company now are H. B. Hollins & Company, Manuel Lehmann and J. &. W. Seligman.

$ $ $

THE Columbus (O.) Street Railway Co. reports as follows the result of its operations for March: Gross earnings, 1894, $42,965.65; 1893, $42,305.07; increase, $660.58. Operating expenses, 1894, $21,232.13; 1893, $28,017.18; decrease, $6,785.05. Net earnings, $21,733.52; 1893, $14,287.89; increase, $7,445.63.

$ $ $

THE Pittsburgh (Pa.) & Birmingham Traction Company gives the following statement of its operations for February: Gross earnings, 1894, $20,650.74; 1893, $26,307.64; decrease, $5,656.90. Operating expenses, 1894, $10,635.72; 1893, $13,353.66; decrease, $2,717.94. Net earnings, 1894, $10,015.02; 1893, $12,953.98; decrease, $2,938.96.

$ $ $

THE directors of the Fairhaven & Westville Horse Railroad Company, of New Haven, Conn., have decided to increase the capital stock of the company by the addition of 8,000 shares at $25 a share. Stockholders of record May 15, 1894, will be allowed to subscribe for the new stock at par, at the rate of one share of new stock for each two shares of old stock held.

$ $ $

THE electric railway and lighting plant of the Consolidated Electric Company, of St. John, N. B., were sold at auction under an order of the equity court. The bidding was done by E. C. Jones, local manager of the bank of Montreal; C. E. Fawcett, a wealthy land owner of Sackville, N. B., and Mr. Donovan. At $92,000, Mr. Jones secured the property. Mr. Jones is thought to represent a Montreal syndicate, which will put the road in first rate shape immediately.

$ $ $

THE Buffalo (N. Y.) Railway Company reports the following as its operations for March:

	1894.	1893.	Inc. or Dec.
Gross earnings	$120,009.02	$112,374.84	Inc. $7,634.18
Operating expenses	71,721.73	76,119.92	Dec. 4,398.19
Net earnings	$ 48,287.29	$ 36,254.92	Inc. $12,032.37

THE Scranton (Pa.) Traction Company reports the following as its operations for March:

	1894.	1893.	Inc. or Dec.
Gross earnings	$19,252.72	$15,687.61	Inc. $3,565.11
Operating expenses	11,436.59	10,227.08	Inc. 1,209.51
Net earnings	$ 7,816.13	$ 5,460.53	Inc. $2,355.60

$ $ $

THE North Shore Traction Company, of Lynn and Boston, Mass., submits the following comparative statement of its operations for February:

	1894.	1893.	Inc. or Dec. 1894.
Gross earnings	$67,147.62	$63,267.50	Inc. $ 3,880.12
Operating expenses	63,632.36	78,739.13	Dec. 15,106.77
Net earnings	$3,515.26	Loss 15,471.63	Inc. $18,986.89

$ $ $

WE have received the following statement of the operations of the Brooklyn Traction Company for the months of January and February. January: Gross earnings, 1894, $69,291.70; 1893, $53,456.60; increase, $15,835.10. Operating expenses, 1894, $48,637.10. Earnings from operation, 1894, $20,654.60. Miscellaneous earnings, 1894, $5,635.07. Net earnings, 1894, $26,289.67. February: Gross earnings, 1894, $61,445.22; 1893, $49,562.75; increase, $11,882 47. Operating expenses,

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1894, $45,433,36. Earnings from operation, 1894, $16,011.86. Miscellaneous earnings, 1894, $4,820.62. Net earnings, 1894, $20,832.48. We have no data showing the operating expenses and net earnings for the corresponding months of 1893.

$ $ $

THE last installment of $5 per share on the new stock of the City Passenger Railway Company, of Baltimore, Md., will be payable May 1. This will complete the payment for the $1,000,000 of new stock, and the company will deliver the certificates to the holders of receipts given for the several partial payments. The Board of Directors has also determined to declare and pay May 1, a stock dividend of 50 per cent. to the holders of the original $1,000,000 capital stock and authorized by the Legislature two years ago. This distribution represents accumulated earnings spent on real estate, new roads and other improvements. It is expected that the City Passenger Company will commence the payment of dividends on its entire capital stock in July, and that the earnings of the company will at first enable the payment of 6 per cent. per annum. If the new stock sells at 44 (par 25) which is at about the prices it is figured, the new stock will correspond to the old stock at present prices of the latter, the stock will be selling on about a 3⅜ per cent. basis.

Map of the United States.

A large handsome Map of the United States, mounted and suitable for office or home use, is issued by the Burlington Route. Copies will be mailed to any address on receipt of fifteen cents in postage by P. S. EUSTIS, General Passenger Agent, C., B. & Q. R. R., Chicago, Ill. ***

Of Interest to Travelers.

The Baltimore & Ohio Railroad announces that it has placed on sale round trip tickets at reduced rates to the winter resorts in Florida and the South, and also to such points of interest as Luray, Natural Bridge and Gettysburg. This company has also arranged to place on sale excursion tickets to San Francisco and other points in California, on account of the Mid-Winter Fair, at unusually low rates. Excursion tickets are now on sale to Baltimore and Washington via the famous Royal Blue line.

With its vestibuled train service, via Washington, to Cincinnati, St. Louis and Chicago, the Baltimore & Ohio is in the best of condition to handle Western and Southern travel. That the line is a popular one, is attested by the immense World's Fair business handled this summer.

Those contemplating a trip West or South this winter should write to C. P. Craig, general Eastern passenger agent, 415 Broadway, New York, for rates and other information. ***

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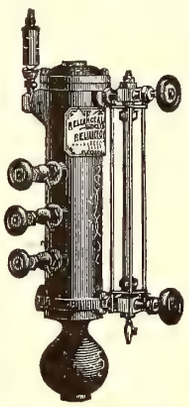
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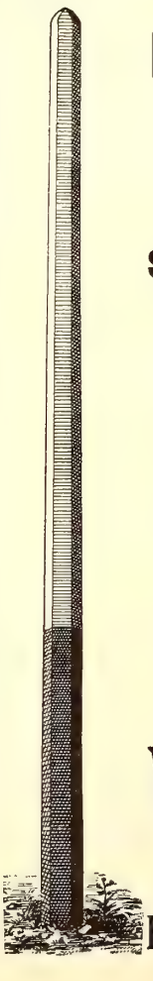
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THE STREET RAILWAY JOURNAL

Vol. X. *NEW YORK & CHICAGO, JUNE.* *No. 6.*

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THE CINCINNATI, NEWPORT & COVINGTON RAILWAY.

This company has absorbed all of the street railway lines formerly operated under several names, and embracing the territory of Covington, Newport, Bellevue and Dayton, and the neighboring villages and suburban districts, and aggregating nearly sixty miles of track, for the most of which the company holds a perpetual franchise. The company caters to a population south of the Ohio of about 100,000, crosses the river to Cincinnati over three bridges, and penetrates to Fountain Square, receiving a large resident and pleasure traffic from the latter city. The road, in the opinion of many, is one of the most promising street railway plants in that section, if not in the entire country. The lines operate in two states, three counties, five cities, and seven villages.



FIG. 1.—EXTERIOR OF POWER STATION OF CINCINNATI, NEWPORT & COVINGTON RAILWAY—NEWPORT, KY.

MANAGEMENT.

John J. Shipherd, of Cleveland, is president of the company, and was the prime mover in the purchase of the lines and the consolidation of the old companies. To him great credit is due for the judgment and foresight that has provided the people in the district with rapid transit. Chas. E. Orr, of Pittsburgh, is vice president, H. P. Eells, of Cleveland, treasurer, and James Hoyt, of Cleveland, secretary. The resident operating officers are S. Bigstaff, general manager; G. M. Abbott, secretary and treasurer; T. M. Jenkins, superintendent. Mr. Jenkins was for a number of years assistant superintendent of the Albany, (N. Y.) Railway, and received a good training under the well known general manager of that system. In his present position he is executive officer in all matters of discipline, operation and construction.

The capital stock of the company is $3,000,000, and there are $3,000,000 of bonds. The local offices of the company occupy a large brick building on the northwest corner of 4th and Scott Streets. This building was formerly occupied by a bank, and is provided with large burglarproof and fireproof vaults built into the walls, and the rooms are handsomely furnished with convenient counters, desks, cases and other office fixtures, making it in all respects a first class street railway office.

PHYSICAL FEATURES.

The cars are operated mostly by electric power, there being only one or two short mule lines, on one of which,

including one of the bridges to Cincinnati, the mule cars are run only two or three times a day, for the purpose of holding the franchise. Some of these lines, which we have before described, were electrically equipped as early as 1890, the Short system of motors and generators being employed. The purchase of the lines by the new company was made in July, 1892, and the work of reorganization and re-equipment at once begun. The track construction through the principal streets has been entirely renewed, a new power house and several car barns erected, and a large extension made to the lines, and a new equipment of rolling stock and motors provided. The lines, when the extensions are completed, will be operated in divisions, over all of which, with one exception, the cars will cross over to Cincinnati.

The standard rail for track construction in the paved streets is eighty pound, seven inch girder rail, and that in the present construction was purchased from the Pennsylvania Steel Company, and from the Johnson Company. The paving consists of asphalt and vitrified brick, of the Hallwood type, and is all done by the city at a cost for brick of from $4.18 to $4.22 per running foot, measured to the middle of the streets which are from forty to sixty feet in width. In the process of track construction, the surface is excavated to a depth of eighteen inches, when the foundation is thoroughly rolled with a twenty ton steam roller. A foundation of broken stone (three inch mesh), from six to eight inches deep, is then thoroughly rolled, on which the ties are placed (two feet centers) and tamped up with fine grit composed of the screenings of broken stone. The space between the ties is then filled up with broken stone, above which is the paving foundation. Oak ties, 5 × 7 ins. × 8 ft., are employed on all city and suburban construction, and cost in this market thirty-five cents each. No tie rods are employed, but on the alternate ties tie plates and brace plates are provided. Where a brick paving is to be employed, the foundations are prepared in the same manner, only the rails are surfaced up and supported on blocks and stones, when a foundation of concrete is tamped in, and the space between the ties filled up with the same material to the top of the ties, when a layer of sand is spread over, on which a single layer of brick is placed edgeways. On the approaches to two of the bridges the construction is of T rails and wooden blocks. In the opinion of the superintendent, a T rail construction, with asphalt or brick paving, is most desirable for city streets, both from the standpoint of the public and that of the operating company. On the asphalt streets, granite blocks are placed each side of the rails, and toothed into the paving material, the blocks being placed flatwise and parallel with the rail, and endways, alternately. The construction on suburban lines consists of a fifty-six pound T rail, with a clay, gravel and macadam foundation, according to the kind of soil, making a regular steam roadway.

On the extension to Ludlow, which is now being constructed, and where the formation is a stiff clay, the excavation is being made across the street eighteen inches in depth, and then, at the outside ends of the ties, a ditch is cut eighteen inches below the street excavation. In the bottom of this, a four inch porous drain pipe is placed. The ditch is then filled with gravel above the pipe, and the pipe is connected with catch basins at suitable intervals, which provides for suitable drainage of the foundations. A foundation prepared of broken stone and gravel is then prepared, and on this oak ties, 5 × 7 ins. × 8 ft., are placed, and on the portions which are to be paved with brick a concrete foundation is provided, as before described. The special work on the entire system was furnished by the Cleveland Frog & Crossing Company, and by the Johnson Company. The latter company furnished the special work for the sections constructed with the Johnson rail.

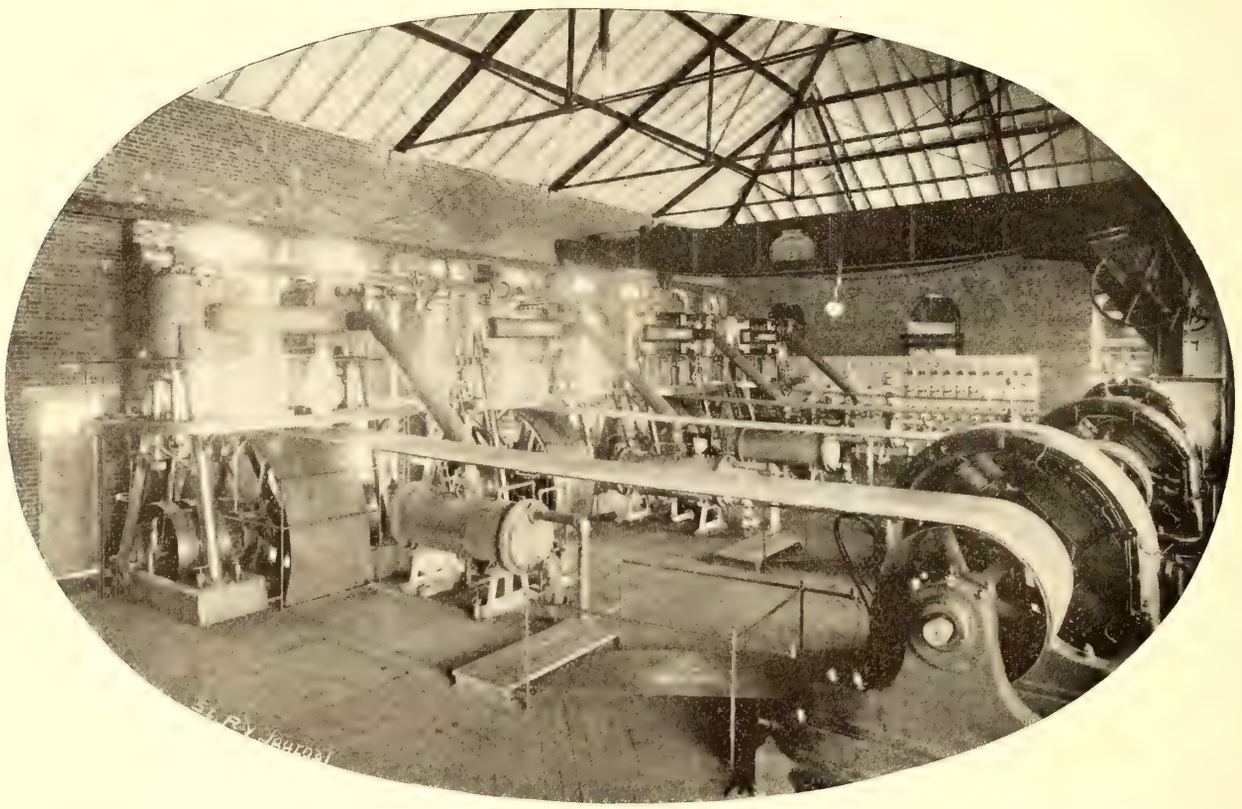


FIG. 2.—INTERIOR OF POWER STATION OF CINCINNATI, NEWPORT & COVINGTON RAILWAY—NEWPORT, KY.

Spiral transition curves are provided on all turns, so that the cars enter and leave the curves with a very easy movement. At one of the steam railway crossings a derailing switch is placed. This is of the tilting tongue type and was manufactured by the Cleveland Frog & Crossing Company. On all suburban lines the practice of the present engineer of the company is to make as short curves as possible except where corners are turned, the theory being that the cars can round the short curves quicker, then speed up on the tangents, and make better headway than following steam practice, which employs a long radius usually. On the Fort Thomas line, however, which was laid out under the supervision of a former en-

gineer, steam practice was followed and long curves were employed, necessitating a large amount of grading. The number of cubic yards of grading for the four miles of double track on this line amount to 180,000 cu. yds.

BONDING.

On that portion of the system first reconstructed a No. 0, B. & B. gauge, iron wire was employed for bonding the rails, and although having been in service for more than a year, seems to be all right so far. In more recent construction, however, a No. 0 copper rail bond is being employed, and this is being attached to the rail by means of a channel pin devised by the electrician of the company. A split copper washer about one inch in diameter is first placed on the wire a short distance from the end, then inserted in the channel pin, when the latter being upset, the channel pin head and the washer are made to embrace the rail firmly. The surface of the rail is faced off in the process of drilling the bond hole, thus giving a large and sure contact with the rail. The rails are then cross bonded over 500 ft. and both tracks about every 1,000 ft. One return feed wire is also provided with which the rails are connected at certain intervals. Eleven No. 0000 return wires connect the track with the station. These are to be increased to twenty-two to equal the number of feed wires.

OVERHEAD CONSTRUCTION.

On all the original electric construction a double trolley was provided in order to comply with the requirements of the local authorities in Cincinnati. About one-third of the present equipment is still double trolley, but only single wires are being installed on all extensions, and all the rails are wired for a ground return. The cars, however, are all provided with two trolley poles, each having an independent base, and the change is made from double to single trolley on the Covington and Newport sides of the bridges, by pulling down and fastening one trolley pole and throwing a canopy switch which makes the contact for ground return. The return from single to double trolley is done by returning one pole and replacing the switch, the change being made without stopping the car. At the street corners, overhead insulated crossings are provided on which, for a short distance, the trolley wheel runs on a wooden surface and the cars pass the dead point by momentum. The overhead switches and crossings were manufactured by the Railway Switch Company, of Cincinnati, and are very ingeniously devised. The management is not in favor of the double trolley, and will change the entire system to single trolley, as soon as permission to do so has been had. The overhead construction, nearly over the entire system, even on the suburban lines, is supported on tubular iron poles. On one short line octagonal wooden poles are provided. The poles are all painted and numbered. The Garton lightning arresters are placed on the poles every 1,200 ft., and Westinghouse arresters on all the feeder and junction boxes outside the station and also inside the station on each section of the feed wires. Both types of arresters, so far, have proved very efficient. No guard wires are employed.

ROLLING STOCK.

The Accelerator type of car is the standard closed car of the company. The equipment consists of forty-five of these cars, which are manufactured by the Brownell Car Company, of St. Louis. One particular feature of these cars is a blind window or panel midway of the car on each side, which is painted green and bears the monogram of the operating company. On the inside of this panel a plate glass mirror is provided. There are also twenty-six Stephenson sixteen foot cars, which belonged to the original equipment, and are occasionally operated. There are also forty open cars all of the Brownell make.

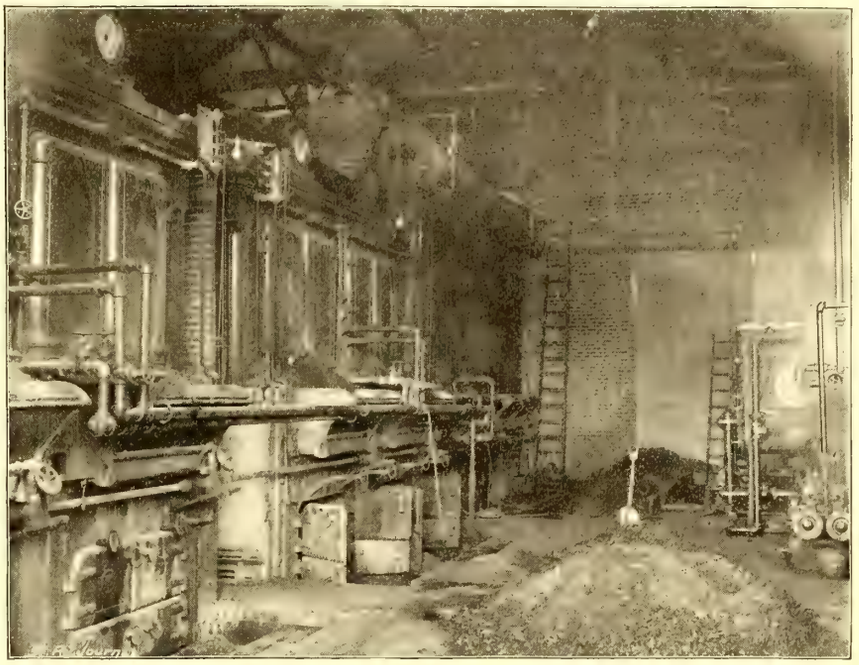


FIG. 3.—BOILER ROOM—CINCINNATI, NEWPORT & COVINGTON RAILWAY, NEWPORT, KY.

Twenty of these are of the latest type and have the new Brownell reversible seats, with a seating capacity for thirty-two people. These seats are readily reversed by taking hold of the round cross bar, which forms the upper part of the back support, and throwing it over to the opposite side—a very ingenious arrangement. By means of the folding seat seven inches of room is gained over the old style, and the device accomplishes for street

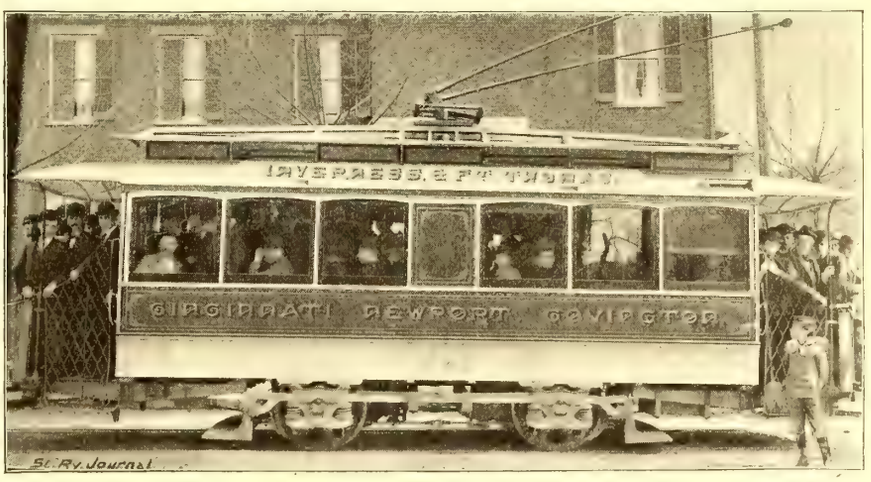


FIG. 4.—CAR—CINCINNATI, NEWPORT & COVINGTON RAILWAY.

cars what the folding opera chair has done in theatres and public halls. In a car with seven seats, forty-nine inches in length can be saved, yet the passengers have the same accommodation that they have now in a stationary seat car. Another great advantage claimed for this over the ordinary seat, is the convenience of cleaning out the cars. All the seats can be folded up and the car can be swept out almost as easily as if there were no seats at all. They are shown in Figs. 5 and 6.

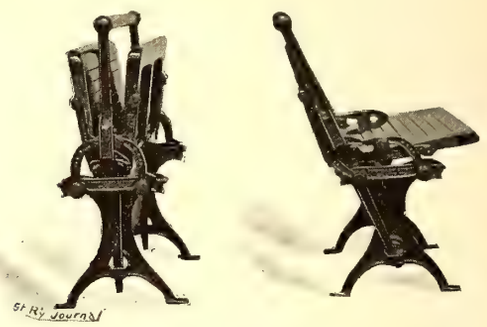
The curtains, which have waterproof material on the outside, are of the roller type, and the ends of the curtain sticks slide in channels cut in the posts, and at the ends are provided with the new triangular or cam attachment, which holds them in place. In case of storm the curtains effectually close the car. The new open cars are provided with a bronze rod or pipe attached to the outside post on each side of the cars, which extends the full length of the car, midway between the floor and the eave plates, adding greatly to the strength of the car. Below these are wire screens, about two feet wide and painted green, and which are employed on all the cars on each side in order to protect the passengers from coming in contact with the walls and bridge columns on the central bridge, which is very narrow, so the passengers are required to enter and leave all the cars at the platforms. The ceilings in all the cars are painted white, with delicately painted borders. No advertisements are allowed in any of the cars. The Meaker register is provided, and those in the new open cars are of special design, with the name of the operating company in small gilt letters on the front. The outlines of the new cars are very graceful, the roof having a slight curve from end to end, and provided with double planks for the support of the trolley base, and are supplemented by the well known truss construction of the above named car company.

In addition to the car equipment, a closed freight and mail car is provided, on which freight and mail bags are carried between the stations and offices in Cincinnati and Covington. This, when in use, is towed by the motor cars. All the cars have painted upon the dashboards, "United States Mail Line." A sprinkling car is also provided, with tank and the usual apparatus for sprinkling, by which some of the streets on the Dayton division are sprinkled at the expense of the street railway company.

The forty-five Accelerator cars and twelve of the open cars are mounted on the Brownell trucks, while twenty of the open cars have Dorner & Dutton forged trucks. Twelve of the Brownell trucks have an inside duplicate equipment of brake mechanism which has been designed by the superintendent, and which is operated by means of a straight lever in position against the dashboard. These are provided as emergency brakes in case the ordinary equipment should fail on any of the steep grades, which on some portions of the Cincinnati division amount to 8 per cent. The wheels are thirty-three inches in diameter, and until recently have been purchased from the different makers, but more recent purchases have been from the Bass Foundry & Machine Company, of Fort Wayne, Ind., made after a pattern designed by the superintendent. These wheels have a two and a half inch tread and seven-eighths inch flange, and weigh 350 lbs., a wide tread being in favor with the management, especially for suburban work. The standard axle is of steel, three and five-eighths inches in diameter. The standard shoe with which the cars are equipped is of the Brownell type. These are so arranged that a set of shoes can be taken off and a new set put on in half an hour. The motor equipment is all of the Westinghouse type, each car being provided with a double equipment of twenty-five horse power motors. The controllers are all of the latest type—Westinghouse No. 14.

One of the cars has been equipped with a pair of revolving wire brushes for the purpose of removing dirt and snow from the rails. These brushes are each about twelve inches long and ten inches in diameter, and are attached to a shaft at an angle of about 45 degs. by means of a bell crank joint which is supported just in front of the wheels by means of a pipe frame, which is hinged under the front end of the platform and supported in front of the wheels by means of chains, which connect with a foot lever on the platform, and by means of which the brushes may be raised or lowered. The shaft is revolved by means of a sprocket chain which embraces a small sprocket wheel on the shaft and an idler wheel just back of and below the axle. The axle is provided with a sprocket wheel which, by the lifting of the idler, is brought in contact with the chain, setting it and the brush shaft in motion, being so arranged as to revolve the brushes rapidly, which serves effectually to clear the track of any obstructions. The device has been designed by the foreman of the repair shop, and is working so successfully that an additional number of cars will be equipped. The winter cars are all equipped with electric heaters, two types being employed, the Dewey, manufactured by the Central Heating Company, of New York, and those of the Consolidated Heating Company, of Albany, N. Y. This method of heating is very satisfactory to the public, and the policy of the company is to provide everything that will please its patrons. It is proposed now to provide electric buttons at convenient places in the cars so that the passengers can signal the conductor.





FIGS. 5 AND 6.—OPEN CAR AND FOLDABLE SEATS—CINCINNATI, NEWPORT & COVINGTON RAILWAY.

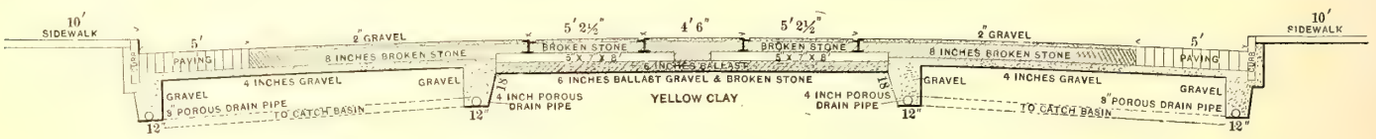


FIG. 7.—SECTION OF TRACK CONSTRUCTION—CINCINNATI, NEWPORT & COVINGTON RAILWAY.

POWER EQUIPMENT.

The power for operating the system is generated at two stations. The old station, which formerly provided all the power for the system, stands on 2d Street, in Covington, near the end of the suspension bridge, but at present supplies the power for operating the sections across the bridges and on the Cincinnati side only. A new central station has recently been erected in Newport, beside the Licking River near 11th Street, above the second bridge connecting Newport and Covington, the two cities being separated by the Licking River, which

forms a junction with the Ohio at this point. The new station is of brick, having a ground dimension 169¼ × 70 ft., with a wing for the boiler room 70 × 50 ft. The roof of the station is of slate, and supported by steel trusses. The smokestack is of brick, circular, and 135 ft. in height; the base is nine feet in diameter, but tapers to six feet at the top.

The original design was for a double station with switchboards at either end of the building, and the first half has been equipped with this view, but it is the intention of the management to add to the equipment as necessary, placing the switchboard in a tower on the side so that one set of engineers can operate the entire station.

The boiler equipment, which is located in the wing, in the rear of the engine room, consists of four Babcock & Wilcox boilers of 250 H. P. each, and two Stirling boilers, each of the same capacity on all, are provided with Roney mechanical stokers. The auxiliary steam equipment consists of a Webster purifier and pumps of the Blake type. A hot well, which was formerly in the engine room, has been removed to a corner in the rear of the boiler room. This was rendered necessary as the vapors in the hot room destroyed the insulation on the trunk wires which pass under the floor in the basement. The feed and condensing waters are obtained from the river, from which the station is distant about 800 ft. The pumps for lifting the water are located on the river bank, and are housed in a small wooden building, provided with wheels and supported on an incline track laid on the sloping banks of the river. Steam is delivered to the pumps from the station by means of a four inch pipe which is provided with a covering for most of the distance. The suction pipe is provided with a screen, and the whole arrangement of the station is such that the building can be moved up or down the incline by means of wire ropes and hoists to adjust it to the height of the water in the river which has an extreme variation between low and high water of forty feet. Two hoists are provided and also safety ropes, and the arrangement is such that the power of six men can operate it. The water and steam pipes are provided with junctions (the former of which are ten inches in diameter), so that attachments can be made at different stations as conditions may require. The station has a pumping capacity of 2,000,000 gals., and the feedwater is lifted into a tank near the boiler room, having a capacity of 39,000 gals., the entire lift above low water being eighty feet.

Pittsburgh and Kanawha coal is employed, which is delivered by carts from neighboring coal depots, being brought from the mines on barges, and costs delivered about $1.25 per ton. From twenty-six to twenty-eight tons are consumed a day for fuel, the cost being about $.0119 per car mile.

The power equipment consists of four 500 H. P. vertical compound, condensing engines of the marine type, which were manufactured by the Cleveland Ship Building Company. These exhaust into Brooklyn surface condensers placed between the engines and generators, as shown in the illustration (Fig. 2), the condensers being the standard in use on vessels in the United States Navy. The flywheels of the engines are eleven feet in diameter, and the governing mechanism is contained in the fly wheel. The cylinders are 18-34 × 28 ins., and are run at 130 revolutions. The tops of the cylinders extend about sixteen feet above the floor, and are provided with iron platforms and iron steps, so that all the operating parts are readily



CENTRAL BRIDGE FROM COVINGTON APPROACH.
SUSPENSION BRIDGE—COVINGTON APPROACH.

FORT THOMAS LINE—HORSE SHOE BEND.
VIEW OF RIVER AND STEAMBOATS.

FIG. 8.—VIEWS ON LINE OF CINCINNATI, NEWPORT & COVINGTON RAILWAY.

reached by the attendants. A band wheel eleven feet in diameter with a fifty inch face is used. It is placed between the frames, with the cranks on the outside of the main bearings, at right angles to each other. The wearing surfaces of the crossheads and the main bearings, are lined with anti-friction metal. The shaft is of mild steel forging, eight and one-half inches diameter in journals. The valve motion is very accurate, and the engine is under perfect control, notwithstanding the rapidly varying load. The high pressure valve is actuated by an eccentric connected to a flywheel governor; the low pressure valve is moved direct by an eccentric keyed to the main shaft. The throttle valve is six inches in diameter and is operated by a hand wheel placed in a convenient position for operating from the floor. Around the engine at a light up when a call is rung so as to attract the attention of the attendants in case the noise of the machinery should prevent them hearing the bell call. All the appointments of the station are very complete, and the details as to cleanliness and operation reflect creditably upon the engineer in charge.

The original equipment of the old station, referred to above, consisted of three high speed engines, two of them being of the Armington & Sims type, and of 125 H. P. each, and one of McIntosh & Seymour make of 150 H. P., and were arranged to belt direct to Short eighty kilowatt generators. More recently, however, the equipment of the station has been increased by the installation of a 400 H. P. Corliss engine, manufactured by Lane & Bodley, of Cincinnati, and which drives, by means of belting and



OFFICE OF STREET RAILWAY COMPANY.
NEWPORT CAR HOUSE.

MADISON AVENUE CAR HOUSE AND REPAIR SHOPS.
DAYTON CAR HOUSE.

FIG. 9.—OFFICE AND CAR HOUSES—CINCINNATI, NEWPORT & COVINGTON RAILWAY CO.

convenient height is placed a platform of iron grating and iron pipe railing. The engines are belted direct to Westinghouse generators by means of forty-eight inch belts, the distance between shaft centers being about fifty feet.

The four generators are of the M. P. type, of 500 H. P. each. The belts are of three ply leather, and were manufactured by the Bradford Belt Manufacturing Company, of Cincinnati. The arrangement of station and switchboard is shown in the illustration, Fig. 2. The latter is of white marble and equipped with Westinghouse instruments. A current of 550 volts is carried. An overhead, ten ton, hand power crane, manufactured by the Phœnix Iron Works, of Cleveland, completes the principal station equipment.

In connection with the telephone equipment of the station, colored incandescent lights are provided, which

countershaft, the Short generators referred to above, the high speed engines being used only in case of emergency.

Still more recently an additional unit of power has been installed, consisting of a 500 H. P. vertical engine, of the same make as those described above for the central station, and which is belted direct to a 400 H. P., M. P. Westinghouse generator. This unit has a separate switchboard equipped with Westinghouse instruments, while the switchboard for the balance of the station is provided with instruments of the Short type. The boiler equipment of the station consists of four tubular boilers, of 100 H. P. each, which are equipped with Murphy smokeless furnaces. These furnaces, the superintendent states, operate very satisfactorily when the boilers are moderately fired, and the grates last from six to eight months; but when it is necessary to force the fires, the grates require changing frequently.

The same is true of other auxiliary equipment, including the pumps; as long as they are not overtaxed, everything works in a satisfactory manner, and this, said the superintendent, is the secret of success with all street railway appliances, as nearly all breakdowns come from overloading. The same quality of coal is supplied as described for the central station, and it requires ten tons a day, of nineteen hours each, at a cost of $12.50, to operate the twenty-two cars, the average number on the Cincinnati side of the river. Some of the grades are 8 per cent., as



JOHN J. SHIPHERD,
PRESIDENT CINCINNATI, NEWPORT & COVINGTON RAILWAY CO.

before noted, and the approach to the suspension bridge, on the Cincinnati side, is especially difficult, as it consists of a long curve on a 7¼ per cent. grade. The approach to all the bridges is over a considerable grade, and, with one exception, on difficult curves.

A comparison is made in this station on the cost of operating with condensing and non-condensing engines. With the compound engines water for condensing purposes costs six cents per 1,000 gals., or a total cost of $200 per month for water, and for feedwater only about $50. This expense offsets the extra cost for oil which is consumed on the countershaft and extra bearings connected with the single cylinder engine, so that the cost of operating the engine with either system is about the same, there being a 50 per cent. saving in oil, ordinarily, with the direct connected apparatus.

CAR BARNS.

Four car barns provide storage for the rolling stock. These, with one exception, are frame buildings with corrugated iron sheeting painted chocolate color, but on one of the barns the sheeting is pressed to imitate brick. The principal barn is of brick and is located on the corner of State and Madison Streets in Covington, and contains the principal repair shop. The storage tracks have a capacity for holding thirty-five Accelerator cars, or forty cars of the ordinary type. There are two pits in the barn proper and two in the repair shop, each having a capacity for six cars. The trolley wires are protected by inverted wooden troughs. The tool equipment of the repair shop is operated by a fifteen horse power Card motor, and the tool equipment consists of one twenty inch lathe having a twelve foot base, one fourteen inch lathe, one shaper, one drill press, a thirty-six inch car wheel borer and a 100 ton wheel press. Most of the tools are of the Niles manufacture. There is also a small complement of wood working machinery, consisting of a band saw, cross cut saw and other tools with a twenty-four inch Sturtevant fan. The blacksmith shop has two forges and the usual equipment of blacksmith tools. In connection with repairs, it may be stated that four extra armatures only are provided for 154 motors, and so far the repairs to motors have been very slight. Each of the car barns is provided with an office for the foreman, and in each case is carpeted and kept in a neat condition.

In connection with each of the offices, a safe is provided in which the conductors deposit their receipts. These safes are located in the forman's office, but are provided with a trap to which access is had from the outside. These safes, which were designed by the superintendent and manufactured by the Littleford Brothers, of Cincinnati, are about four feet high and fourteen inches square, and are so constructed as to be fireproof.

The traps in the safes through which the deposits of money are made are of sufficient size to drop the bags and returns, and are modeled after the tilting traps in the more recent type of letter boxes. The contents of the safe are removed through a door near the bottom of the safe on the side projecting into the foreman's office. These safes cost about $35 each. A special attendant collects the receipts and delivers them at the central office every morning.

At each of the car barns there is a fireproof oil room, constructed of brick, with iron doors and cement floors, where all the oil is stored and the lamps filled and trimmed. These oil safes are about nine feet square and ten feet in height inside, and cost about $120 each. All the barns are provided with arc and incandescent lamps.

The 11th Street barn, which was built after designs made by the superintendent, has a capacity for storing twenty-six cars, has a ground dimension of 75 × 100 ft., with eight storage tracks. The roof is supported by frame trusses. The office is located at the front center of the building and has a store room above. The cost of the entire structure was about $2,300. The superintendent is of the opinion that were he to apply he could secure the prize offered by the J. G. White Company, as noted in the last issue of the STREET RAILWAY JOURNAL, for an inexpensive car barn. At some of the stations sand driers are provided, which consist of metal sheets resting on an ordinary brick flue in which the fire is kindled. There are also salt bins, and at one station we noted that



MAJ. SAMUEL BIGSTAFF,
VICE-PRES. AND GEN. MAN. CIN., NEWPORT & COVINGTON RY. CO.



THOMAS J. JENKINS,
SUPERINTENDENT CIN., NEWPORT & COVINGTON RY. CO.

the track scrapers had all been recently painted and numbered to correspond with the car number, and put away for winter use.

OPERATING FEATURES.

The superintendent hires and discharges the car employes. The engaging and control of other employes is left to the heads of the different departments, and the superintendent holds them responsible and requires that they employ only good men. For instance, the chief

engineer of the power station engages all his assistants, and the chief electrician, the superintendent of the overhead construction, the track master and foremen of the car barns are each responsible for the men under their immediate charge. The granting of leaves of absence to the car men is left entirely with the foremen of the different stations. The foremen also have authority to suspend car men in case of gross violation of rules when the matter is referred to the superintendent. The heads of the different departments report to the superintendent in person at his office every morning, when a conference is held from nine to ten o'clock, and all matters pertaining to the operation of the lines are carefully discussed, and orders issued. This practice has resulted in a very efficient service in all departments, and is commendable. The superintendent makes it a practice never to reprimand his employes when on duty, but in case any violation of rules is noted they are called before him, and suitable admonition rendered with careful instruction as to their duties. The discipline is firm and fair, and the superintendent makes it a practice to deal in a pleasant manner with the men even when discharging them. An employe once out is never reinstated. The aim is to employ only men of good habits. In case men contract the habit of drinking or visiting objectionable resorts they are soon dismissed.

New motormen, before being assigned to their regular work, are required to serve as students over all the company's lines, and then to spend a week or more in the repair shops, where they are allowed to study the mechanism of the motor, and the foreman instructs them in the manipulation of the switches, and especially as to what to do in emergency cases, when and how to reverse, and how to adjust the fuses. Men who have been employed on street car lines in other cities are required to bring letters of recommendation from their former employers.

Car men are required to wear a blue uniform, and their caps are of a style somewhat different from those usually worn. The pay of motormen and conductors is 16⅔ cents an hour, or $2 a day of twelve hours. Three crews are provided for each two cars.

The men longest in the employ of the company have the choice of runs which are divided into odd and even numbers. The odd numbers, or day runs, are considered the preferable, while the even numbers are the late day runs. The runs which are numbered 1, 3, 5, 7, etc., are the first to start out in the morning, and are manned by the regular crews, while the runs numbered 2, 4, 6, 8 are also early runs, but the cars are manned by tripper crews. The regulars of the odd runs are relieved at the dinner hour by the trippers of the even runs, whose cars in turn are taken by the regulars of the even numbers. After the dinner hour, the trippers go home for sleep and rest, and again come out to relieve the cars of the even numbered runs for the supper hour, when they again take the odd runs and finish the night work, while the regulars of these runs go home for rest. This arrangement evens up the work all round, and is very satisfactory to the men.

The pay of all trackmen is $1.50 for spikers, and $1.65 for handy men. The fare is five cents. No tickets are sold. A book of tickets is provided the officers and employes. Policemen and firemen ride free when in uniform. No passes are granted to city officials, and only a few to newspaper men.

Under the present management the operation of the system has been very free from accidents.

The entire force seems to, unconciously, have become a "mutual admiration society." The president is proud of his subordinates, and the excellence of the equipment. The superintendent, in turn, admires the president, and is proud of his employes, while all the foremen and employes have a good word for the management, take great interest in their work, and, what is still better, the public boast of their transit facilities, and are in hearty sympathy with the management.

FRANCHISES AND BRIDGE TOLLS.

The franchises secured by the operating company through the principal streets of Covington, Newport and Dayton, are exclusive and perpetual, and what may be termed compensation for the use of streets on the south side of the Ohio is very moderate, but it is not so liberal in Cincinnati. In lieu of all license, paving and street repairs, except such as are incident to track repairs, the company makes an annual payment to the city of Covington of $2,600; to Newport the annual payment for the same purpose is $500; in Dayton, $200, and in Bellevue, $1 per car per year. For the privilege of operating through the streets in Cincinnati, a payment of 1¼ per cent. of the gross receipts from all the Newport system is required. Besides this, an annual car license of $4 per foot for inside measurement of each car is required in Cincinnati. The payment to Cincinnati authorities for operating the cars of the Covington system is $30 per car. Nothing is paid on the gross receipts to Cincinnati, for the cars of the Covington system. The tolls over the suspension bridge are eighteen cents per car per trip; over the Newport Bridge fifteen cents per trip. Between Newport and Covington the tolls over the lower bridge are half a cent per passenger, and those over the upper bridge are not yet adjusted.

EXTENSIONS AND PARKS.

The extensions are now being constructed, one to and beyond Ludlow, and the other, known as the Evergreen line, which will terminate at the Evergreen Cemetery. The construction of the former has been referred to above. The line runs from Covington through Ludlow in a direction parallel to the river, and over most of the route a good view is had of the river and Cincinnati. The line curves in and out among the highlands back of Ludlow, opening up a new residence territory through which streets have recently been graded, making the route a very attractive one both for new residents and pleasure traffic. Some of the hills along which the line passes are 400 ft. above low water mark in the river, and 800 ft. above sea level. The line terminates below Ludlow in what is termed the lagoon, about four miles distant from Fountain Square, in Cincinnati, where a very attractive pleasure resort is being provided. The lagoon, so termed, consists of a basin a short distance back of the Ohio, which embraces a tract of ninety acres, and receives the drainage of seven square miles of territory. A small stream passes through the basin, and during high water in the Ohio the basin is flooded. It is now proposed to convert this lagoon into a permanent lake, and for this purpose a dam is being constructed across the mouth of the creek. When finished it is proposed to stock the lake with game fish and provide drives both for vehicles and bicycles entirely around the shore. The numerous islands which will be formed, are to be connected by rustic bridges, and a fleet of electric launches will be provided. The natural forest on each side of the lake is to be converted into parks, and provided with pavilions. The dam is to be located near the mouth of the creek, and will be fifty-two feet in depth between the sloping banks; the top will be 500 ft. in length, the thickness at the base of the dam will be 220 ft., and it will taper to forty feet on the top, providing a roadway. The flood gate, consisting of a cast iron pipe, thirty-six inches in diameter, will be placed at the bottom of the dam with the upper end protected by a coffer dam. Both ends will be protected by screens to stop the entrance of fish from the river or the escape of the game fish. In the construction of the dam, Wakefield lap sheet piling in a ten foot puddle wall, will be provided. The surface will be furnished with two feet of gravel on which will be placed eighteen inches of rip-rap. The overflow channel will be lined with stone laid in cement, and will be 24×10 ft. and the outer slope for the same width paved. The location is a very delightful one, the region being surrounded by steep hills cut up by numerous gorges and dotted over by farm houses and suburban homes, so that it will form an attractive resort for people of Cincinnati and neighboring cities, and the new line will doubtless become one of the best paying lines of the entire system.

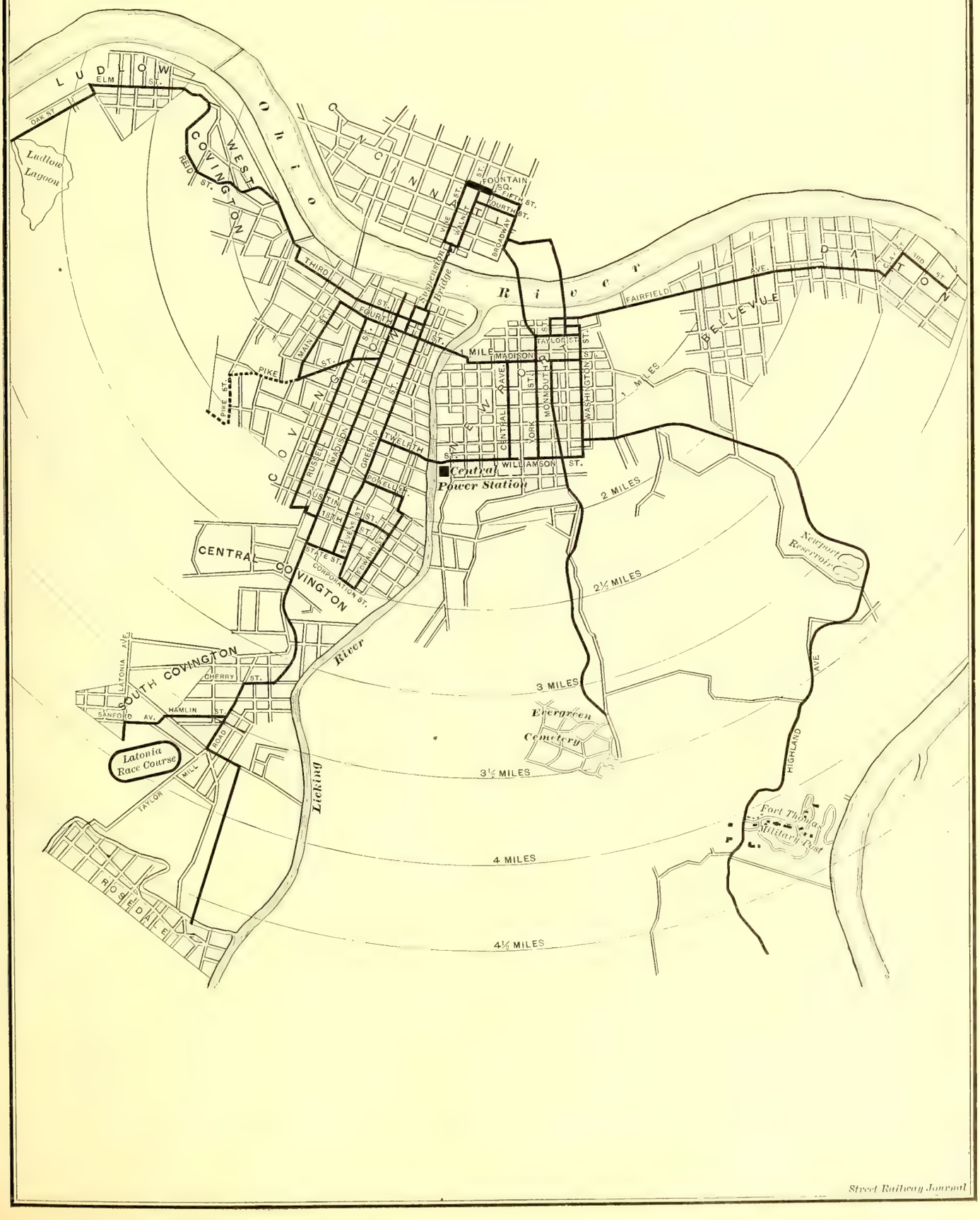
The Milldale line which runs to South Covington terminates at Latonia race track, four miles from Fountain Square. This line caters to a large pleasure traffic, as races and other amusements are provided at frequent intervals during the season at the tracks.

MAP SHOWING

THE LINES OF THE

CINCINNATI, NEWPORT AND COVINGTON

RAILWAY CO.



Another line running through an attractive country is the Fort Thomas line put into operation last month. Fort Thomas is a United States Government Post, embracing a tract of 100 acres, and provided with officers' quarters and barracks, sufficient for the accommodation of a large garrison, and which is located on the bluffs 450 ft. above and overlooking the Ohio River, giving a commanding view of the valley for many miles. The location is distant from the river at Covington about four miles in a southeasterly direction, the river making a big bend between the two points, and is about seven miles by rail from Fountain Square, Cincinnati.

The location is reached by the new electric line which ascends and traverses the crest of the intervening highlands, curving around bluffs and peaks, and giving here and there through clefts in the hills, glimpses of Cincinnati in the distance. The average grade in the ascent is 2½ per cent. and in a few places is 4 per cent. The proportion of tangent and curves, over the distance of a little more than four miles is, respectively, 12,877 and 9,283. The changing scenes of valley and hill, woods and cultivated farms, river and city views, cottages and mansions, together with the bracing atmosphere of the elevation (800 ft. above sea level), makes the trip one of the most enjoyable to be found in all the surrounding region.

Electric Railway Construction in Philadelphia.

The electric railway construction in Philadelphia is being rapidly pushed forward, and the greater part of the track work within the city limits has been completed. As mentioned in our January issue, the city streets occupied by tracks have been repaved by the street railway companies in connection with this new track construction, the performance of this work being part of the conditions under which the electric franchises were granted. The result is that Philadelphia is now one of the best paved cities in the country. Asphalt is used on a number of the streets, and Belgian block is employed on those where the traffic is the greatest.

The Philadelphia Traction Company has proceeded further in the equipment of its system than any of the other companies, and has now in operation the Thirteenth & Fifteenth Streets line, the Twelfth & Sixteenth Streets line, the Ridge Avenue line, the Seventeenth & Nineteenth Streets line, the Eighteenth & Twentieth Streets line, the Twenty-second & Allegheny Streets line, the Jefferson & Manchester Streets line, the York & Dauphin Streets line, and others within the city. Those to be started next by this company are the Darby Road line, the Chestnut & Walnut Streets line, the Lancaster Avenue line, the Haddington line, the Market Street extension of the cable line and the extension of the Ridge Avenue line.

The Electric Traction Company has put in operation its Tenth & Eleventh Streets line. The other companies have, as yet, not any cars in operation.

The track construction is most substantial throughout, and consists of heavy, nine inch girder rails, weighing about ninety pounds to the yard, mounted directly on ties, and employing tie rods, in most cases, every six feet. The manufacturers of the rail used are the Wm. Wharton Company, the Johnson Company and the Pennsylvania Steel Company.

Span wire construction, center, double bracket poles and side bracket poles are used, the former construction being the most common.

THE PHILADELPHIA TRACTION COMPANY.

The current for operating the city lines of the Philadelphia Traction Company is supplied from two stations very similar in appointments and capacity, and located, respectively, at the corner of 13th and Mt. Vernon Streets, and on Market Street, near 33d Street. The former station has been in operation since about January 1, 1894, and was fully described in our January issue. The Market Street station was put in operation May 20, and will have an ultimate capacity of 6,500 H. P.

The steam equipment will consist of four 500 H. P. Westinghouse direct connected engines and generators and three 1,500 H. P. Wetherill-Corliss engines, direct connected to Westinghouse generators of the same size. As shown in Fig. 1, three of the Westinghouse engines are now in place. The engine room, which is light and well ventilated, contains one twenty ton, electric traveling crane, manufactured by Wm. Sellers & Company, of Philadelphia, and one ten ton crane of the same manufacturers. These cranes have a span of eighty feet from center to center of the carrying wheels, and consist of two plate girders, each five feet two inches deep throughout their entire length. Heavy horizontal and diagonal cross braces are provided, and the girders are connected by plates at the ends, forming a combined girder of great lateral stiffness. On the inner side of each girder near the bottom is a T rail which is carried on the lower flange of the girders, and upon which the trolley wheels run. Diagonal struts on the outside, connecting the lower flange with the cross braces on top, provide for the eccentric load. As the hoisting trolley runs entirely within the bridge, the arrangement secures freedom from vibration and racking of the girders.

The bridge is provided with double flanged, steel tired wheels, twenty-eight and a half inches in diameter.

The switchboard, which is located near the southern wall of the building, is double decked like that in the Mount Vernon Street station, described in our January issue, and has a capacity for 150 feeders. The board is of the panel type and has an iron framework. The instruments are mounted on slate. The equipment includes Westinghouse and Weston appliances, lightning arresters, meters, etc., and Hill switches. The lower deck is set sufficiently in front of the upper to provide a commodious platform in front of the latter, from which the connections on the latter can easily be set. This platform is provided with a handsome brass railing, and a stairway is located at each end to provide access to it. The board is placed at some distance from the wall so that all terminals are easily accessible.

The boiler room is located directly in the rear of the engine room, from which it is separated by a fireproof brick wall, as in the Mount Vernon Street station. The characteristic feature of both these stations, it will be remembered, is the mechanical draft system which was installed by Westinghouse, Church, Kerr & Company, and has given excellent satisfaction in the present station. In this system the gases of combustion, after leaving the economizers, pass through Sturtevant exhaust fans, one being provided for each half of the boiler room. These exhaust directly into the stacks, which in consequence can be made very much shorter and of cheaper construction than if a natural draft were depended upon. The gases are so cooled through their passage through the economizers as not to burn the blades of the fans.

A slight difference in construction of the system is employed in this station from the Mount Vernon Street station, and each fan is directly driven by a separate engine of twenty-five horse power. The advantages claimed for this method, besides that of economy in construction from avoiding the use of the tall stack, are: Perfect control of combustion regardless of fuel or barometer, perfect smokelessness when combined with mechanical stoking, temperature of flue gases down to 200 degs., temperature of feedwater up to 300 degs., from which results a large net economy of fuel. It is estimated that the first cost of a mechanical draft, including the economizer, seldom exceeds, and with inexpensive foundations is always much less than, that of an equivalent brick chimney in which the flue gases are wasted at 400 to 600 degs.

The boiler equipment will consist ultimately of sixteen Babcock & Wilcox boilers of 265 H. P. each; six of these are new in type. The economizer used is of the Green type, and the engines will be run non-condensing. The pumps are of the Worthington type. The separators, which are shown in Fig. 2, are located over the boilers, are of the Stratton type and four in number, two being sixteen inches and two eighteen inches in size. The heaters are of the Goubert make and are located directly back of the pumps. Two are in place and two more are to be installed. This part of the equipment is similar to that at the 13th Street station of the company, and was

selected on account of the excellent results attained there in the generation of steam.

Coal and ash mechanical conveyors supplied by the Link-Belt Engineering Company will be used, and the general arrangement will be very similar to that at the Mount Vernon Street station, except that the coal bin will be located outside of the building. The water tanks will be located underneath the floor. The iron work was supplied by Levering & Garringues.

As will be remembered, a special feature of the Mount Vernon Street station was a completely equipped testing room, and a similar room is being fitted up in the Market Street station. The room is entirely protected from all external magnetic induction, by being completely lined with corrugated iron, and is supplied with all the necessary instruments for careful insulation tests of the underground feeders and other parts of the railway circuits. In the center is a table for supporting the instruments. This consists of a single slab of stone mounted on a solid brick pier carried down to solid rock, and entirely disconnected from the walls of the building, insuring entire freedom from vibration.

The feeders for all the Philadelphia lines within the city are underground. The cables adopted by the Philadelphia Traction Company were manufactured by the Standard Underground Cable Company, of Pittsburgh, and are placed in conduits principally of the National type manufactured by the National Conduit Manufacturing Company, of New York.

Views of the cars have been published in previous issues. The engineers of the Philadelphia Traction Company are: Electrical engineer, F. Uhlenhardt, Jr.; mechanical engineer, J. E. Grist.

THE ELECTRIC TRACTION COMPANY.

The Electric Traction Company, of Philadelphia, which includes the Lombard & South Streets Passenger Railway, Frankford & Southwark City Passenger Railway and leased lines, put its first line, the 10th and 11th Streets line into operation the latter part of April. The present power station of the company, which is the smallest which the company will build, is located on Hutchinson Street near the corner of Oxford Street. The company is now engaged in constructing a large power station on Delaware Avenue, between Beech and Laurel Streets, which will be put in operation early in the fall. This station will have a capacity of 6,000 H. P., and will be equipped with Porter-Allen engines, Babcock & Wilcox boilers and General Electric generators. Later in the year work will be started on additional power houses, and Engineer Kerr of the company states it is anticipated that within eighteen months there will be from 125 to 160 miles in operation.

The present station is of brick, with the southern wall of corrugated iron to permit of extensions in that direction. The engine room contains two Porter-Allen engines manufactured by the Southwark Foundry & Machine Company, with cylinder dimensions, 14½ × 24 ins. by 14 in. stroke, and one McIntosh & Seymour tandem compound engine, with cylinder dimensions, 16½ × 36 ins. by 17 in. stroke. Each of these is directly connected to a 250 K. W. General Electric generator, which operates at a speed of 200 revolutions per minute.

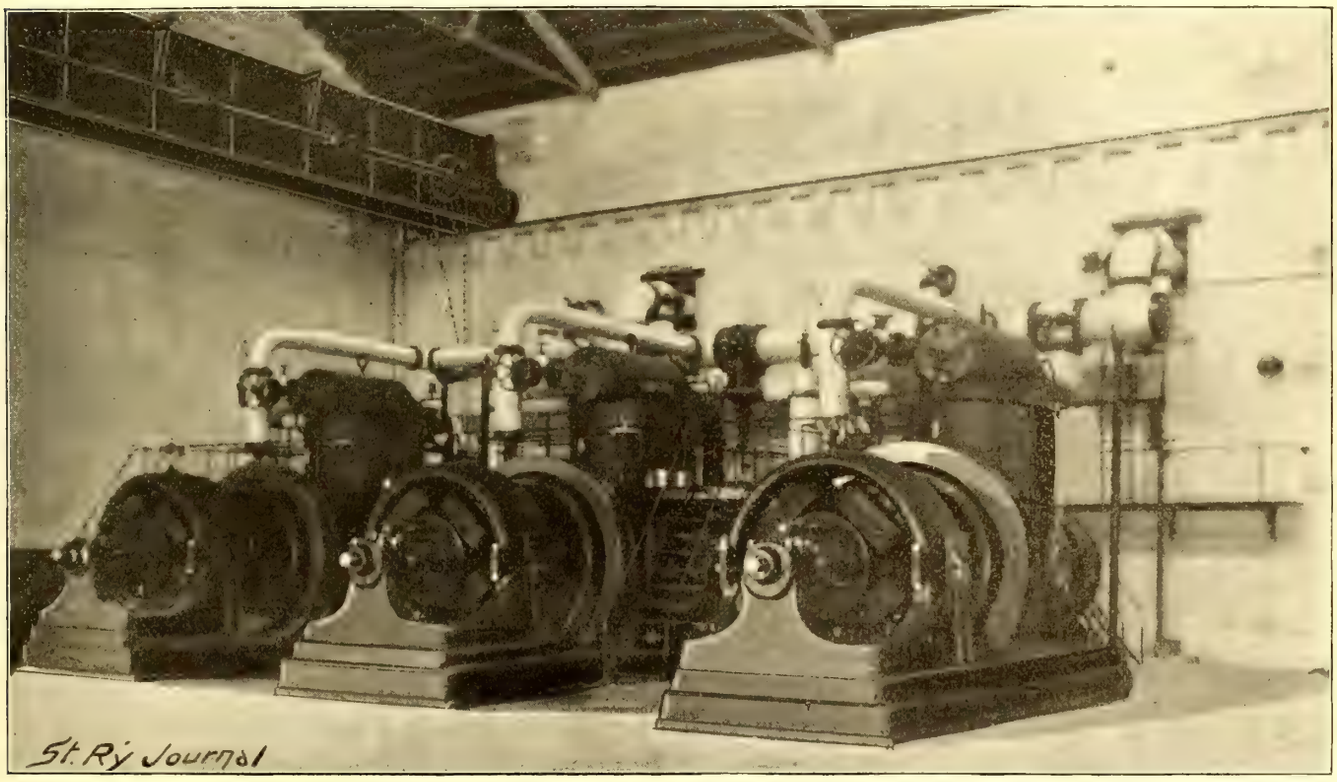


FIG. 1.—INTERIOR OF POWER STATION OF PHILADELPHIA TRACTION CO. ON MARKET STREET, SHOWING ENGINES IN PLACE.

The switchboard is located a short distance from the northern wall of the building and is supplied with the standard General Electric circuit breakers, large station ammeters and voltmeters, together with a number of special devices designed by Chief Engineer Edward B. Ives. It is of slate mounted on an iron frame, which is insulated from the concrete floor.

The boiler room contains four Babcock & Wilcox boilers of 250 H. P. each, set in two batteries of two each. The mechanical draft system of Westinghouse, Church, Kerr & Company is used, two Sturtevant exhaust fans operated by direct connected engines being employed. The stack is of iron, only sixty feet in height and six inches in diameter, the short stack being made possible by the employment of mechanical draft. The equipment of the boiler room also includes two 600 H. P. Goubert feedwater heaters, Stratton separators and Green economizers. Chapman valves are employed throughout, and all the larger valves are by-pass valves. All live steam piping is extra heavy, and all piping is so arranged that any engine can be run from any boiler and any boiler or engine can be cut out without interfering with the operation of the remainder of the plant. The power house

operates on 150 lbs. pressure, and is non-condensing.

The station is next to the track of the Philadelphia & Reading Railway, so that fuel is received directly from the cars, without city transportation. The boiler room is located below the level of the railway tracks, and coal is dumped directly into the boiler room from a siding.

As with the other Philadelphia roads, all the feeder system is underground, the feeders being laid in a special type of creosoted tubes, manufactured by the Wyckoff Company, of Williamsport, Pa.

These feeders lead, at the station, to a cable vault, made of brick arches and iron girders, and are absolutely fireproof. All the underground cables were furnished and put in place by the John A. Roebling's Sons Company, of Trenton, N. J. The overhead system, which is of the bracket type, contains a number of interesting features described in our January issue. The cars of the company were illustrated in our last number.

the rail, and which span the joint plate. Connections are made every block to the return feeders which are placed in subways.

The subways, which contain all the underground feeder cables, are of vitrified Akron clay, manufactured by H. B. Camp, of Cuyahoga Falls, O. The feeders are of 1,000,000 circular mills capacity each, and are now being drawn into the subways. They were all supplied by the Safety Insulated Wire & Cable Company, of New York, the contract given for these having been the largest which was ever awarded for work of this character by any street railway company.

The company has received fifty of its new cars, and these are being mounted with electrical equipment. 125 of these cars will use the General Electric 800 motor, and 125 will be equipped with the Sperry motor equipment. The cars are exceedingly tasteful in design, and are said to be as handsome as any ever built for regular passenger

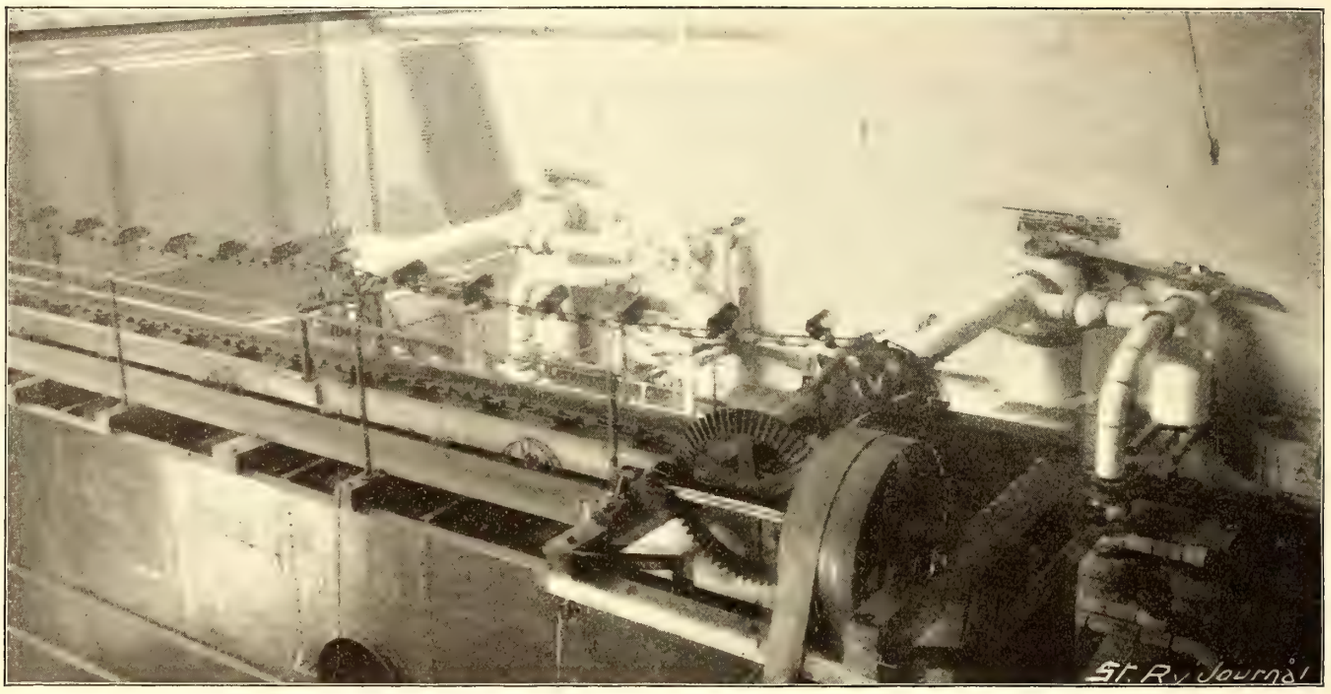


FIG. 2.—VIEW OF SEPARATORS—MARKET STREET POWER STATION OF PHILADELPHIA TRACTION CO.

THE PEOPLE'S TRACTION COMPANY.

The track construction of the People's Traction Company is being pushed forward rapidly,under the supervision of Chief Engineer L. H. McIntire, and the power station is nearing completion, so that it is expected that operations will be commenced about the last of June. A brief description of the work accomplished by the company is given below, and full details of the plant will be published after the road has commenced operations.

The power station is located between Delaware Avenue and Beech Street, near Fairmount Avenue, where will be one of the most handsome buildings for the purpose in the country. The engine plant will consist of Allis engines of the twin tandem compound, condensing type, of 2,000 H. P. each. Each will drive a 2,000 H. P. General Electric generator located between the pairs of cylinders, and whose armatures are mounted directly on the engine shaft. Two of these engines are now erected, and one of the armatures, which is being built on the shaft, will be finished June 1. The armature on the second engine will be completed about June 20. The boilers, which are of the Babcock & Wilcox type, and twelve in number, are erected, and will be under steam about June 15.

The overhead work is nearly completed, and the reconstruction of the horse car tracks will be finished by the middle of June.

The company is using a ninety-three pound, nine inch Johnson girder rail laid on 5 × 9 in., yellow pine ties, located two feet between centers. The joints are connected by copper bonds, with forged ends riveted into service. They were supplied by the St. Louis Car Company and the Lamokin Works. Star headlights, manufactured by the Star Headlight Company, of Rochester, will be used. The Sperry cars will use an electric brake attachment, which will be separate from the regular hand brake, and which operates a friction plate or disk against the inner surface of the car wheel.

THE HESTONVILLE, MANTUA & FAIRMOUNT PASSENGER RAILWAY COMPANY.

The work of electrical construction is going forward rapidly, under the supervision of Electrical Engineer A. Langstaff Johnston. The company is using the Johnson nine inch girder rail, mounted directly on the ties, of which thirteen are used to every thirty feet of rail. The rails are bonded with the Johnston bond, and cross bonded at every third joint. This bond, which is illustrated elsewhere in this issue, is the invention of the electrical engineer of the road, and has a number of valuable features, one of which is that it provides a contact surface at the rail, twelve times the cross section of the bond itself. The bond is manufactured by the Car Equipment Company, of Philadelphia.

The power station will be located on the Schuylkill River, near 26th Street, and will contain engines of the Providence Steam Engine Company's make. Babcock & Wilcox boilers will be used, and the current will be generated by General Electric generators. The details of the steam equipment have not yet been decided upon.

The Street Railway System of Terre Haute.

Terre Haute covers a rectangular area of about nine square miles, fronting the Wabash River. It is not divided by anything, except railways, and is quite compactly built. The city is a great center of production and distribution. It is located in the best corn and wheat region in the Central States, and its flour output is about thirty-five car loads per day. The city has 300 manufacturing establishments representing an investment of $10,000,000, employing 8,000 hands, and the largest distillery in the world is located there. The breeding of horses also forms a large industry, and during the coming year stakes and purses aggregating $85,000, the largest ever offered for a meeting in the history of light harness racing, have been guaranteed by the capitalists and business men of the city. The fact that the city is situated over a large bed of coal and that the coal is mined within the city limits, gives a good idea of the advantages from the point of cheap fuel under which the street railway lines of the city operate.

The business of the city is done chiefly near the center, and the lines of street railway, dividing the whole city as they do quite evenly, carry passengers to the business center of the city without transfer. The street railway system was operated by horses until January 1, 1891, when the two main lines of the system were equipped electrically, and since that period other lines have been rebuilt and extensions made, until the mileage at the present time is about double what it was then. The northern terminals of two lines reach Collett Park, an attractive pleasure resort. The southern terminus of the main line extends to the campus of Coates College for Women, and at the eastern terminus of the main line, in a beautiful valley two miles east of the city, lies the celebrated race track—the fastest in the world—which holds the world's record, both pacing and trotting. The street railway lines also pass the State Normal School, City High School, Rose Polytechnic Institute, and other principal public buildings. The miles of track owned by the company are sixteen and a half, covering twelve miles of street. Among the interesting features of the street railway system from an operating standpoint is the fact that the lines are laid throughout with T rails, as described below. The construction is giving very excellent satisfaction, and a paper describing the special methods employed and the successful results obtained is to be read by one of the officials of the company at the next meeting of the American Street Railway Association at Atlanta.

Power House.—The power station and car house of the company is located on North Wilson, 9th and Cherry Streets, and measures 150 × 142½ ft. Here are also a well equipped machine shop and car and motor repair shops. The building is of brick, wood and iron, and is provided with a slate roof over the engine room. The stack is 110 ft. in height, and twelve feet square at the base. The engine room, which measures 45 × 28 ft., contains two Westinghouse automatic, compound, non-condensing engines of 100 H. P. each, and one of 250 H. P. These are direct belted to two 100 H. P., bipolar United States, and one 250 H. P. Westinghouse multipolar generator. The belt in the latter case is a twenty-four inch perforated, of Schieren's make, while the smaller engines use fourteen inch belts. The switchboard is of marble, equipped with Weston and Westinghouse meters, Wirt lightning arrester, etc.

The room containing the boilers measures 54 × 48 ft. The steam generating equipment consists of three tubular boilers, fifty-four inches in diameter by sixteen feet in length, and containing each thirty-six four inch tubes. The furnaces are equipped with Roney stokers, operated by a Standard five horse power engine. One Stilwell-Bierce open heater, and a second heater of the Collis make, and of 1,000 H. P. capacity, form part of the equipment of the station. Roberts steam gauges and Deane duplex pumps are used. The stack is equipped with a Green fuel economizer, of 250 H. P., and each of the engines is



VIEWS ON THE LINE OF THE TERRE HAUTE STREET RAILWAY CO.

supplied with a Westinghouse steam loop. Both globe and gate valves are used, and the magnesia coverings are used on the piping.

The arrangements for handling the fuel are most complete, and manual labor is eliminated as much as possible. Coal is conveyed to the boilers from the bins by chutes, which feed direct into the furnaces. The ashes are dumped into steel side ash cars, which are drawn out by the regular electric cars, and unloaded at the suburban terminus of the lines.

Near to the power plant there is a drill well eighty-five feet deep, operated by a pump which, running at slow speed, can supply 4,000 gals. per hour. This pumps directly into a water tank of 12,000 gals. capacity, and in this way the company insures itself against any lack of water supply.

Next to the power station, as mentioned, are the car houses. These are three in number, measure 100 × 50 ft. each, and are of brick with stone trimmings. There are six tracks in each house, two of which are raised on pillars, so that the motors can be easily inspected after the day's run. The car houses are equipped with Hathaway transfer tables.

Track.—The track is laid with T rails, and the method of roadbed construction employed is extremely interesting, owing to the popular interest felt at the present time in T rail construction. The weight of the rail used is sixty pounds in the suburbs and seventy-two pounds in the center of the city. The form is the Shanghai, rolled by the Illinois Steel Company. Fig. 1 shows a section of track. As will be seen, the rails are mounted directly on ties 5 × 7 ins. × 7 ft., which are of white and burr oak. The paving is carried up flush with the outside of the rail, and on the inside a special brick block, moulded to suit the purpose, is employed. The space between the rails and the blocks on each side is filled with grouting, and the ties rest on a bed of concrete ten inches in depth. The space between the brick blocks within the tracks is laid for part of the distance along the road with brick, for another section with asphalt, and on a third division with gravel. All the crossings were supplied by Elliott, of East St. Louis, and the Paige Iron Works, of Chicago.

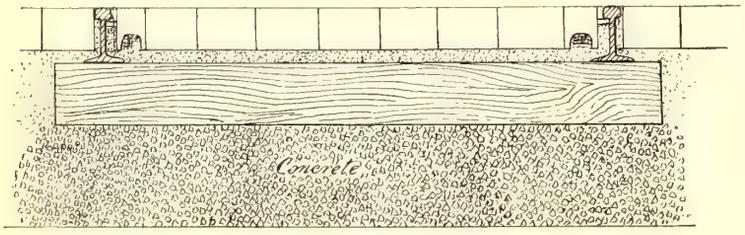


FIG. 1.—T RAIL TRACK CONSTRUCTION—TERRE HAUTE.

The rails are double bonded at the joints, and are connected to a supplementary iron and tinned copper wire. Seven-sixteenths of an inch iron bonds are used where the streets are unpaved, and No. 0000 copper bonds are employed in the paved streets.

Overhead Lines.—The overhead construction is carried on cedar poles thirty feet in length and measuring twelve inches in diameter at the base and seven inches at the top. The trolley wire used is a hard drawn No. 1 copper wire, and triple braided No. 0 Okonite is used for feed wires.

Rolling Stock.—The rolling stock consists of twenty-eight motors cars and twelve trail cars. The former were built by Stephenson, Pullman, the Centropolis Car & Manufacturing Company and other makers. Five of the trail cars were built by the Pullman Car Company, and the others were manufactured by the Terre Haute Street Railway Company. All are mounted on McGuire trucks, and are operated by Westinghouse No. 1, No. 3 and No 12 motors. This road was first to place in service the new Westinghouse No. 12 motors. These motors are giving good satisfaction, and the officials of the railway company speak loudly in their praise. The gears used are steel and cast iron, the latter being made by the railway company.

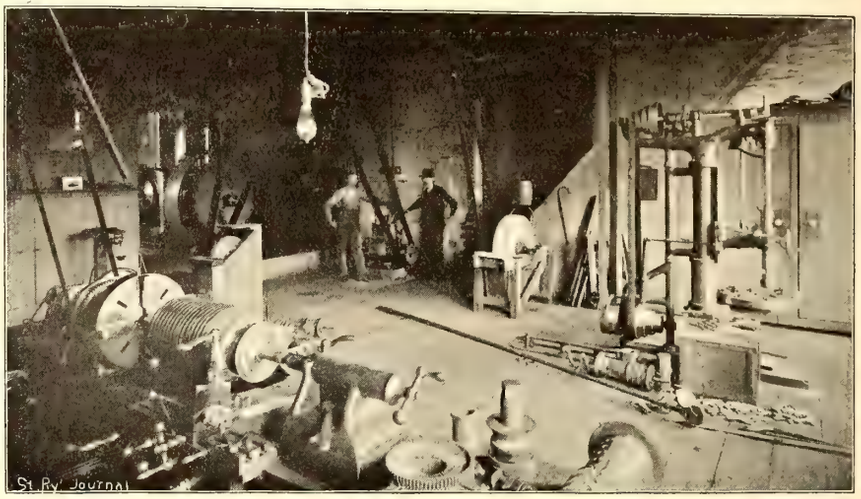


FIG. 2.—REPAIR SHOP—TERRE HAUTE STREET RAILWAY CO.

The cars are supplied with Lewis & Fowler ten inch, Meaker square, stationary and portable, and New Haven registers, and two types of electric heaters are used. The seats are covered with Wilton carpets, and the sand boxes are of the DeWitt type. The company purchases its wheels from the Terre Haute Car & Manufacturing Company, and fenders from the Crawford Manufacturing Company of Pittsburgh, Pa. The rolling stock of the company also includes a Lewis & Fowler electric sweeper,



FIG. 3.—AT THE RACE TRACK—TERRE HAUTE.

a reversible snow and track sweeper, built by the Fleming Manufacturing Company, of Ft. Wayne, Ind., and having scrapers at each end. Dorner & Dutton track scrapers are carried on cars.

Machine Shops.—The repair shops are well equipped, and as already mentioned, the company makes a considerable portion of its supplies, as well as doing a great deal in the repair line. The machinery in the repair shops includes one twenty inch lathe, manufactured by the Ohio Machine & Tool Works, a thirty inch drill press, emery wheel, etc. The armature winding room, which is located over the machine shop, is 28×28 ft. All armatures, fields, heaters, etc. are rewound here, and any other needed repairs to the electrical apparatus can be made by the company's own employes.

Adjoining the machine shop is a car repair shop 50×25 ft., where the cars be thoroughly rebuilt and repaired; and near this is a paint shop 25 ×24 ft., where the company's cars are repainted. The company also has a blacksmith shop 25×12 ft. Here all the iron work for the entire system is formed, and motor bearings are repoured.

Organization.—The Terre Haute Street Railway Company received an ordinance from the city March 20, 1866, and the first line, extending from the Union Depot to First Street, was put in operation the following year. The system has been gradually extended and the number of cars in operation increased until the present time. The ownership of stock was held chiefly by the original incorporators until 1889, when the road was sold to three resident citizens of Terre Haute, who changed the system from a horse to an electric road, making extensive improvements and extensions until 1893, when the road was sold to its present owners. During the ownership of the original street railway by these persons, they purchased the Vigo County Street Railway together with its extensive franchise, covering the county roads of Vigo County and consolidated this with the Terre Haute Street Railway.

Capital Stock and Funded Debt.—The amount of common stock authorized is $200,000 in shares of $50 each, all of which is issued and outstanding. There is no preferred stock. $500,000 of first mortgage bonds are authorized, issued and outstanding. These are coupon, dated July 1, 1892, bear interest at the rate of 6 per cent. per annum, and both principal and interest are payable in gold. The Illinois Trust & Savings Bank, of Chicago, is trustee of the mortgage.

Franchise, Officers, etc.—The original franchise, which allowed only the use of animal power, extended from date of adoption until 1898. This was amended in 1888 to permit the use of electric power, and the franchise was also extended until 1938. The franchise is practically exclusive, covering all the streets of the city. The number of passengers carried annually is now between 2,500,000 to 3,000,000. The officers are: President, Russell B. Harrison; treasurer, L. D. Thomas; superintendent and purchasing agent, M. F. Burke; assistant secretary and cashier, P. P. Thomas. The company has an Eastern office, at No. 1 Broadway, New York City.

New Suburban Line Near Philadelphia.

The Delaware County & Philadelphia Electric Railway, which was thrown open to the public service May 7, is of peculiar interest at the present time, as being typical now of the suburban and interurban electric rapid transit, attracting so much attention in all parts of the country.



SUBURBAN CAR—DELAWARE COUNTY & PHILADELPHIA ELECTRIC RAILWAY.

The part of the road now in operation is four miles in length, and extends from the Philadelphia line at Angora, through Fernwood, Lansdowne, Burmont, Clifton Heights and Primos, in Delaware County. The extension to Media and West Chester is now building, and within sixty days, it is expected, the cars will be running into Philadelphia as far as 38th Street, over the Electric Traction Company's Lombard and South Streets extension.

The road is a series of long and heavy grades, some of them 10 per cent., but the cars run at the rate of thirty miles an hour, and have no difficulty in climbing the hills. On opening day, one car, loaded with the officers, directors and guests, ran over the line, four miles, in nine minutes, including stops.

The electric apparatus is entirely of the General Electric Company's make, the motors being of the 800 type.

The rolling stock consists of handsome closed cars, thirty-five feet over all, built by the Lamokin Car Company, and the high speed and traction on heavy grades is the result of using McGuire adjustable traction trucks, equipped with the cushion steel tired wheels.

The officers are: James S. Austin, president; S. L. Kent, vice-president; W. H. Sayer, treasurer; Samuel Haige, secretary, and T. S. Hayward, superintendent.

THE INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS.*

By Edward E. Higgins.

SIXTH PAPER.

Class VI. Surface and Elevated Railways in American Cities of over 500,000 Inhabitants.

There are four cities in the United States having a population of over 500,000 inhabitants by the census of 1890, and another whose rich and populous suburban district brings it within this class. The total track mileage in these five population centers exceeds 1,800, of which about 70 per cent. is operated by horses, 13 per cent. by electricity, 7 per cent. by the cable system and 9 per cent. by steam (elevated). All of these cities are represented in the Table of Statistics.

The properties of this class are among the safest and most profitable in the entire range of capital investment. Defaults in interest charges are almost unknown, and dividends on stocks have been, with few exceptions, regular and satisfactory, in spite of extreme overcapitalization of costs. So well recognized are these facts that the securities are, as a rule, closely held by "insiders," and have not, at least until recently, formed an important feature in stock exchange transactions.

The primary causes of this unusual investment prosperity may be briefly set forth as follows:

1. The first experiments in street railroading were naturally made in the larger cities, and the results were then so problematical that capital could not be brought in upon short time franchises. Those granted, therefore, were, as a rule, practically perpetual (999 years), frequently exclusive upon the streets granted, and without serious burdens of special taxation, paving, etc.

2. The distances in these cities are so great as to necessitate patronage of all existing transportation facilities between the business and residential districts.

3. The crowded sidewalks and increasing street traffic in general make walking difficult and disagreeable, and short distance riding—the most profitable to the street railway companies—is steadily increasing.

4. The steady growth of urban population already severely taxes the street railway facilities, and the problem is, and always will be not how to obtain traffic, but how to take care of all that is offered.

5. The gross receipts per car mile and per mile of street are thus much heavier than in smaller cities, and, as the magnitude of the enterprises permits greater perfection in organization, the percentage of operating expenses is comparatively lower. Moreover, the properties of this class are able to obtain the very best managing ability in the market, this being an element of safety of no mean importance.

6. Finally, the local market for these securities is so broad, and the knowledge of all the conditions affecting gross and net revenue can be made so intimate, that the securities can be instantly converted into cash under pressure of necessity, and become, therefore, much safer to the ordinary investor than those which have a more limited market.

Cities of this class differ from each other in so many important respects that it will be impossible to draw any general conclusions applicable to all. Each case, therefore, must be taken up and discussed in detail in order to arrive at any just idea of its possibilities.

CASES NOS. 123 AND 127.

This is an important and extremely valuable street railway property, nearly all of which is under one management. It serves a large metropolitan area consisting of a densely populated city of 450,000 inhabitants, surrounded by a group of the richest and most beautiful suburban residential cities and towns to be found in the country and perhaps in the world. This outward expansion of the residential area tributary to the city itself is the result of many contributing causes, among the most important of which may be counted the existence of a magnificent system of steam and street railways reaching every part of the territory with constant and frequent service. The steam railways within this area carry about 60,000,000 passengers per annum, and the surface system, nearly all of which is now operated by electricity, carries about 150,000,000 passengers.

The extent and importance of this system is shown by its track and street mileage, 267.3 and 170 respectively. Its burden of funded debt is small, being but $16,300 per mile of track. Its capital stock represents the accumulated cash investments of many years, together with profits (based on earning power) realized in recent consolidations. The cost of duplicating the tangible assets as they exist to-day would probably be not less than 60 per cent., nor more than 75 per cent. of the total capital liabilities.

This system is serving about 4,000 inhabitants per mile of street with twenty-six car miles per capita. Extreme congestion in the heart of the city prevents a more frequent service in the suburbs. If this could be given the surface system would gain largely at the expense of the competing steam railway system. The passenger income was, in 1892, $37,000 per mile of street, $.354 per car mile and $9.35 per capita. The earnings of the last five years, during which the electric mileage has been rapidly increasing, has shown a somewhat greater ratio of increase than the normal, but hardly as great as might have been expected nor as great as that realized elsewhere under similar circumstances. This is partly because the system has always been overtaxed, especially in the congested district above referred to. The operating expenses are $.272 per car mile and 76.7 per cent. of the passenger income. This large percentage (which was reduced, however, to 73 per cent. in 1893) is partly due to imperfect early apparatus and construction, partly to the severe conditions of traffic, which are particularly destructive on track, and partly to special causes which need not be referred to here. The unusual earnings and expenses per car mile are due in part to the long cars (30 ft. to 40 ft.) which are in general use on the greater part of this system. The net income is equivalent to 8 per cent. on the entire capital liabilities, and regular 8 per cent. dividends are now being declared after meeting fixed charges.

Case No. 127, is an extension of Case No. 123 and serves a much larger area and population. Its main characteristics are not materially different from those of Case No. 123, and the two may be profitably studied together.

CASES NO. 124, 125 AND 126.

These systems all serve the same city, Case No. 124 being its entire surface system, Case No. 125 its elevated system, and Case No. 126 a combination of the two, forming its transportation system. This city (with a few unimportant suburban townships) forms a part of a much larger metropolitan area embracing nearly 4,000,000 people. Its manufacturing interests are extensive and its dock and warehouse properties give it some commercial importance, but its business interests are chiefly local and a large proportion of its population find daily employment outside its limits.

In 1890, the surface system was capitalized with moderation, its total capital liabilities being but $52,500 per mile of track. The fixed charges were small and the stocks of the various companies paid large dividends and were held at high figures for investment. Since 1890, control of the principal properties has passed into other hands, various amalgamations have been made, and elec-

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tricity is being introduced throughout. Both the capital stocks and the funded debts of the underlying companies have been largely increased, and dividends on certain of their stocks have been guaranteed by controlling "traction companies."

The surface system in 1892 consisted of 320 miles of track and 158 miles of road, and served a population of 5,100 per mile of road, with about 30 car miles per capita. The congestion of traffic in one portion of the city is about as serious here as in Case No. 123, and unless it can be remedied, the system cannot reach its full development and the competition of the elevated system must remain important.

The passenger income in 1892 was nearly $6,000,000, equivalent to $36,900 per mile of street, and $7.20 per capita. The operating expenses, with as yet comparatively small electric mileage, were 82.6 per cent. of the gross, and the net income was equivalent to nearly 6 per cent. on the capital liabilities.

With the complete conversion of this system to electric operation, with careful and conservative management and with reasonable freedom from mistakes of construction, it is probable that this complete city system will soon develop an earning power of perhaps $9,000,000 gross, and $3,000,000 net. Any increase in the net beyond the figure last named will be the result of unusual skill and ability in management.

The elevated system in this city (Case No. 125) shows a net income nearly as large as that of the surface system as compared with passenger receipts less than 50 per cent. those of the latter. This is, however, a return in 1892 of but 2.6 per cent. on the enormous capital liabilities of the elevated system, which are undoubtedly greatly in excess of the actual cash investment. The passenger income was equivalent to $109,400 per mile of street, $.68 per train mile and $3.31 per capita, while the operating expenses were 62.2 per cent of the gross and $.425 per train mile. The car mileage was probably about three and one-half times the train mileage.

The elevated system in this city has been seriously injured during the past year by the introduction of electricity on the surface lines in competition with its own. It is hardly probable, however, that this falling off in receipts will be permanent since the density of the population will inevitably increase, and all existing transportation systems will eventually be heavily taxed.

The combined transportation system of the city (Case No. 126) exhibits a passenger income of $8,528,891, equivalent to $46,600 per mile of street and $10.58 per capita while the net income was 25 per cent. of the gross.

CASE NO. 128.

This system serves a city of large area and of great manufacturing and commercial importance. The present city limits include a somewhat crowded business and residential "heart," surrounded by what were formerly suburban villages and townships which still retain their names and characteristics, although now a part of the larger corporation. The population of this city is nearly all self contained, few business men living outside the city limits. The suburban traffic on two of the important steam railroads entering the city is enormous. The street railway system has been operated until recently, almost entirely by horses, although with a small proportion of cable mileage, and the service has been poor and unsatisfactory. Within the last two years extensive changes of motive power have been commenced, and two years hence the entire city system, with the possible exception of the cable lines, will be operated by electricity.

The system consists of 371 miles of track and of 300 miles of street, its peculiarity being the large number of loop roads and single track mileage, the cars going up one street and returning by a parallel street one or two blocks away.

The gross income was, in 1892, $8,245,509, equivalent to $27,400 per mile of street, and $7.85 per capita, a low figure for the complete surface railway system of a city of this size. The operating expenses are low for what is chiefly a horse railway system, being but 68.8 per cent. of the passenger income. The net income is equivalent to 13.6 per cent. on capital liabilities of $56,600 per mile of track.

The complete equipment of this system by electricity will doubtless be followed by an unusually large increase in the passenger income which may easily reach a total of $12,000,000. Much of this increase will, of course, be "stolen" from the steam railway companies which now obtain most of the traffic between the outlying and the central districts. The operating expenses of the four or five controlling companies in this system should not exceed 65 per cent. of the passenger income, and a net income of $4,000,000 is reasonably to be expected.

CASE NO. 129.

This system serves an immense area tributary to the most highly contracted and densely populated business district in America. The problems of engineering and management in this city are of the most complex description. The principal street railway lines are operated chiefly by the cable system, and are taxed to their utmost capacity, each grip car drawing three or four trail cars at certain periods of the day. Here, again, we have an enormous suburban traffic carried on by a number of steam railway companies, the details of which are not obtainable.

The surface railway system consists of 428 miles of track laid through 214 miles of street, the entire mileage being practically double track. The large cable railway mileage is no doubt primarily responsible for capital liabilities of $105,000 per mile of track, and it is important to know that in this city, as in the others of this class, the funded debt is considerably less than the capital stock, and that the latter represents, in nearly every case, a large cash investment.

The passenger income obtained by the surface system of this city is $11,507,792, equivalent to $53,700 per mile of street, $.256 per car mile and $10.36 per capita. These figures do not seem large considering the size of the city, and the cause is doubtless to be found in the steam railway suburban service referred to above. The operating expenses are $.157 per car mile, and but 61.4 per cent. of the passenger income, a practical commentary on the advantages of the cable system on heavily patronized lines. The net income reaches the so far unprecedented figure of $4,572,661, equivalent to 10.2 per cent. on the capital liabilities.

A large proportion of the horse railway mileage in this city is being converted to electricity, and a moderate increase in gross and net may be expected for the future. Elevated railroad construction is also going on, one line being already in operation, but the conditions of traffic in this city do not justify the belief that the elevated railroad system will meet with as large a degree of financial success as has been found with Case No. 131, or even with Case No. 125.

CASES NOS. 130, 131, AND 132.

We have now to consider the surface, elevated and transportation systems of the largest city in the United States. By far the greater part of its population is situated on a long, narrow island about twelve miles in length by two in width. The remaining territory is a much less thickly settled district on the main land, of about equal area and possessing much the same proportions as to length and breadth. The commercial and business interests of the city are nearly all located in the lower half of the island, and the residential area covers the upper half. The entire tide of travel, therefore, moves up and down the island daily, a condition which ensures the development of maximum street railway traffic.

The elevated system (Case No. 131) carries nearly all of what may be called the "through traffic" between the residential and business areas, together with a not unimportant amount of local or short distance traffic. The surface system, with the exception of one or two through cable lines recently built, is given over almost entirely to local traffic, to the service of ladies for longer distances and to crosstown riding. Each of the two general systems has at present, therefore, a separate function, and

TABLE VI.—AMERICAN STREET RAILWAY SYSTEMS

PART I.—STATISTICS OF CAPITALIZATION.

See "Intrinsic Value of Street Railway Investments." Horse Railways are given in Roman figures.

Case Number	Miles of Track					Miles of Street	Capital Stock			Funded Debt			Capital Liabilities			Floating Debt		Case Number
	Horse	Electric	Cable	Miscel.	Total		Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Per Mile Track	Per Capita	Total	Memo.	
A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T
123	174.0	83.0	.....	....aa	257.0	163.3	10,113,350	39,300	14.90	4,034,442	15,600	5.90	14,147,792	54,900	20.90	1512,435	Net,	123
	99.3	*168.0*	.....	....aa	*267.3*	*170.0*	*15,752,200*	*59,200*	*23.20*	*4,365,000*	*16,300*	*6.40*	*20,117,200*	*75,300*	*29.70*	*959,178*	"	
124	277.6	11.3	.....	8.0	296.9	147.7	9,572,480	32,200	12.00	5,996,705	20,200	7.00	15,569,185	52,500	19.00	535,120	.....	124
	271.9	38.8	1.2	8.0	319.9	158.8	9,816,230	30,700	12.20	9,259,500	28,900	11.50	19,075,730	59,700	23.70	156,310	.....	
125	.....	.....	.....	*54.8*	*54.8*	*24.8*	*16,833,600*	*307,100*	*20.80*	*21,331,500*	*389,400*	*26.40*	*38,165,100*	*696,500*	*47.40*	s *552,637*	.....	125
	.....	.....	.....	*54.3*	*54.3*	*24.4*	*16,833,600*	*310,000*	*20.80*	*22,135,700*	*407 700*	*27.40*	*38,969,300*	*717,700*	*48.30*	s *470,613*	.....	
126	277.6	11.3	.....	62.8	351.7	172.5	26,406,080	75,000	32.80	27,328,205	77,600	33.90	53,734,285	152,600	66.60	s 17,517	.....	126
	271.9	38.8	1.2	62.3	374.2	183.2	26,649,830	71,100	33.00	31,395,200	84,000	39.00	58,045,030	155,100	72.00	s 314,303	.....	
127	262.2	121.0	.....	....aa	383.2	.....	11,300,500	29,500	12.30	5,154,942	13,400	5.60	16,455,442	43,100	17.90	1761,763	Net.	127
	159.4	*248.8*	.....	....aa	*408.2*	.....	*17,302.200*	*42,400*	*18.80*	*6,715,500*	*16,500*	*7.30*	*24,017,700*	*58,800*	*26.10*	*813,665*	"	
128	322.3	6.0	23.0	....dd	351.3	279.5	12,311,016	35,000	11.70	6,105,400	17,400	5.80	18,416,416	52,500	17.50	.....	.....	128
	331.3	6.0	34.0	....dd	371.3	300.6	14.914,895	40,200	14.20	6,131,360	16,500	5.80	21,046,255	56,600	20.00	.....	.....	
129	313.6	.....	69.8	....aa	383.4	192.2	22,750,000	59,500	20.50	17,689,500	46.200	15.90	40,439,500	105,700	36.40	.....	.....	129
ff	315.1	26.6	86.0	....aa	427.7	214.4	24,750,000	57,900	22.30	19,959,500	46,700	18.00	44,709,500	104,600	40.30	.....	.....	ff
130	251.4	.....	11.5	.....	262.9	132.5	21,391,800	81,400	14.10	a 21962000	83,500	14.50	43,353,800	164,900	28.60	s 511,870	.....	130
gg	264.8	.....	11.5	.....	276.3	145.1	24,230,000	87,700	16.00	23,707,000	85,800	15.70	47,937,000	173,500	31.70	s 644,434	.....	gg
131	.....	.....	.....	*94.2*	*94.2*	*35.6*	*26,632,045*	*282,700*	*17.60*	*29,318,000*	*311,300*	*19.40*	*55,950,045*	*593,900*	*36.90*	s 1502633	.....	131
	.....	.....	.....	*100.2*	*100.2*	*36.2*	*29,991,180*	*299,300*	*19.80*	*34,493,000*	*344,200*	*22.80*	*64,484,180*	*643,500*	*42.60*	s *6726588*	.....	
132	251.4	.....	11.5	94.2	357.1	168.1	48,023,845	134,500	31.70	51,280,000	143,600	33.80	99,303,845	278,100	65.50	s 2014503	.....	132
	264.8	.....	11.5	100.2	376.5	181.3	54,221,180	144,000	35.80	58,200,000	154,600	38.40	112421180	298,600	74.20	s 7371022	.....	

INTERURBAN STREET RAILWAYS IN AMERICA.

133	.....	*6.4*	.....	.....	*6.4*	*6.0*	*60,000*	*9,400*	*3.50*	*50,000*	*7,800*	*2.90*	*110,000*	*17,200*	*6.50*	2,487	Net.	133
	.....	*6.9*	.....	.....	*6.9*	*6.5*	*60,000*	*8,700*	*3.50*	*50,000*	*7,300*	*2.90*	*110,000*	*15,900*	*6.50*	*20,981*	"	
134	14.0	.....	.....	....	z 14.0	z 14.0	100,000	7,100	3.30	25,000	1,800	.80	125,000	8,900	4.20	34,720	Net.	134
	14.0	.....	.....	.....	z 14.0	z 14.0	97,800	7,000	3.30	85,000	6,100	2.80	182,800	13,100	6.10	8,179	"	
135	31.3	7.0	.....	.....	38.3	36.6	245,000	6,400	7.90	47,000	1,200	1.50	292,000	7,600	9.40	265,887	Net.	135
	14.9	*26.2*	.....	.....	*41.2*	*39.0*	*230,000*	*5,600*	*7.40*	*475,000*	*11,500*	*15.30*	*705,000*	*17,100*	*22.70*	*150,943*	"	
136	5.8	.....	.....	.....	5.8	5.5	100,000	17,200	2.30	.....	.....	.....	100,000	17,200	2.30	81,746	Net.	136
	.....	*6.1*	.....	.....	*6.1*	*5.5*	*135,000*	*22,100*	*3.10*	*100,000*	*16,400*	2.30	*235,000*	*38,500*	*5.50*	s *5,010*	"	
137	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	137
	.....	*22.2*	.....	.....	*22.2*	*17.3*	*1,000,000*	*45,000*	*20.00*	*700,000*	*31,500*	*14.00*	*1,700,000*	*76,600*	*34.00*	.....	.....	
138	28.2	9.7	.....	.....	37.9	.....	250,000	6,600	3.70	475,500	12,500	7.00	725,500	19,100	10.70	111,256	Net.	138
	19.2	*24.0*	.....	.....	*43.2*	.....	*300,000*	*6,900*	*4.40*	*1,300,500*	*30,100*	*19.10*	*1,600,500*	*37,000*	*23.50*	s *276,072*	"	
139	24.8	.....	.....	.....	24.8	16.0	224,000	9,000	2.40	.....	.....	.....	224,000	9,000	2.40	10,403	.....	139
	15.0	*17.0*	.....	.....	*32.0*	*22.1*	*324,000*	*10,300*	*3.40*	*350,000*	*10,900*	*3.70*	*674,000*	*21,100*	*7.20*	*116,534*	.....	
140	.....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	140
	.....	*46.0*	.....	.....	*46.0*	*41.5*	*5,100,000*	*110,900*	*53.70*	*1,865,000*	*40,700*	*19.70*	*6,965,000*	*151,500*	*73.40*	.....	.....	
141	56.1	7.0	.....	.....	63.1	52.6	469,000	7,400	3.80	47,000	740	.40	516,000	8,100	4.10	276,290	.....	141
	29.9	*43.2*	.....	.....	*73.1*	*61.1*	*554,000*	*7,600*	*4.40*	*825,000*	*11,200*	*6.60*	*1,379,000*	*18,900*	*11.00*	*267,477*	.....	
142	60.0	28.3	.....	.....	88.3	.....	937,150	10,600	5.40	645,000	7,300	3.70	1,582,150	17,900	9.10	138,072	Net.	142
	40.9	*56.8*	.....	.....	*97.7*	.....	*1,250,000*	*12,800*	*7.20*	*1,050,000*	*10,700*	*6.00*	*2,300,000*	*23,500*	*13.20*	*130,559*	"	
143	42.0	15.5	.....	.....	57.5	36.7	1,099,700	19,100	5.60	1,252,155	21,700	6.40	2,351,855	40,900	11.90	s 12,526	Net.	143
	3.8	*56.5*	.....	.....	*60.3*	*38.5*	*2,080,000*	*34,500*	*10.60*	*1,563,348*	*25,900*	*8.00*	*3,643,348*	*60,400*	*18.50*	*70,465*	"	
144	64.7	.....	3.0	.....	67.7	54.6	2,000,000	29,500	9.20	.....	.....	.....	2,000,000	29,500	9.20	55,700	.....	144
	73.3	.....	3.4	.....	76.7	59.6	2,500,000	32,600	11.50	.....	.....	.....	2,500,000	32,600	11.50	226,787	.....	
145	88.2	38.0	.....	.....	126.2	.....	1,187,150	9,400	4.90	1,120,500	8,900	4.60	2,307,650	18,400	9.60	249,328	Net.	145
	60.1	*80.8*	.....	.....	*140.9*	.....	*1,550,000*	*11,000*	*6.40*	*2,350,500*	*16,700*	*9.70*	*3,900,500*	*27,700*	*16.10*	s *145,513*	"	

aa. The street railway mileage is closely approximate, but not exact. dd. The track and street mileage are closely approximate, but not exact. ff. This case covers nearly the entire street railway system of the city, but certain small and unimportant operating roads are omitted in 1892. gg. One surface railway included in this system is the horse railway division of an extensive steam railway, and the capital liabilities properly chargeable to the city road cannot be ascertained. The capital stock and funded debt are here assumed to be $100,000 per mile of track each, figures which, for various reasons, seem to be a fair representation of the value of this property as compared with the capitalization of the other systems in the city. s. Current assets exceed current liabilities. z. Approximate.

SERVING OVER 500,000 POPULATION.

PART II.—STATISTICS OF OPERATION.

Electric, Cable and Steam Railways are given in italics.

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Case Number	Population Served	Area	Population Per Mile Street	Population Per Square Mile	Year Ending	Car Mileage Total	Car Mileage Per Capita	Passenger Income Total	Passenger Income Per Mile Street	Passenger Income Per Car Mile	Passenger Income Per Capita	Operating Expenses Total	Operating Expenses Per Car Mile	Operating Expenses % Passenger Income	Net Earnings Total	Net Earnings Per Car Mile	Net Earnings % Passenger Income	Net Earnings % Cap. Liab.	Case Number
a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s	t	u
123	678,000	....	4,200	.....	9-30-1890	17,818,475	26.3	5 727,495	35,200	.322	8.45	4493,994	.252	78.3	1322,823	.074	23.2	9.4	123
	678,000	....	*4,000*	.....	*9-30-1892*	*17,880,715*	*26.4*	*6,341,853*	*37,300*	*.354*	*9.35*	*4864,049*	*.272*	*76.7*	*1547,164*	*.087*	*24.4*	*7.7*	
124	806,000	....	5,400	.....	6-30-1890	21,416,916	26.6	5 097,978	34,500	.238	6.33	4 349,857	.203	85.3	834,007	.039	16.3	5.3	124
	806,000	....	5,100	.....	6-30-1892	.....	.....	5 861,202	36,900	....	7.27	4 839,352	....	82.6	1 115,301	....	19.1	5.9	
125	*806.000*	....	*32,500*	.....	*6-30-1890*	*b 13,670,486*	*24.2*	*2 250,371*	*90,700*	*.164*	*2.79*	*1 492,555*	*.109*	*66.2*	*524,938*	*.038*	*23.3*	*1.4*	125
	806,000	....	*33,000*	.....	*6-30-1892*	*b 13,708,429*	*24.3*	*2 667,689*	*109,400*	*.195*	*3.31*	*1 658,752*	*.121*	*62.2*	*1 021,586*	*.074*	*38.2*	*2.6*	
126	806,000	....	4,700	.....	6-30-1890	35,087,402	50.7	7 348,349	42,500	.209	9.12	5 842,412	.166	79.5	1 358,945	.039	18.5	2.5	126
	806,000	....	4,400	.....	6-30-1892	cc.....	.....	8 528,891	46,600	....	10.58	6 498,104	....	76.2	2 136,887	....	25.1	3.7	
127	920,000	....	.....	.....	9-30-1890	20,793,214	22.6	6 657,961	.....	.320	7.24	5 257,226	.253	78.9	1 475,111	.071	22.2	9.0	127
	920,000	....	.....	.....	*9-30-1892*	*21,424,661*	*23.3*	*7 419,481*	.....	*.347*	*8.06*	*5 747,169*	*.269*	*77.5*	*1 727,177*	*.081*	*23.3*	*7.2*	
128	1,047,000	....	3,800	.....	6-30-1890	.....	.....	7500,278	26,800	....	7.14	4984,237	ee...	66.4	2756,462	....	36.8	15.0	128
	1,047,000	....	3,500	.....	6-30-1892	.....	.....	8245,509	27,400	....	7.85	5679,759	ee...	68.8	2861,269	....	34.7	13.6	
129	1,110,000	....	5,800	.....	n 1890	36,105,755	32.5	8 891,010	46,300	.247	8.00	5 618,459	.156	63.2	3 315,322	.092	37.3	8.2	129
ff	1,110,000	....	5,200	.....	n 1892	44,950,642	40.5	11507792	53,700	.256	10.36	7 059,695	.157	61.4	4 572,661	.102	39.7	10.2	ff
130	1,515,000	....	11,400	.....	6-30-1890	36,366,645	24.0	10933145	82,000	.300	7.17	8 227,996	.226	75.5	2 763,481	.076	25.3	6.4	130
	1,515,000	....	10,500	.....	6-30-1892	.....	.....	11684454	80,700	....	7.70	9036,244	....	77.3	3 807,820	....	32.5	8.0	
131	*1,515,000*	....	*4,300*	.....	*6-30-1890*	*38,417,600*	*25.3*	*9498743*	*266,800*	*.242*	*6.25*	*5482828*	*.138*	*57.7*	*4 117,928*	*.107*	*43.3*	*7.4*	131
	1,515,000	....	*4,200*	.....	*6-30-1892*	*45,534,350*	*29.9*	*10684979*	*295,300*	*.237*	*7.05*	*5923,213*	*.130*	*55.3*	*4913,111*	*.108*	*45.9*	*7.6*	
132	1,515,000	....	9,000	.....	6-30-1890	74,784,245	49.2	20431888	121,600	.270	13.42	13710824	.180	67.2	6 881,409	.092	33.7	6.9	132
	1,515,000	....	8,400	.....	6-30-1892	hh.....	.....	22369433	123,400	....	14.74	14959457	....	67.0	8 720,931	....	38.9	7.8	

INTERURBAN STREET RAILWAYS IN AMERICA.

133	*17,000*	....	*2,800*	.....	*9-30-1890*	*92,400*	*5.4*	*23,085*	*3,800*	*.250*	*1.36*	*12,967*	*.141*	*56.3*	*10,249*	*.110*	*44.2*	*9.3*	133
	17,000	....	*2,600*	.....	*9-30-1892*	*185,784*	*10.9*	*38,340*	*5,900*	*.206*	*2.25*	*30,494*	*.164*	*79.6*	*8,194*	*.044*	*21.4*	*7.4*	
134	30,000	....	2,100	.....	9-30-1890	.....	.....	21,310	1,500	....	.71	16,478	....	77.4	5,256	....	24.7	4.2	134
	30,000	....	2,100	.....	9-30-1893	.....	.....	28,199	2,000	....	.94	20,823	....	73.8	8,206	....	29.1	4.5	
135	31,000	....	800	.....	9-30-1890	317,797	10.3	99,089	2,700	.311	3.20	71,689	.225	72.3	30,138	.095	30.4	10.3	135
	31,000	....	*800*	.....	*9-30-1892*	*399,192*	*12.9*	*114,482*	*2,900*	*.286*	*3.70*	*84,038*	*.210*	*73.7*	*33,462*	*.084*	*29.3*	*4.8*	
136	43,000	....	7,800	.....	9-30-1890	49,418	1.2	16,685	3,000	.337	.39	14,309	.289	85.6	2,611	.053	15.6	2.6	136
	43,000	....	*7,800*	.....	*9-30-1892*	*228,857*	*5.3*	*61,496*	*11,200*	*.269*	*1.43*	*40,226*	*.176*	*65.4*	*22,641*	*.099*	*36.7*	*9.6*	
137	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	137
	50,000	....	*2,900*	.....	*6-30-1893*	.....	.....	*166,486*	*9,600*	....	*3.32*	*107,796*	....	*65.1*	*58,690*	....	*35.4*	*3.5*	
138	68,000	....	.....	.....	9-30-1890	630,176	9.3	228,504	.....	.363	3.36	176,110	.279	76.8	55,115	.088	24.1	7.6	138
	68,000	....	.....	.....	*9-30-1892*	*782,910*	*11.5*	*259,625*	.....	*.332*	*3.82*	*200,746*	*.257*	*77.3*	*60,856*	*.078*	*23.4*	*3.8*	
139	94,000	....	5,900	.....	9-30-1890	460,291	4.9	136,053	8,500	.296	1.45	111,431	.241	81.6	26,676	.058	19.6	11.9	139
	94,000	....	*4,300*	.....	*9-30-1892*	*662,993*	*7.1*	*189,688*	*8,600*	*.286*	*2.02*	*140,165*	*.211*	*73.7*	*51,465*	*.078*	*27.1*	*7.6*	
140	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	140
	95,000	....	*2,300*	.....	*12-31-1893*	.....	.....	*310,927*	*7,500*	....	*3.27*	*149,240*	...	*47.9*	*162,950*	....	*52.4*	*2.3*	
141	125,000	....	2,400	.....	9-30-1890	778,088	6.2	235,142	4,500	.300	1.88	183,120	.235	77.9	56,814	.073	23.7	11.0	141
	125,000	....	*2,000*	.....	*9-30-1892*	*1,062,185*	*8.5*	*304,170*	*4,900*	*.287*	*2.43*	*224,203*	*.211*	*73.6*	*84,927*	*.080*	*27.9*	*6.1*	
142	174,000	....	.....	.....	9-30-1890	2,344,563	13.5	701,962	.....	.300	4.03	587,122	.251	83.6	97,173	.045	13.8	6.2	142
	174,000	....	.....	.....	*9-30-1892*	*2,761,036*	*15.9*	*818,003*	.....	*.296*	*4.70*	*682,374*	*.247*	*83.4*	*119,157*	*.043*	*14.5*	*5.2*	
143	197,000	....	5,400	.....	6-30-1890	4,924,128	25.0	621,265	16,900	.126	3.15	519,504	.106	83.7	117,368	.024	18.8	5.0	143
	197,000	....	*5,100*	.....	*6-30-1892*	.....	.....	*770,079*	*20,000*	....	*3.90*	*475,058*	....	*61.7*	*287,219*	....	*37.2*	*7.9*	
144	217,000	....	4,000	.....	6-30-1890	.....	.....	944,939	17,300	....	4.35	768,213	....	81.4	190,159	....	20.1	9.5	144
	217,000	....	3,600	.....	6-30-1892	.....	.....	1141,641	19,120	....	5.25	1034,275	....	91.2	125,030	....	11.0	5.0	
145	242,000	....	.....	.....	9-30-1890	2,974,739	12.3	930,466	.....	.313	3.84	763,232	.257	82.0	152,288	.051	16.2	6 6	145
	242,000	....	.....	.....	*9-30-1892*	*3,543,946*	*14.6*	*1077,628*	.....	*.305*	*4.46*	*883,120*	*.250*	*81.8*	*180,013*	*.051*	*16.7*	*4.0*	

bb. Estimated on basis of 3.5 car miles per train mile. cc. Including estimated car mileage elevated railway system. (See bb.) ff. This case covers nearly the entire street railway system of the city, but certain small and unimportant operating roads are omitted in 1892. hh. Estimated on basis of 5 car miles per train mile. The train mileage for a suburban division of the elevated system is not included in 1890, but is not large. n. Fiscal years of the several roads end at different dates. ee. Operating expenses cannot be checked as they are not given in detail.

although the surface railways contemplate the adoption of some motive power other than horses in the immediate future, it is probable that the business of the elevated system cannot be seriously injured by surface railway competition, owing to crowded streets and necessarily slow speed.

The elevated system consists of 100 miles of track built through 36 miles of street, and is capitalized at $64,484,180, equivalent to $643,500 per mile of track, an enormous overcapitalization both of original and present value of tangible assets. It is giving a service of over 9,000,000 train miles and 45,000,000 car miles per annum. Its gross passenger receipts amount to $10,684,979, equivalent to $295,300 per mile of street, $.237 per car mile and $7.05 per capita. The operating expenses are $ 13 per car mile, and 55.3 per cent. of the passenger income, figures which are gradually being reduced in the expectation of reaching an operating percentage of 50. The net income is $4,913,111, equivalent to 7.6 per cent. upon the capital liabilities.

Severe, and largely unwarranted criticism of the management of this elevated system is locally fashionable. As a matter of fact its organization and management are wonderfully perfect, and the admiration of "those who know." The pressure upon the system in early morning and late at night cannot possible be taken care of with existing terminal facilities, and the overcrowding of trains is an almost necessary evil.

The surface system is controlled by seven independent companies which have no general transfer arrangements for interchange of passengers. It consists of 276 miles of track laid through 145 miles of street, and serves a population of about 10,500 per mile of street with approximately 25 car miles per capita. The capitalization is based purely on earning power and has little or no relation to cost of construction, the funded debt alone being $85,800 per mile of track and the total capital liabilities $173,500.

The gross income is a little larger than that of the elevated system, namely, $11,684,454, equivalent to $80,700 per mile of street, about $.30 per car mile and $7.70 per capita. The operating expenses are about 77 per cent. of the passenger income, and the net is $3,807,820, equivalent to 8 per cent on the capital liabilities.

With the introduction of the cable system on the principal through routes of this city, a large increase in gross income may be expected, together with a decrease in operating expenses, which will make a net income more than double that of the present quite a thing to be expected.

The entire transportation system of this city (case No. 132), shows a passenger income of $22,369,433, equivalent to $123,400 per mile of street, about $.27 per car mile and $14.74 per capita; with a net income of $8,720,931, equivalent to 7.8 per cent. on capital liabilities of nearly $300,000 per mile of track.

Class VII. Interurban Electric Railways in America.

With the exhaustion of the supply of large and small cities and towns available for street railway operations has come the promotion of interurban electric railways. Attempts in this direction have been comparatively recent and have met with determined opposition from the steam railway companies, who have justly feared serious injury to their business from electric railway competition, and it is hardly possible at present to speak with any certainty as to results or probabilities in this comparatively unknown field.

I have placed in the Table of Statistics thirteen cases, nine of which may be considered as interurban systems proper, three are systems which connect a series of towns tributary to a more important city, and one is a combination of two large cities seven miles apart. These cases can hardly be considered typical or other than isolated examples of results which have been partially worked out in this field, but they are interesting as throwing some light on possibilities.

Case No. 133 is a six mile single track road serving three small manufacturing towns. Its gross receipts amount to $2.25 per capita, a figure somewhat larger than is usual in single cities of but 17,000 inhabitants. Its net income amounts to 7.4 per cent. on capital liabilities of $15,900 per mile of track.

Case No. 134 is a fourteen mile horse railway serving two unimportant cities located in a farming and lumbering country. This road is earning but $.94 per capita. The traffic is derived only from travel between the two cities, with little or no local business. The road is operated with economy and its net income is equal to 4.5 per cent. on capital liabilities of $13,100 per mile of track.

Case No. 135 serves six townships, the largest of which has 14,000 inhabitants and the smallest three less than 1,700 each. The territory traversed is interesting and beautiful, and summer pleasure riding is an important element in traffic. The difference between this system and case No. 134, just described, is remarkable and shows at a glance how impossible it is to generalize these interurban roads.

Case No. 136 serves three villages within the limits of a single city and two townships several miles away—all rich and beautiful residential territory in the vicinity of a large city. It can hardly be said that this system serves a population of 43,000, since it does not reach the greater part of the principal city and has little or no local traffic. Its gross receipts per capita are not large, but it is well managed and its net income has gradually risen until it is now nearly 10 per cent. on capital liabilities of $38,500 per mile of track.

Case No. 137 is an excellent example of an interurban system. The largest city of the group contains about 25,000 inhabitants and is a county town. Two cars give an excellent but not well patronized local service within this town. A line runs thence a distance of about six miles, through a scattered population of about 1,000, to a town of about 4,000 inhabitants. Another line runs seven miles away, through a scattered population of about 1,500, to a group of three important manufacturing towns having an aggregate population of about 20,000. The total track mileage is 22. A fifteen minute service is given on all lines and the system earned in 1893 $166,486, equivalent to $9,600 per mile of street and $3.32 per capita, a decidedly satisfactory result. The operating expenses in the second year of operation were 65.1 per cent., and the net was equivalent to 3.5 per cent. on heavy capital liabilities of $76,600 per mile of track.

The largest city of Case No. 138 has about 31,000 inhabitants and is a dull, sleepy coast town with large fishing interests, but of little manufacturing importance. Connected with this by the street railway system under discussion are six townships, two of these having a population of about 10,000 each, two of about 8,000 each and two of about 1,000 each. The whole territory covered is an attractive summer pleasuring ground, and that there is a large amount of regular and summer traffic is shown by the passenger income, which is $259,625, equivalent to $3.82 per capita. The operating expenses, with about half the road under electricity, were 77 per cent. in 1892, and the net was equivalent to about 4 per cent. on capital liabilities which represent twice the cost of building such a property *de novo*.

Case No. 139 serves seven towns of from 2,000 to 6,000 inhabitants, and one city of 27,000 inhabitants, all more or less tributary to an important manufacturing city of 45,000 inhabitants. The local traffic in the two larger cities is doubtless of some value, but the passenger earnings amount to but $189,688, equivalent to $8,600 per mile of street, $.286 per car mile and $2.62 per capita. The net is equivalent to about 8 per cent. on moderate capital liabilities of $21,100 per mile of track.

Case No. 140 is another excellent example of a true interurban system. It serves a scattered mining population which earns high wages, spends money freely, is fond of riding and makes it a point to "go up to town" every evening. As a consequence, the cars operated are earning about $50 per diem each, and are crowded at certain hours of the day. The principal city has about 40,000 inhabitants, and in the valleys through which this system extends over twenty-eight towns and mining settlements of from 200 to 10,000 inhabitants are found. The system is

heavily overcapitalized, the funded debt alone representing more than twice the actual cash cost of construction and equipment, but the net income in 1893 was apparently sufficient to meet fixed charges and leave about 1 per cent. for the stock. The low ratio of operating expenses (47.9) is due in part to the cheapness of fuel, but, although the roadbed is of T rail throughout, and its repair and depreciation account is therefore a minimum, it is probable that the ratio of operating expenses will gradually increase in years to come.

Case No. 141 is a combination of Cases Nos. 135 and 139, and consists of three street railway properties serving fourteen cities and towns through the combined farming and manufacturing district previously described.

Case No. 142 serves a rich suburban residence and manufacturing district tributary to, and (by this system) connected with a large and important city. One of the most important features is a heavy business traffic between the metropolis and an adjacent city of 25,000 inhabitants. Six or eight miles farther away the system reaches a city of nearly 60,000 inhabitants, which is the center of a network of lines radiating to a number of more or less important residential towns and villages, nearly all served by the system under discussion. Still farther away from the metropolis a connection is made with the system described in Case No. 138, and the combination of the two, forming the most important interurban system represented in the table, is shown in Case No. 145.

Case No. 143 is a combination of two systems, one of which has been already represented in the table (Case No. 100) as serving an important manufacturing city of about 60,000 inhabitants and a group of suburban townships. The other system serves a city of over 90,000 inhabitants about six miles away, and an interurban line connects the two, adding about 8,000 to the total population served. This case is hardly, properly speaking, an interurban system, but is merely represented here for what interest it may have as a combination case.

Case No 144 has already been placed in the tables (Case No. 111) as a city system. In reality, it is neither that nor an interurban system, since the local traffic in its principal city of 130,000 inhabitants, and in another of nearly 30,000 inhabitants is a most important source of revenue, while the system serves, not only these two cities, but six others of from 2,000 to 20,000 inhabitants.

All of the interurban systems described above, with the exception of the two smallest, are excellent properties, and are safely profitable. There can be no question that in thickly settled manufacturing and residence territory, a network of lines connecting the various settlements will be well patronized for both pleasure and business reasons. It is only since the introduction of improved forms of motive power that "pleasure riding" has become so important a source of street railway revenue. There is no reason why it should not increase in years to come, particularly through the country districts served by interurban roads, such as those just described.

Nevertheless, a great many doubtful interurban "schemes" are being urged upon capital in these later days. The great difficulty with many of the projects is that they are building too much mileage for the possible patronage. It cannot usually be wise, for example, to build a line through ten or fifteen miles of farming country in order to connect a village of 2,000 inhabitants with a town of 5,000 by a fifteen minute schedule—an extreme case, perhaps, but one which we can easily find paralleled in recent prospectuses.

Of a somewhat different character are the more ambitious projects for connecting important cities 100 miles or more apart by a system of electric railways which shall develop a large local and pleasure traffic en route, with little expectation of through business. Such roads come in direct conflict with existing steam railways, and naturally arouse their bitter opposition. From the steam railway point of view it does not seem quite fair for local authorities to grant to the electric railway companies the free use of costly highway systems built at the expense of the public, when the steam railways have been obliged to purchase their rights of way and to assume heavy burdens for expense of grading, bridges, viaducts, etc. This is especially an injustice also if the right to carry freight shall also be granted to companies operating upon the public highways, and if the attempt is made to obtain such rights on any large scale we may expect a "war of corporations" of the most bitter and determined nature.

CONCLUSION.

The street railway field has been so thoroughly exploited, especially during the last five years, that it is now difficult to find many wholly new opportunities for the profitable investment of capital. All, or nearly all the cities of the United States of 10,000 inhabitants or over, together with perhaps half of the smaller cities exceeding 2,500 inhabitants, are served by street railways. It is probable that few valuable routes in these cities are now unoccupied and it is certain that much unprofitable mileage has been buillt. During the past five years extensive consolidations have been made, and many others are yet possible. The gross street railway mileage of the country, therefore, is not likely henceforth to show more than a gradual increase unless the demand for interurban systems shall reach large proportions.

Completing this hasty and imperfect review of the street railway industry in the United States, it may be said broadly that the substitution of cable and electric for animal motive power has dignified the industry and has raised it immeasurably in the estimation of investors. Its future is bright, and, in spite of the many instances of unrealized hopes which time will surely bring, its intrinsic earning power is certain to compare most favorably with that in other fields of industrial enterprise.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

EDITORS STREET RAILWAY JOURNAL:

The following notice appeared in the March issue of the *Electrical and Street Railway Reporter* published in New York: "A receiver for the McGuire Manufacturing Company, of Chicago, has been applied for through Richard B. Davis, of Petersburg, Va., counsel for the company." Unless very carefully noticed, one might think a receiver was asked for the McGuire Manufacturing Company, while in fact the McGuire Manufacturing Company is asking for a receiver for a railway company. The McGuire Manufacturing Company is one of the strongest concerns, with as high a credit as any in the street railway business.

The paper referred to made a correction in its April issue; but good news never travels so fast as bad; therefore, we ask you to publish the above.

Yours very truly,

MCGUIRE MANUFACTURING COMPANY.

A CERTIFICATE of the consolidation of the Metropolitan Street Railway Company, the Metropolitan Crosstown Railway and the Lexington Avenue & Pavonia Ferry Railway, of New York, was filed with the Secretary of State, May 28. The amount of the capital stock of the combination, which is to be known as the Metropolitan Street Railway Company, is $13,500,000. There are nine directors, as follows: Herbert H. Vreeland, Thomas F. Ryan, R. S. Hayes, Albert W. Fletcher, H. S. Beattie and Ralph L. Anderton, Jr., of New York; Daniel B. Hasbrouck and Charles E. Warren, of Brooklyn, and Henry A. Robinson, of Yonkers. The new road assumes all the debts of the others, amounting to $9,250,000. The shares of the new company are to be given share for share for those of the companies combined. The capital stock is equal to the combined stock of the three.

AN electric railway has been put in operation in Lyons, France, by the Compagnie des Omnibus et Tramways, of that city.

Established 1884.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

Mr. Robert W. Blackwell, M. I. E. E., 39 Victoria Street, London, England, has been appointed European representative of the Street Railway Journal. Mr. Blackwell is well known among street railway and tramway managers on both sides of the water. He was president of the Bentley-Knight Electric Railway Company, of New York, from 1884 to 1890. During the latter year he removed to London, where he has since been engaged in electric traction matters, having been associated for several years with the late Mr. Anthony Reckenzaun. Our new London office is on the first floor of the New Albany Buildings overlooking Victoria Street, the great thoroughfare between the Victoria, Charing Cross and Waterloo Stations, and close to the Institutions of the Civil, Electrical and Mechanical Engineers.

Hurry Has Been the Bane of street railway operations to a greater extent than is often realized. Franchises have been secured with a limiting clause that the line should be in operation at a certain period, or extensions have been contemplated for the purpose of meeting a prospective traffic that would be inaugurated on a certain date incident to the establishment of an exposition, race track or something of the kind. Also under fear of adverse climatic conditions hurry orders have been placed for rolling stock, equipment., etc. The result too often is that the appliances of the roadway fail, owing to the fact that in the hurry of construction some of the minor details had been overlooked or inferior materials employed. The result has been great expense for repairs and renewals and annoying failures that would never have occurred had longer time been allowed for perfecting the details of equipment. In justice to themselves the manufacturers should generally refuse to fill hurry orders, for with the best intentions the chances are that some element of weakness will be found in the machine or device which will ever after work to the prejudice of the firm.

The Exhibits made by the manufacturers of street railway appliances at the annual conventions of the American Street Railway Association form one of the most interesting and instructive features of these gatherings, and are greatly appreciated by the delegates who thus have opportunity to inspect in practical operation the apparatus designed for street railway service. The executive committee of the Association recognizes the value of this department of the meetings, and, as is well known, has always shown the utmost willingness to assist towards its success by arranging for suitable exhibition rooms, and in other ways to be of help to intending exhibitors. In the circular just issued by the secretary of the Association, to manufacturers who intend to be represented at the Atlanta Convention, next October, the suggestion is made that all apparatus intended for exhibition purposes be shipped in ample time before the meeting, to insure delivery and erection at the Exhibition Hall before the assembling of the delegates. We cannot too strongly urge compliance with this important point. The duration of the Convention is none too long, as it is, for the delegates to become acquainted with the important features of the apparatus shown, and no time should be lost after the Convention opens in preparing exhibits for inspection.

Much Injury Has Been Occasioned the legitimate street railway business of many cities by the organization of new companies by irresponsible persons. Fair competition is often a benefit, inciting as it does to better results and a more perfect service, and as a city increases in size it is to be expected that new companies will engage in the field of transportation. There are other kinds of competition, however, and one of these is from a company which has been organized by persons who have no real intention of keeping control of the road after cars have been put in operation. In many cases the promoters of such companies, in order to secure franchises in cities where there was a competition between themselves and the local corporation for the same franchises, have made offers to the local authorities to pay into the city treasury extravagant amounts either as lump sums or as an annual per cent. on the gross receipts for the franchises, well knowing at the time that the business would never warrant the outlay, the only object in the minds of the promoters being to secure the franchises and in some way to dispose of the securities. In some cases these offers have forced the legitimate competitors to agree to the same terms, and we now find roads loaded with obligations, which if met will ever tend to cripple the service, while they leave but little encouragement for the accumulation of sufficient funds to renew the plant when worn out. This state of affairs should serve as a lesson to local authorities, and they should be keenly alert to know the antecedents and intentions of the promoters before granting the contemplated franchise.

The Future Prospects of the Electric Railway Construction and supply business seem brighter than ever before. The field, instead of growing narrower with the general electrical equipment of the present horse roads, is broadening in many directions, and with the new

roads made possible only by the trolley, there are now as many miles of railway and as many cars to be equipped with electric apparatus as ever before. When we consider that very little has been done in the line of railway construction in other countries, and that interurban lines of considerable length are certain to be among the products of the near future, it is easy to see that we are on but the threshold of an era of extended electric railway transportation. This is of itself a distinct advantage to street railway companies even for those who have roads already equipped. The larger the market for electric railway apparatus the greater the stimulus to manufacturers to develop new appliances and improve those already designed and in use. A radical change in practice which forms one interesting feature of the evolution of the equipment business has already occurred. This is that the large electrical, manufacturing and supply companies are confining themselves more to the simple manufacture of electrical apparatus, and the contractors to supplying only the labor or superintendence required in road equipment than formerly. The selection and purchase of all parts of the railway equipment are being done more and more by the officials of the railway company directly. The effect of this custom, we think, will be beneficial in two ways. In the first place, it permits the street railway companies to secure their supplies directly from the manufacturer without the use of an intermediary and thus buy at better prices. And secondly, the influence on the manufacturing companies must be better, as each becomes responsible only for the equipment which it supplies.

To Street Railway Companies, as to other business enterprises in general, the last year has been unsatisfactory from a financial standpoint. The universal depression has been indicated, in their case, by a general falling off in receipts, and while this has been accompanied by a retrenchment in operating expenses, more or less extensive, according to the size of the road, it can safely be said that many roads have shown a large decrease in net receipts per mile of track during the last nine months. While this is true, it is interesting to notice that the number of roads, of moderate size or larger, which have gone into the hands of receivers has been small. None of the prominent street railway properties were declared insolvent during the year, and, so far as we have been able to learn, with but two exceptions, no receivers have been appointed during this time for any road of prominence in any city of over 50,000 inhabitants. During the same period, however, there has been a very large number of steam railway companies which have gone into receiverships owing to their inability to pay the interest on their funded debts. These failures have not only comprised short lines, but such important trunk roads as the Reading, Erie, Northern Pacific, Union Pacific, New England and Atchison. While these corporations may not have enjoyed a very high reputation for financial strength before their declaration of insolvency, they were the owners of extensive properties, and the securities of all, especially the one last named, were held by many for investment purposes. Not only have street railway companies held their own as shown, but many have built important extensions, re-equipped, and made other costly improvements. In fact, the total amount of new work done in the reconstruction of existing street railway properties during the past twelve months, so far as we can judge, has fallen but little behind, if it is at all less than, that of the previous year. The experience of the last year has shown that street car travel has become a necessity to the majority of the denizens of our cities. It is no longer considered a luxury to be dispensed with during hard times, and the continuance of the traffic can be depended on with more certainty than on the steam roads.

Street Railway Men at Atlanta are already making extensive preparations for the Convention, October next, and unless indications mislead us, that meeting will mark a most important epoch in the history of the Association. That the Association has done a most important work in the past no one familiar with its history will deny, but that the time has come for a new lease of life by more actively taking upon itself new duties as the field broadens, is evident. In other words, the Association must keep abreast of the progress made in street railway development, and should lead, not follow. We hear many suggestions for improvement and new work. Not the least among them is the matter of encouraging exhibitors. This feature of the annual gathering is important, in fact is the life of the Convention. A correspondent in the April issue of the STREET RAILWAY JOURNAL called attention to the importance of the Convention setting apart certain fixed times to inspect the exhibits in a body. All will agree, we think, that this should be begun at Atlanta. Many manufacturers go to large expense in placing an attractive exhibit before the Convention, and are entitled to every possible consideration. Another suggestion, which comes from prominent members of the Association, is that the work heretofore has been too much hurried, and that more time should be taken by the Convention; that the sessions should continue for at least three days, and the fourth day be given to pleasure trips, inspecting points of local interest, etc. We understand an effort will be made to inaugurate this change at the Atlanta meeting. In a recent conversation with President Payne he expressed himself as heartily in sympathy with the changes as herein outlined, and with the idea of greatly broadening the work of the Association in the future. We believe the time has come when the Association, to do its best work, should employ someone to devote his entire time to its needs. The most natural person to select for this position would be the present secretary. Mr. Richardson has been the secretary of the Association from its beginning, and deserves great credit for the efficient and business like manner in which he has conducted its affairs. He is thoroughly familiar with the details, and is alive to the future needs of the Association. The objects to be accomplished are most worthy, and we hope to see marked advance made at the Atlanta meeting.

"American Street Railway Investments"—our long promised financial supplement—will be ready for distribution this month. We should be ungrateful indeed did we not express once more our appreciation of the hearty good will and co-operation which have been so freely extended to us by the street railway managers of the country. This friendliness has been particularly gratifying, partly because the attempts of others to properly cover this field have been to a much less extent successful, and partly because it is evident that the old spirit of reserve and jealousy which has for a long time prevented street railway investments from taking their proper place among the

industrial enterprises of the country is passing away. The fact is generally recognized to-day that the ability to obtain frequent and accurate reports concerning the operation of important properties is a *sine qua non* with those who are sought as investors, and that a most important factor in the demand for investment securities is a market so broad as to insure ready sale under pressure of necessity. "American Street Railway Investments" contains a careful financial description of nearly 1,000 street railway properties operating in over 600 cities and towns, a large amount of valuable descriptive and statistical matter bearing upon the value as street railway centers of over fifty cities and towns, and a large number of maps of the principal systems. Five years ago, such a publication would have been impossible. To-day it expresses in the clearest and best manner possible, the immense strides which have been made in the street railway industry by the introduction of the cable and electric systems of motive power.

* * * * *

Other indications of this striking development are found in the series of articles by Mr. Higgins, which are concluded in this issue. These articles are unique among financial essays. In few other fields of industrial enterprise is it possible to compare and discuss results philosophically or in such a way as to deduce laws or general conclusions to any such extent as has been done here. Mr. Higgins' work in this field has received the profound and thoughtful attention of street railway managers and financiers throughout the country, and will undoubtedly have a large influence in shaping the future of the industry. Within a short time we shall announce the republication in book form of these essays with the author's corrections and additions.

William J. Clark.

No man connected with street railway interests is more widely known and more heartily esteemed by his friends than William J. Clark, who has just been appointed general manager of the railway department of the General Electric Company. Few, perhaps, have done more to advance the commercial side of the application of electricity to street railway purposes, and a brief sketch of his life will be of unusual interest at this period of his career.

Mr. Clark was born in Derby, Conn., July 20, 1855. He commenced business at the age of nineteen in the wholesale and retail coal firm of Merritt, Clark & Son. This connection continued until 1888. From 1879 to 1887 he also held the office of postmaster at Birmingham, Conn., and prior to 1887 held other important political offices in that State. While postmaster at Birmingham he was often called upon by the post office department to act as post office inspector. His investigations included the "Star Route" frauds, frauds in the Brooklyn post office, the famous mail robbery on the Chicago & St. Louis Railway post office route in 1886, and the Jersey City post office burglary, and many others. Mr. Clark's friends will recognize his characteristic energy and cleverness in the fact that while acting as post office inspector he succeeded in convicting over 100 criminals, and failed to convict only three. This was no child's play, and Mr. Clark's courage was tested quite as much as his skill and ability. In one instance he was shot at twelve times; two attempts were made to poison him, and another conspiracy to assassinate him was organized by the post office criminals.

In 1886 Mr. Clark began his street railway career by securing a charter to build a street railway connecting Ansonia, Derby and Birmingham, Conn. In 1887 he contracted with the Van Depoele Electric Company for the equipment of this line, which was the first of its kind in New England. This enterprise suggested the reorganization of the Van Depoele Company, and the negotiations which were begun with that end in view finally culminated in the sale of the Van Depoele electric railway patents to the Thomson-Houston Company, with whom Mr. Clark became connected on April 1, 1888, as general agent of the railway department. In this year he also succeeded in securing the famous amended charter of the Thomson-Houston Company from the Connecticut Legislature. It will be remembered that the passage of this charter caused an advance in the stock of this company of over 100 per cent. Mr. Clark continued to act as general agent of the Thomson-Houston Company until its consolidation with the Edison General Electric in 1892. During this time he visited almost every state in the Union, and was instrumental in carrying through some of the very largest equipment deals ever known in the United



WILLIAM J. CLARK.

States. He also distinguished himself by his skill in aiding many of the greater companies in securing electric franchise rights.

After the formation of the General Electric Company Mr. Clark was put in charge of the railway department at its New York office. He remained in this position until October 1, 1893, when he was appointed manager of the Cincinnati office of the same company, and was called from that place to take his present position, where the best wishes of his many friends follow him.

The regular monthly meeting of the Massachusetts Street Railway Association was held at Young's Hotel, Boston, May 17, thirty being present. Col. John H. Cunningham presided. After dining, the members listened to remarks by Hon. Amos F. Breed, of Lynn, Hon. E. P. Shaw, of Newburyport, and Hon. Charles B. Pratt, of Worcester.

The Middletown-Goshen Traction Company, of Middletown, N. Y., commenced operations April 7. The officers of the company are: President, James C. Hinchliffe; vice-president, M. J. Wightman; secretary, E. J. Wightman; general manager, W. B. Rockwell.

EDITORIAL CORRESPONDENCE.

FORT WORTH, DALLAS.

Fort Worth, Tex.

This city, although one of the youngest in the State, is one of the most progressive and enterprising, and having had a marvelous growth thus far presages, what its people claim, that it is to be the metropolis of Texas. It became an incorporated town in 1872 without a single railway; was incorporated as a city in 1876 with a population of 1,100, but now has a population of about 33,500 and is an important railway center, having nine lines of steam railway connecting with all parts of the country.

The water works system is very complete and was recently erected at a cost of $160,000, and is apparently of sufficient capacity to supply the city for many years to come. The building is a handsome brick structure, and is located near the city limits on the west side of the city, and supplanted the old station which was on the north side. The equipment is of the Holly type, and consists of two vertical, triple expansion, condensing engines of 950 H. P. each, which have a pumping capacity of 8,000,000 gals. in twenty-four hours. The water supply is obtained from thirteen artesian wells which are located in the neighborhood of the station, and from which the water flows through a connecting pipe to a large cistern or reservoir from which it is lifted by the pumps and forced directly into the main. The water is said to be of exceptional purity.

In public and office buildings, handsome homes and school and church edifices, Fort Worth is distinctively rich. The new city hall, one of the finest municipal buildings in the State, cost upwards of $125,000. The government building or post office cost $275,000, while the new car house, now in process of construction, is to cost $425,000. All these structures are of native sandstone or granite, and are admirably designed. There are thirty manufacturing establishments, while the public improvements in the line of sewers, water works and sanitary appliances are first class in every particular, the city being regarded as one of the healthiest in the Union.

STREET RAILWAYS.

The street railway lines embrace about forty miles now in operation which are controlled by four companies, some of the tracks formerly operated having been abandoned. The gauge of all the lines is four feet, and on all the T rail, spiked directly to the ties, is employed. This construction is admissible in the business streets as only macadamized pavement is employed, the wearing surface of which is composed of a species of gravel which, because of its cementing qualities, forms a durable roadway, and which is found in great quantities along the river bottom.

North Side Street Railway Company.

This company operates, under a lease, the lines of the Fort Worth Street Railway Company, and embraces twelve and one half miles of track, all of which is now being electrically operated. This company, like many others, having been unfortunate and having suffered from the hard times, was compelled to place its affairs in the hands of a receiver, and the property has recently been sold and the management reorganized. For a considerable period the affairs of the company have been in the hands of N. Harding, receiver, and the operation of the lines managed by G. B. Hendricks, who has been able to show quite a saving over operating expenses. The lines of the North Side Company were the first to be electrically equipped in the State of Texas, having been started April, 1889, The original equipment consisted of Rae motors, but these were supplanted in 1890 by the General Electric F 30 type. The average number of cars now run is twelve, and these are all of Brownell make, and are mounted on Bemis trucks, and all have a double motor equipment. The Lappin brake shoe is employed, and is said to be giving excellent satisfaction.

One car is equipped with an anti-oscillating device which was illustrated and described in our February issue, and which was a joint invention of B. F. Cholor of Fort Worth, and G. B. Hendricks. The device seems to accomplish all that is claimed for it so far as we could observe, and it prevents teetering even on a rough track and when the car is running at high speed. The device consists of a pair of levers composed of flat rolled bars or bars of malleable iron, which are placed on each side and just under the car body. These levers are fulcrumed at the journal box, and joined by a bolt near the middle of the car. The outer ends are attached to the car sill by means of a yoke and pair of vertical spiral springs which can be adjusted to any desired tension by means of the bolt which holds them in place. Any tendency of the car body to go down at one end operates with the same force to pull down the other end, and corrects the tendency to teeter. The device can be attached to any pattern of truck at a comparatively small cost.

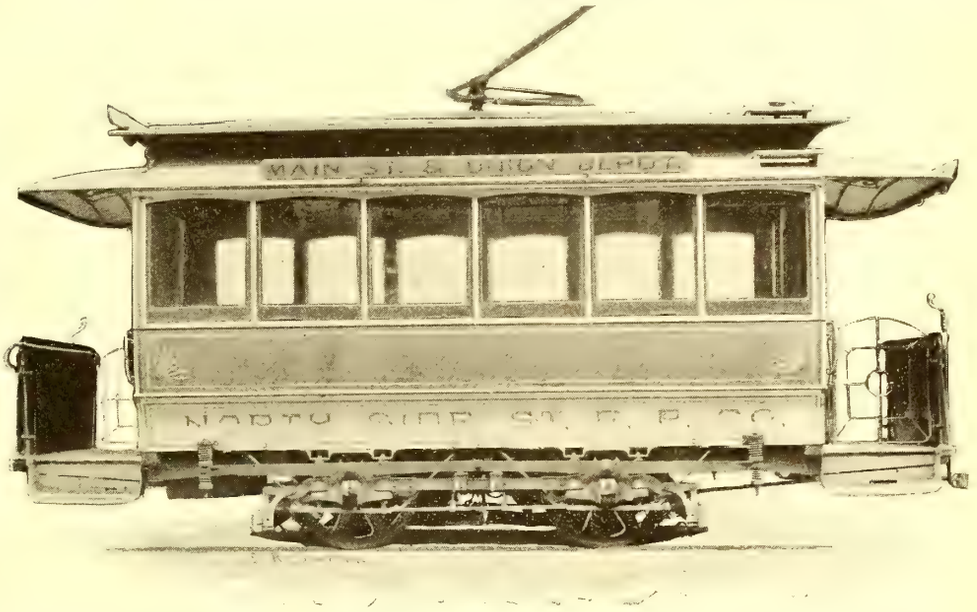


FIG. 1.—CAR WITH NON-OSCILLATING TRUCK—NORTH SIDE RAILROAD CO., FT. WORTH.

The cars are provided with Brownell fare boxes and operated without conductors. On the Main Street line which connects with the Union Depot, and on which the cars are run to connect with the incoming trains, an assistant superintendent collects the fare at the depot when there is a crowd, and deposits the amount in the box. Special attention is given the depot traffic, an agent being on hand on the arrival of trains to inform incoming passengers that the cars pass the principal hotels, while these agents also assist the passengers in regard to baggage transfer.

The power station is located on the west bank of the river, just north of a bridge over which the track descends from the bluff and crosses over the bottom to the stock yards, a few miles west of the city. The

station equipment consists of a 500 H. P. Hazleton boiler having two furnaces, which are provided with Roney stokers to which the coal is delivered from hoppers, first being elevated by chain and spiral conveyor. The fuel consists of Indian Territory and Texas coal costing from $2.35 to $2.55 per ton delivered, and it requires about four tons per day to operate twelve cars for seventeen hours. There is also an auxiliary equipment of two tubular boilers of 275 H. P. each.

The power is supplied by a 300 H. P., cross compound, condensing Hamilton-Corliss engine having cylinders 13 × 30–48 ins. The power is transmitted from the fly-wheel by nine one and a quarter inch continuous ropes to a countershaft. From this shaft the power is supplied by leather belts back to three D 62 Thomson-Houston generators. In the early installation of the plant ropes were employed for transmitting power to the generators, but these were abandoned and belts substituted. The feedwater is obtained from an artesian well 275 ft. in depth located some little distance from the station, in which the water rises within thirty feet of the top, and from which it is pumped into an elevated tank holding about 10,000 gals., the steam for operating the pump being conducted to the well through a one inch pipe. The water is said to be absolutely pure so that no scale forms in the boilers. The condensing water is obtained from the river. The home made oil separator has been devised by the engineer of the station, which consists of a six inch iron pipe about two and one half feet in length, which is filled with coils of old baling wire; the water being led into this, the oil collects on the wire, and is led off through the waste pipe.

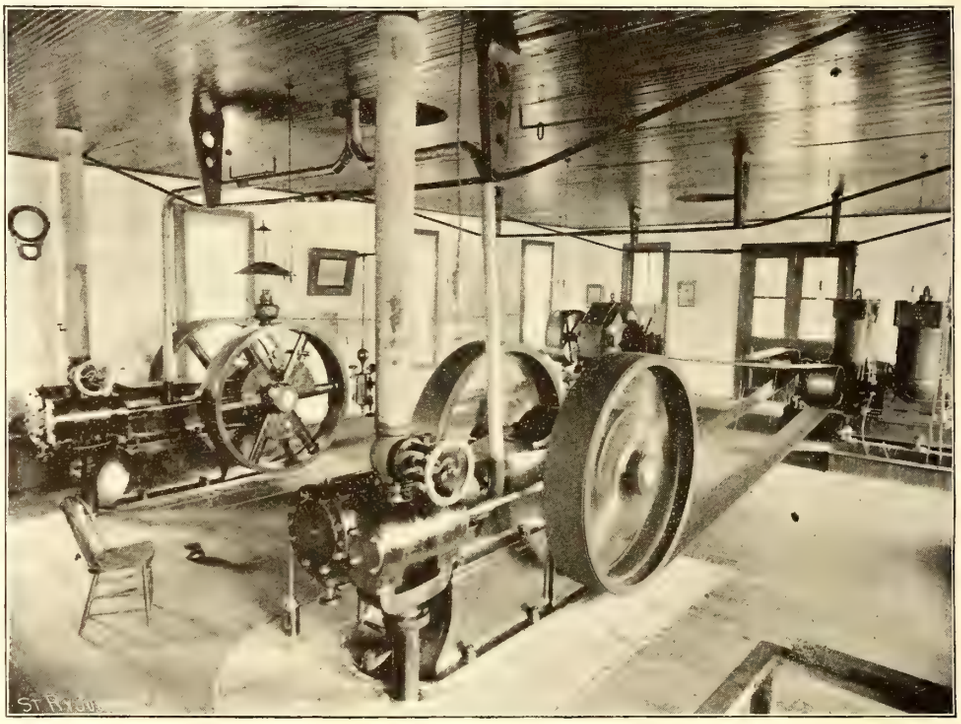


FIG. 2.—INTERIOR OF POWER STATION—FT. WORTH & ARLINGTON HEIGHTS RAILWAY.

EMPLOYES.

Motormen are paid $1.50 per day, and have every fifth day off. Country bred men and men with families are said to make the most efficient motormen. A very strict watch is kept over the men by the manager and his assistants, and they are discharged when anything goes wrong. If men are seen to enter saloons or are found drunk, whether on or off duty, or are found to be associating with bad characters, it is a cause for discharge. The use of profane or vulgar language or any discourtesy to passengers is also regarded as a cause for discharge. Strict discipline has resulted in securing a very desirable class of men.

Motor armature repairs are made in the company's shops, but generator armatures are sent to the St. Louis Machine & Oil Company, St. Louis, for repairs.

The franchise of the company was given for ninety years from 1876. New franchises are now granted for fifty years.

The Fort Worth & Arlington Heights Street Railway Company.

This line was originally constructed by the Chamberlain Investment Company for the purpose of developing Arlington Heights, a suburb of Fort Worth, about five miles distant, and embracing a tract of 14,000 acres. The line is single track and about six and a half miles in length, which starts at the Union Depot, foot of Rusk Street, runs along this street, paralleling the lines of other companies to 7th Street, then turns west on 7th Street, crosses the Clear Fork of the Trinity River, and continues along Arlington Boulevard, which is 125 ft. in width, across the river bottom, and ascends the heights over a grade, for about a mile, of 4.2 per cent. Four cars are run at present on a headway of from seventeen to twenty minutes. On the level strip of line, across the valley, a very high rate of speed is attained. The trip, including stops, is usually made in about thirty minutes.

Thirty-five pound T rail is employed, and outside the city limits the construction is of the ordinary steam railway type with gravel ballast.

The rolling stock consists of over five closed cars and seven open cars, mostly built by the Pullman Company, there being two closed and one open car which were built by the Woeber Brothers of Denver. Three types of motors are employed, there being two equipments of Edison fifteen horse power motors, three of Thomson-Houston of same capacity, and three equipments of Westinghouse twenty horse power motors.

The cars are provided with fare boxes of the National type and with registers of the same make. The motormen collect the fares, deposit them in the boxes, and ring up the registers. In summer, when the traffic is heavy, conductors are employed. Motormen are paid $45 a month.

The cars are equipped with electric heaters, of which three different types are employed, and the New Departure bell is employed for signaling.

The car barn is located at the terminal of the line at Arlington Heights, and consists of a wooden structure, of tasty design and of ample capacity for storing all the company's cars. There are pits and the usual appliances for the car and motor repairers. One portion is partitioned off and furnished for the superintendent's office, and adjoining it is the store room.

The power station, which is a small, brick structure, is located on the Clear Fork of the Trinity near the bridge where the line crosses the river and at the city limits. The equipment consists of three Heine safety boilers of 110 H. P. each, having Roney mechanical stokers, and the usual steam pressure carried is 125 lbs. Texas coal is employed, which costs delivered $1.40 per ton, and it requires about six tons per day to operate the four cars. There are two Ideal engines of 125 H. P. each, and three Edison generators of fifty kilowatts each.

To the usual ventilating tube of these engines, the superintendent has attached a four inch tin pipe, which connects with one at the ceiling and passes out at the roof and serves to carry off the oily vapors which, without this precaution, condensed and settled upon the belting and the machinery.

Arlington Heights is a very attractive locality and is rapidly building up. The elevation is about 135 ft. above Fort Worth, giving a very commanding outlook, as noted in the introduction to the notes. There are quite a number of very fine homes, while the streets are broad and well graded and graveled, and are bordered by young trees, which have been recently planted. The principal attraction of the location is "Ye Arlington Inn," one of the finest all-the-year-round hotels in the locality, and which is patronized not only by tourists, but also by the commercial travelers who prefer it to the city hotels, as the service is superior to that found in most cities. It is easily reached, as the cars are run to meet all trains, while an agent is at the depot to superintend the transfer of baggege and look after the comfort of the travelers.



S. HORN,
SUPERINTENDENT FT. WORTH & ARLINGTON HEIGHTS RAILWAY CO.



GEO. B HENDRICKS.
GENERAL MANAGER NORTH SIDE RAILWAY CO., FT. WORTH.

The exterior of the inn presents a pleasing semi-colonial design. The structure is four stories high and is built of a combination of pressed brick, red sandstone, and natural wood. There are numerous broad verandas and private balconies. The interior finish and furnishings are apparently of the best the experience could suggest, but our space will not allow a description in detail. Beautiful plants and shrubs adorn the lawns about the hotel, while on the north the bluff slopes off abruptly to the valley park 200 ft. below, and in this direction one of the loveliest views is had of the surrounding region. The settlement is provided with an electric light plant, a water works plant and all the sanitary requirements of a modern city. The street railway company runs a freight and express car back and forth between Ft. Worth and the Heights several times a day, for the purpose of transporting groceries and other freight, which is delivered from the station by wagons to the residents, free of charge.

The town of Arlington Heights was laid out with the most liberal proportions, and a large sum of money has evidently been spent in its development, there being a lake, parks, and other attractive features; and had it not been for the general depression in business affairs, it would have doubtless become a large residence city equal to the expectations and plans of its promoters. It is only a question of time, however, when it will thus develop and make a handsome return for the investment.

The Fort Worth & Arlington Heights Street Railway Company is a separate corporation from the Investment Company, although some of the parties are interested in both enterprises. H. W. Tallant whose death is recorded elsewhere in this issue, was president of the street railway company, The operation of the line, however, for a long period has been superintended by S. Horn, who also has a general oversight of the lighting and water plants and the other property of the Investment Company. Mr. Horn was formerly with the North Side Street Railway Company, and supervised the original electric equipment of that system.

City Railway Company.

About three years ago the lines controlled by this company were electrically equipped, the Detroit motors being employed. These motors are still running, but the cost of keeping up repairs is very great. Formerly the system embraced sixteen miles of track, but only ten miles are now being operated. The rolling stock consists of fourteen motor cars, only four of which are being regularly operated, and those are run with fare boxes, without conductors.

The power for operating the system is rented from a neighboring lighting plant, the company's plant having been sold, as it was found to be cheaper to rent power than to operate the plant.

Motormen are paid $1.50 per day, and have every fifth day off. Trackmen receive the same wages.

D. P. Quigg is superintendent, and in charge of the local affairs of the company. The lines will, doubtless, soon be sold, and possibly consolidated with some of the other systems.

The Polytechnic Street Railway Company.

This company takes its name from the Polytechnic Institute which is located two miles and a half from the Union Depot, from which the tracks run out to the Institute, and the cars are operated by animal power. Only one car is run, except on Saturdays and Sundays, when two cars are operated. It takes, ordinarily, one hour to make the round trip.

The region is rapidly building up, and the line will eventually, doubtless, develop into a good paying one. Steps are being taken preparatory to equipping the line with electric power.

At present the affairs of the company are being managed by E. Fosdick, with Harry G. Borny as secretary.

The Mistletoe Hill Railway,

which was operated by animal power, has been abandoned, although the tracks remain in the streets. The same is true of the Riverside Street Railway. The original car equipment of the latter line consisted of two thirty-six foot, eight wheel, straight side cars which were equipped with the Rae motors These cars are at present stored at the barn of the Fort Worth & Arlington Street Railway, at Arlington Heights, and will doubtless be re-equipped and operated in the near future.

Dallas, Tex.

What was said above regarding northern Texas and the advantages of Fort Worth in its relation to the surrounding region, climatic conditions, etc., is equally true of Dallas, for this city is located thirty-five miles due east from Fort Worth on the line of the Texas Pacific Railway, and between the two cities a spirited, but friendly, rivalry exists. Dallas, however, is some years older than Fort Worth and has the start of her rival in population, in amount of business done, and in the general appearance of her business streets and public buildings, and somewhat of an advantage in the development of street railways.

The city occupies a plateau three miles square on the east bank of the Trinity River, about 350 miles above its

entrance to Galveston Bay. The elevation provides for good natural drainage, which is supplemented with about sixty miles of sanitary sewers and four miles of storm water sewers. In this connection should be mentioned a very excellent water works system, costing $800,000, which gives an abundant supply of water, which is drawn partly from the river and partly from artesian wells. In time, it is expected, the entire supply will be drawn from wells, the quality from the latter being soft and pure. The amount of water pumped by the station is 41,030,000 gals. per day, and there are two large settling reservoirs, with a capacity of 135,000,000 gals., while a third with 750,000,000 gals. capacity will be built. There are fifty-six miles of water mains, with all the necessary hydrants and connections.

About thirty miles of the city streets are paved, the material employed being chiefly *bois d'arc* sawn and round blocks laid on a gravel foundation. Bois d'arc is a native wood practically indestructible, and is used in the East as a dye wood. The city is in shape like a fan. Some of the streets, unfortunately, as in many Southern cities, are narrow and do not run at right angles or parallel. This is occasioned by the land having been held originally under Spanish land grants, measured by metes and bounds, or located by warrants, before the state survey.



FIG. 3.—CAR HOUSE—QUEEN CITY RAILWAY, DALLAS.

All the public improvements in Dallas, have been developed on a liberal scale, and with a view to providing a healthy and desirable residence city, placing the city in the front rank of Southern cities in this respect, and showing remarkable enterprise for so young a city. The first settler is said to have located here in 1841, but the place was not incorporated as a town until 1856, and in 1858 the records of the first census ever taken show a population of only 1,299. For the last twenty years, however, the population is said to have doubled every four years, and now, it is claimed, the number of its people is 61,000, including the suburb of Oak Cliff, which is on the opposite side of the river. The first railroad, that of the Houston & Texas Central, entered the city in 1872, the Texas Pacific followed in 1876, and now there are five trunk lines, with twelve outlets by rail. Not only does the city enjoy excellent railway transportation, but by improvements being made in the Trinity River, which include a system of locks and dams, water transportation, it is expected, will soon be had with the Gulf of Mexico, which will doubtless serve to keep freight rates at a low figure for all time to come. The river is virtually only a canal carved out by nature with steep but uncaving banks, and with sufficient depth for small steamers and freight barges. Already a steamer is plying daily between Dallas and McCommas' Bluff, thirty-five miles below. From its location (there being an immense area of rich and productive land tributary to it) and its solid and substantial growth thus far, Dallas claims to be the Queen City of the Southwest, and may well do so, for the possibilities of the city, as a manufacturing center, are both brilliant and innumerable. It is already a great commercial and distributing center full of ambition and the genius of modern life, so that it is bound to grow to a still greater extent within the next few years. In this connection it is worthy of note that Dallas is the headquarters for Texas and part of the Indian Territory, for the trade in agricultural implements and farming and mining machinery, there being nine houses engaged in this line, with an aggregate of sales last year amounting to $7,000,000.

STREET RAILWAYS.

The railway lines of the city embrace fifty-one miles of track, and are controlled by five companies, which operate by both animal and mechanical power. Nearly all the lines make the Exposition or Texas State Fair Grounds an objective point, and as the neighborhood is well built up, cars are run throughout the year, but during the Fair season cars are run on very short headway. The location is about two miles east from the business center of the city. The tract embraces 120 acres and is ornamented with shade trees and shrubbery. There are two race tracks, one a mile long, while the buildings are of magnificent proportions and pleasing in design.

The Queen City Railway Company.

There are embraced in this system, which has absorbed the North Dallas Railway, about ten miles of track, and the lines are operated under the direction of A. W. Childress, president of the company, and C. L. Wakefield, secretary and treasurer, who also acts as executive officer, with R. S. Wakefield as assistant superintendent. The principal line on Elm Street, the retail street of Dallas, was originally planned for a cable road. The material was distributed over the entire distance, three and two-tenths miles, and about a mile and a quarter of conduit and track construction was completed in 1891, when the work was suspended, and the line was electrified in 1893, the work of reconstruction having been begun in March, and the line started the first of August. In rebuilding the cable portion the slot rails were removed, a portion of the concrete and the tops of the yokes were broken off and the ties for the new construction placed on the remaining concrete bed with a gravel cushion between. A forty-five pound T rail is employed, which is spiked directly to the ties, which are of long leaf yellow pine 6 × 8 ins. × 7 ft. long, and cost in this market $.40 apiece. In the paved streets the rail is spiked directly to the ties and short tie blocks are used. So far the track is standing up exceedingly well. The overhead construction is especially fine, all the latest insulating devices being employed, and No. 0 trolley wire is employed. Along the business street the trolley is protected by three guard wires placed about two feet above the trolley, suspended from different eyebolts and the span wires are then thoroughly insulated. Three No. 0000 feed wires are employed, and two No. 0000 return wires connect the track with the station. The rails are joined by a single No. 00 copper bond wire. A pressure of 525 volts is carried, and the loss has been found to be only 2 per cent. The power is rented from the Dallas Electric Light Company, for which the street railway company pays $3 per day per car, which are run usually about eighteen hours. The overhead work is in charge of W. C. Ure, the electrician, who was foreman in charge of constructing the overhead lines.

The rolling stock consists of six open and twelve closed cars of the latest design, and very attractive. Twelve of these were manufactured by the American Car Com-

pany, and the other six are mounted on McGuire Columbian trucks, having a six foot base and on which a thirty-three inch wheel is employed. Car bodies were manufactured by the St. Louis Car Company, and mounted on Bemis trucks, on which a thirty-six inch wheel is employed. There are twelve equipments of W. P. 30 Thomson-Houston motors and six single equipments of F No. 40 Thomson-Houston motors, both types of which are standing up excellently well under the traffic. Both rawhide and wave pinions are employed, which are purchased for the most part from Davis & Cougill, of Omaha. On some of the lines a seven minutes headway is maintained, and on others it is twenty minutes. The speed is from eight to twelve miles an hour, and on some of the divisions the cars make an average of 120 miles a day, on others 115 miles. The lines of the company run to the Exposition Grounds, at which the racing tracks are said to be second to none in the country.

The cars are run without conductors and are provided with fare boxes. The motormen are paid twelve and a half cents an hour, trackmen $1.50 per day. The fare is five cents, and transfers are issued at two points, one being at an extension and the other at a crossing. Children's tickets, good for children under ten years of age, are sold fifty for $1.50; these tickets are also good on school days for school children of all ages. All passes are in the form of tickets, so that every passenger has to deposit either ticket or fare. The conditions of the franchise are that on one street a payment of $500 a year is required, on another $600, so that the annual payments to the city amount to $100 per car per year, on the basis of eleven cars now in service.

The car barn occupies what was designed to be the cable power station, and is a handsome brick structure located at the corner of Peak and Elm streets within the city limits. To accommodate the electric cars, it was necessary to raise the roof over the storage tracks about four feet. There are six storage tracks and one pit for repairs, capable of accommodating five cars.

One portion is set off for a washing room, in which a concrete floor is provided. In the portion which was designed for the power plant the foundations which were prepared for the engines and machinery remain, as do also the walls of the tension runs. A portion of this section has been provided with a floor, and is used for a store room and a repair shop, and a portion of the front of the building was designed for the company's offices, but has never been finished, and is now occupied by the trainmen. Against the wall outside the office room a large blackboard is provided, on which the names of the motormen and leaving time are written. This board is supported by hinges and can be swung back against the wall, being so arranged that both sides of the board are utilized for names.

By a recent regulation of the company the motormen are now all uniformed in gray cadet suits and helmets of the same color for summer. The neat appearance of cars and station, the politeness of the employes and excellence of discipline, reflect creditably upon the management. Each employee is practically a "drummer for business" for the road, which speaks well for the friendly feeling which exists between them and the management.

The Dallas Consolidated Traction Co.

The cars of this company are operated both by animal and electric power, there being twenty-two cars regularly run by mules, two animals to a car, and ten electric cars. On a portion of Main Street both systems run over the same track. The company owns in addition quite a number of open and closed cars, which are not, at present, being operated. A fire on December 5 last destroyed the Main Street car barn and stables, together with twelve motor cars, fourteen other cars and eighteen mules.

The electric portion of the system began operating in October, 1890, and in October, 1892, the entire system was placed in the hands of a receiver, and has since been operated under the direction of the Court. S. P. Cochran is receiver, and, although having had no previous experience in street railway business, has managed the business admirably and in an economical manner, showing good returns. His principal assistants in the management are J. L. Sale, purchasing agent, and Wm. Dresser, superintendent. Recently an addition has been made to the electric mileage by the equipment of 21,000 ft. of double track and 24,000 ft. of single track. This extension was over an outlying district, the formation being black prairie soil, while the overhead equipment is supported on center poles hewn and painted. The overhead construction, which has now been in service for about four years, began to show signs of failure, so is now being thoroughly overhauled.

The rolling stock was principally manufactured by the St. Louis and Laclede car companies, and the cars are mounted on Bemis, Brill and St. Louis trucks. The original



FIG. 4.—CAR ON COMMERCE STREET—DALLAS, TEX.

motor equipment consisted of both Thomson-Houston and Edison machines. There are six motors of the old F 30 type, and six equipments of the Edison No. 6. More recently four G 8 Thomson-Houston motors have been added. The power is rented from the Dallas Electric Light Company. The Street Railway Company furnishes the generators which consist of two of the Thomson-Houston D 62 type, and one Edison generator.

Fare is five cents. Tickets in books of 100 are sold for four cents to working girls and school teachers. Tickets in books of fifty are also sold to school children for three cents, good at any hour and any day. Transfers are issued at two points The cars are run without conductors, fare boxes of different makes being provided.

Ordinary employes receive $1.25 a day for the first four months of service, $1.50 for the second four months, and $1.75 after this. They are allowed one day off every fifth day with full pay. Thirty-three regular drivers and motormen are employed, and fifteen extras. The officers claim to have a very excellent class of men, quite a number having been in the company's service for seven years. The cars are run usually until eleven o'clock at night, and on Saturday and Sunday nights until twelve o'clock.

Since the fire a car barn has been improvised from the Live Oak Street stable, which has been remodeled, and a portion is being equipped for a repair shop. On one of the poles in front of this barn a switch is provided with which the barn wires can be cut out and in. When it becomes necessary to run a car out or in the barn an attendant throws the switch lever and holds it in position until the car is in place, when the current is cut out. This arrangement is a precaution against the possibility of fire from the current or from a lightning discharge.

Quite a number of the one horse cars are being fitted with a single motor, and are to be operated for the sum-

mer traffic. None of the grades on the line are very severe, the surface being generally level.

The cost of feeding the animals is about $.14 a day. Prairie hay is fed together with oats and corn unground. Mules cost usually from $40 to $50, and those standing about fourteen and a half hands high are preferred.

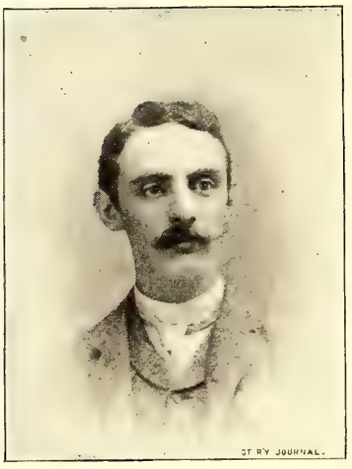
The track construction consists of T and Johnson girder rail. The girder rails were formerly laid on chairs in the paved streets, but these have been taken out and a three inch block substituted. The paving, which is of *bois d'arc*, as before noted, cost $1.25 a square yard, and there is also considerable macadam pavement on the streets through which the lines pass.

The Dallas Rapid Transit Company.

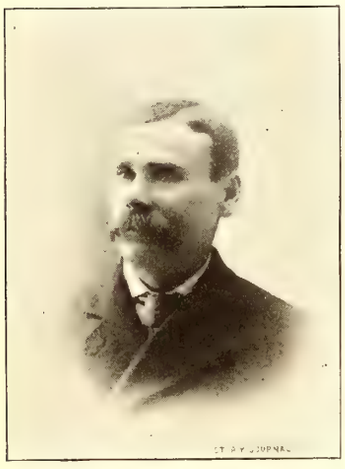
The lines of this company, which are now in the hands of a receiver, were built about four years ago for the purpose of developing suburban property on the east side of the city. The system forms an irregular loop of about seven miles, half of which is in the city and the other half through a sparsely settled district on the east side of the limits, together with a line crossing the loop near the center, of about three miles. The portion outside the paved streets is virtually a steam track, being laid with T rails, and much of the way through private property. By economical management the system is paying expenses, and as soon as the city takes on a new growth it will doubtless prove a paying proposition. Like all the other lines of the city, the loop passes along the front of the Exposition Grounds.



SAM'L P. COCHRAN,
RECEIVER DALLAS CONSOLIDATED TRACTION CO.



J. L. SCALE,
SECRETARY DALLAS CONSOLIDATED TRACTION CO.



A. W. CHILDRESS,
PRESIDENT QUEEN CITY RY. CO., DALLAS.



GEO. D. HARTSON.
SUPERINTENDENT DALLAS RAPID TRANSIT CO.



R. S. WAKEFIELD,
ASSISTANT SUPERINTENDENT QUEEN CITY RY. CO.



C. L. WAKEFIELD,
SUPERINTENDENT QUEEN CITY RY. CO.

The power station is located on the eastern part of the line well in the country two miles from the post office, and near the line of the Texas Trunk Railway. The system is being operated under the supervision of George T. Hartson, who in his capacity combines superintendent, electrician, chief engineer, bookkeeper and master of repairs. Mr. Hartson has had a long experience in electric street railway work, having been employed on the early Sprague electric road in Richmond, Va.

The rolling stock consists of ten motor cars, but only six are run regularly. Some of these were built by Lewis & Fowler, some by the Pullman Company of Detroit, and others by the St. Louis Car Company. All are mounted on the Manier truck. The motor equipment consists of eight Edison double reduction motors and two equipments of Westinghouse motors. In the repairing of generator and motor armatures the superintendent uses an insulating material which he prepares himself, composed of asbestos paper, treated with boiled linseed oil and coach japan varnish, and for the ends of the armatures he employs duck which has been treated in the same manner. This is prepared and hung up in sheets and used when required, and thus far has proven a very durable material.

The cars are equipped with National fare boxes and are run without conductors. Motormen are paid $1.50 per day for twelve hours' work.

The car station is a plain wooden structure located in the suburbs, as noted above, and has an equipment of tubular boilers and two Armington & Sims eighty horse power engines which are belted direct to two fifty kilowatt Edison generators. Texas and Indian Territory coal is employed for fuel, the former of which is $1.25 a ton and the latter $2.50 per ton, and the daily expense for coal consumed for the operation of six cars is about $6.00. In addition to the ordinary switchboard equipment, the superintendent has provided several home made lightning arresters. One of these consists of carbon pencils, with the points separated about one sixteenth of an inch, which has proven very efficient, but the peculiarity of the device is that when there is a heavy load on the line a blue flame or arc is noted between the points, but when the load is light, although the voltage remains the same, no arc appears. Two other lightning arresters on the switchboard are made of serrated copper plates about eight inches in length after the style of some of the early lightning arresters, except that the plates are longer than those usually used. In case the plates are melted together across the gap by an arc the connection is cut out with a knife. The trolley wire, which is composed of No. 4 Birmingham gauge copper, has grown crystalized by four years of service and frequently comes down. The experiment is being made of using a three-eighths inch steel wire for a trolley, and leading in a current from the feeders at short intervals, the object being to get a strong trolley wire that will not come down by its own weight. The economy of this construction is not yet apparent. A new splicing joint has been devised by the superintendent for repairing broken trolleys. It consists

of a cast bronze rod having lugs near the center, and flat, concave ends. The ends of the trolley wire being bent, they are hooked over the lugs, and the wings of the joint are then turned over to embrace the wire, making



FIG. 5.—TROLLEY WIRE CONNECTOR—DALLAS, TEX.

a smooth track for the trolley wheel. A cast iron trolley wheel is being employed on some of the cars, which has proved very durable, and, in the opinion of the superintendent, is just as efficient as those of brass. The income of the line being limited, the superintendent has demonstrated the old adage that "Necessity is the mother of invention."

The Dallas & Oak Cliff Railway Company.

This company has recently been reorganized. The lines, which embrace eleven miles, are at present operated by steam dummies, but are to be electrified, and it is expected will be operated by electric power within ninety days.

The president of the company is Henry C. Scott, of St. Louis. Vice-president C. F. Carter is in charge of the local affairs of the company and B. F. Sibert is superintendent. This is also a loop suburban line which starts near the Court House in Dallas, runs west parallel with the river for a short distance, then crosses the river bottom and over a long bridge and high embankment, and describes a circle through and around the suburb of Oak Cliff on the southwest side of the river and returns to Dallas over a second bridge further down the river at the foot of Main Street. An effort is being made to secure an entrance into the heart of the city of Dallas from some of the existing lines.

Oak Cliff, as its name implies, occupies an elevated plateau, and is a very desirable residence location. The present population is about 4,500. There are probably in this suburb a larger number of beautiful homes than in any other city of its size in the South.

There are a number of fine school buildings and a female college which occupies a very imposing building, and is one of the most noted schools in the State. As a residence city the location has many attractions, and is bound to grow in proportion to the City of Dallas, so that the railway system will doubtless become a very important one.

North Dallas Circuit Railway Company.

Only two cars are operated over this system at present. Power is rented from the Dallas Electric Light Company. The system embraces about four miles of track, laid with a forty pound T rail. The cars are equipped with Thomson-Houston motors. Royal A. Ferris is general manager and in charge of the local affairs of the company.

ADIEU TO TEXAS.

We take a reluctant leave of Texas, for our reception and entertainment have been so generous by the street railway men of all the cities we have visited that we have been made to feel quite at home, and take our leave with exalted views of the State, its resources and the size and beauty of its principal cities, with regret that time has not permitted a visit to some of the other cities of the state, which have equally as complete and interesting railway systems as those in the four cities described. We take our leave over the lines of the Texas & Pacific Railway, which occupies the same relation to northern Texas as does the Southern Pacific to the southern counties, and which was described in our last issue. The main lines of this system have a length between New Orleans and El Paso, the western terminal on the Colorado River, of 1,487 miles. There are two branches between the cities, Marshall and Fort Worth, one only about seventy-five miles north of the other and going through some of the northernmost cities of the state.

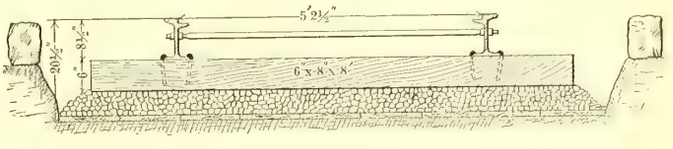
The passenger equipment is excellent and the service efficient in every particular. The territory through which it passes has many interesting and wonderful features, so that a tour over its lines is very enjoyable and instructive.

C. B. F.

Track Construction at New Orleans.

We present herewith a sectional engraving showing the type of track construction selected as standard by the New Orleans Traction Company, of New Orleans, La. The rail is eight and a half inches deep, of the Johnson girder type, weighing from ninety-three to 100 lbs. to the yard, and the joints are united by twelve bolt fish plates the bolts being one inch in diameter.

As mentioned in our April issue, the peculiarity of the ground, which being low, is exceedingly wet and spongy, made a special construction necessary, as the soil could not be relied upon to hold the ties in position. The



TRACK CONSTRUCTION AT NEW ORLEANS.

surface of the street is first excavated to a depth of about twenty and a half inches; then as a foundation a covering of one inch cypress plank is placed at the bottom of the trench, and upon the planking is placed a layer of Rosetta gravel from six to eight inches in thickness, and on this gravel bed the ties are placed two feet centers. The rails are spiked directly to the ties, and the space between and over the ties is filled with the excavated material, except where block paving is employed.

The company has recently received fifteen miles of feeder cables, 500,000 circular mills, from the John A. Roebling's Sons Company, of Trenton, N. J. The wire is of the waterproof, triple braided type, and the company will use at present an overhead return, although an underground copper return of some twenty No. 0 wires laid in a wooden conduit may be used later. The rails will be bonded with three No. 0, tinned copper wires.

Suburban Roads in St. Louis.

There is talk of extending the Manchester Road line of the Lindell Railway Company to the suburban towns and villages of Clifton Heights, Arloe, Gratiot, and others within the city limits, and out into St. Louis County.

The St. Louis & Kirkwood Electric Railway Company has awarded the entire contract for its construction to the Suburban Construction Company. The railway has a private right of way from the southwest corner of Forest Park, St. Louis, to Meramec Highlands, St. Louis County, a distance of about fifteen miles. The company is capitalized at $300,000. Its city connection will very likely be with the Lindell Railway line at Forsythe Junction.

The Manchester Road Electric Railway is at present constructing its roadbed, and the Forest Park & Clayton Electric Railway Company is ready to start its cars very soon. There are in all six electric roads laying tracks in or already running into the county, the latter numbering four.

The St. Louis County Street Railway has been running its line from the city limits to Normandy for a month past. Its line is operated by horse power, but will be changed to electricity some time in the near future.

AN electric street railway was opened to public traffic in Hamburg, Germany, on March 29, 1894. It was constructed by the Union Electric Company, of Berlin, and the overhead trolley system is applied. This street railway has thirty-five kilometers of track and forty-two motor cars, each of them equipped with a General Electric fifteen horse power motor.

Wood Paving in Sydney, Australia.

The city of Sydney is heavily committed to the use of wood blocks as a material for the pavement of the roadways. According to City Surveyor Richards, who has kindly sent us a copy of the last annual report, that city has an area of more than seventy-seven acres, or a length of more than thirteen miles, laid with it. The experience in Sydney has been entirely different from that of New York City, where the results with this kind of paving have been far from satisfactory.

The different timbers used and the amount of wear noticed are as follows: Blue gum, $\frac{1}{10}$ in. per annum; mahogany, $\frac{1}{8}$ in.; turpentine, $\frac{1}{17}$ in.; brush box, $\frac{1}{7}$ in.; spotted gum, $\frac{1}{8}$ in.; Baltic, $\frac{1}{10}$ in.; colonial cedar, $\frac{1}{12}$ in.; black butt, $\frac{1}{26}$ in.; colonial pine, $\frac{1}{22}$ in.; blue gum, $\frac{1}{12}$ in. (about); red gum, $\frac{1}{10}$ in. The cost of wood paving varies from 20*s.* to 25*s.* per yard, including excavation, etc.

Mr. Richards recommends paving with close joints in distinction from the original theory that there must be a broad interval filled in with grouting between the rows of blocks to provide the necessary foothold for the horses, and states that he believes that any of the following timbers would suit admirably for so paving roadways: Blue gum, red gum, black butt, tallow wood, mahogany and turpentine.

Lack of space prevents our giving further extracts from this most interesting report.

The Heilman locomotive was to have commenced regular service on the line between Paris and Mantes before the end of May. Careful experiments will be made to learn exactly the difference in consumption of fuel between this locomotive and an ordinary locomotive. Plans for a 1,200 H. P. locomotive are being drawn up.

The Capital Railway of Frankfort, Ky.

In the great distillery district of Kentucky, or "Blue Grass" region, as it is called, little or no attention has been usually given, when locating a distillery, to the matter of transporting the output or supplies. The main idea in the location of these plants has usually been to secure a pure and sufficient supply of limestone spring water, this being one of the leading causes that has made this section so famous for its output of superior whiskies. The Capital Railway of Frankfort is to be congratulated on being the initial enterprise in Kentucky to give these distilleries cheap transportation for their grain, coal and wood to their plants, and their output of whiskies to the steam railway connections. In the city of Frankfort, daily, long lines of heavy wagons could be seen handling this business, which is now being done in an entirely satisfactory manner by the little "Lightning Bug," shown in Fig. 2.



FIG. 1.—POWER STATION—CAPITAL RAILWAY CO., FRANKFORT, KY.

The power house, illustrated by Fig. 1, is a substantial brick building 52×125 ft., with a double track barn 26×125 ft. attached. The boiler room, which is separated from the engine room by a brick partition, is only 35×52 ft., and contains 200 H. P. capacity, boiler plant, with heater, boiler feed pumps, etc. The engine room contains two 100 H. P. Jenney dynamos, driven by one of the latest type of Dick & Church tandem compound engines of 200 H. P. capacity.

The switchboard is of the improved Jenney type with marble panels, and all connections are made from the rear of the board. The instruments used are of the Weston make. The electrical station equipment was furnished and installed by the Jenney Electric Motor Company, of Indianapolis.

Tests of the generating plant have been made with very heavy overloads, the apparatus showing remarkable results in the way of regulation and capacity.

The freight motor car is of a special design twenty-

eight feet in length, mounted on a pair of heavy trucks, with five foot wheel bases. The body is extra heavily built to withstand the severe strain of having loaded freight cars as trailers, and in appearance is very much like an ordinary baggage car as used on steam roads. Fig. 3 illustrates this car hauling three box cars around a curve. Four twenty-five horse power motors controlled by a single specially designed controller, are attached, one to each of the four axles of this car, making each wheel a driver. The total weight, when empty, of this car and equipment, is fifteen tons, and when not used for handling full loads is used for handling small shipments, barrels and boxes.

Besides the freight motor car described above, three eighteen foot, closed, passenger cars, handsomely finished, painted a light and attractive color, are used. These cars are equipped with twenty-five horse power motors and haul trailers. The cars were made by the Barney & Smith Car Company, of Dayton, O.

The track is a fifty-six pound T rail laid on 6×8 in. ×8 ft. white oak ties, two feet between centers, and ballasted with crushed blue limestone rock. Heavy cuts and fills are numerous, the nature of the country through which this road runs being very mountainous and the grades very severe, being in some instances 8 per cent., and in one instance a reverse curve was necessary on a 7 per cent. grade, but even here absolutely no difficulty was experienced in handling from two to three heavily loaded box cars with the freight motor cars.

The overhead line is of the Creaghead patent, flexible, side bracket construction, specially made for high speed roads in the suburbs, but in the city is side pole and span wire construction, using No. 0 trolley wire.

Frankfort is a city of about 10,000 people, is the capital of the state, and has numerous manufacturing establishments. The railway is so situated that it covers a large area, making the four miles of track used for passenger traffic quite profitable. In addition to which the management has a beautiful park, containing about forty acres situated on an elevation of about 500 ft. overlooking the city and river, with a baseball and football ground and grand stand, dancing pavilion, band stand and numerous summer houses, nice walks, rustic seats and other attractions.

The design and construction of this road was supplied for the contractor, Frank Whitley, of Springfield,



FIG. 2.—ELECTRIC LOCOMOTIVE—CAPITAL RAILWAY, FRANKFORT.

O., by the Creaghead Engineering Company, of Cincinnati, under the personal supervision of George R. Scrugham. The stockholders of the local company are the principal business men of the city, of which Pat McDonald is president, and John T. Buckley is secretary and general manager.



FIG. 3.—ELECTRIC LOCOMOTIVE DRAWING THREE FREIGHT CARS—CAPITAL RAILWAY, FRANKFORT.

Electric Emergency Ambulances.

The question of ambulances being operated in St. Louis, on the Union Depot Railroad Company's lines, has been agitated. It is proposed to run these for emergency calls from the City Hospital to any point on the above system, which means a great deal, as it reaches most of the important points in the central, northern and southern portions of the city. The advantages of an ambulance car over the ordinary van can readily be appreciated. They can be run much more rapidly, are smoother, and, on account of size, are more comfortable for a patient than the ordinary wagon.

HEALD & HOLLIDAY, of Ironton, O., are promoting the formation of a company to build and operate a dummy railroad in Adams County, O., between Manchester and West Union. The franchise has been secured and the company will be incorporated during June. A $40,000 bond issue will be made. The distance is ten miles, and construction will be begun soon.

The Johnson-Lundell Surface Contact Electric Railway System.

The different systems which have been presented to the public for operating electric cars without the use of overhead wires, have always been popular with the general public. The trolley system *per se*, has never been a favorite with most city residents, and it has only been permitted because the other advantages of electric cars have more than counterbalanced the objections to the system from an æsthetic point of view. This general desire for a method of operating cars, which should avoid the use of an overhead construction, has been evinced by the popularity with the traveling public of storage battery cars, and the interest felt in conduit systems proposed and in operation here and abroad. In connection with the practical operation of an open conduit system which will be tried by the Metropolitan Traction Company on one of the uptown avenues in New York, as stated elsewhere in this issue, a description of the surface contact system of Messrs. Johnson and Lundell, of New York, will not be without interest. This system has been in operation for some months on a vacant lot at the corner of First Avenue and 69th Street, New York, where an experimental track 1,200 ft. in length has been installed.

In this system the contact conductor is laid midway between the track rails, flush with the pavement as shown in Fig. 3. The current is taken into the car by means of a metallic brush, which bears upon this center rail, the current afterwards returning to the generators at the central station by the track rails. This contact rail is divided into sections about eight feet in length and insulated from each other. By an ingenious magnetic device, which will be described later, each section is connected with the feed wires only when the car is directly over it. All other sections are entirely out of connection with the source of supply, so that there is no possibility that passing pedestrians or horses can receive a shock by touching the center rail. The advantages of a contact system of this character over that in which the conductors are carried in a conduit with an open slot, are obvious from the standpoint of drainage and cost of construction. The first question, that of drainage, is eliminated, and there is no excavation with resulting movement of the subsurface pipes to increase the first cost of the road.

The objections which have been met with in systems of this kind before, such as difficulty of insulation against leakage, complications of the switching devices, the difficulties encountered at crossings, etc., seem to have been entirely overcome in the Johnson-Lundell system. As these are points about which a street railway manager would be apt to inquire first, a detailed description of methods employed to operate the line is given herewith. The contact rail, or working conductor in the experimental track, consists of a copper faced rail mounted on a continuous creosoted stringer, bolted directly to the ties, so that no cutting of the latter is necessary. The distance between the track rails on either side of this conducting rail is then paved with asphalt, extending below



FIG. 1.—SECTION BOX—SURFACE CONTACT RAILWAY SYSTEM.



FIG. 2.—CAR MOUNTING GRADE—SURFACE CONTACT RAILWAY SYSTEM.

the stringer. This makes the surface conductor watertight against seepage, and leaves only the surface water to be cared for. The potential used is only 300 volts, and careful tests have shown that even if the track was submerged for a depth of two inches—a condition impossible under ordinary conditions for any great distance—the leakage per car in operation would only be two amperes, or considerably less than one horse power. Experiments have also been made to test the question of possible leakage under the worst conditions of winter, by dumping on the tracks slush, mud and refuse taken directly from the streets, but in no case was the maximum leakage given above exceeded. On roads where there is heavy vehicular traffic, and where asphalt paving between the rails would not prove desirable, Belgian blocks with pitch or tar grouting has been found to give just as satisfactory results.

The question of leakage and insulation of the contact conductor having now been disposed of in a satisfactory manner, that of the magnetic devices for switching the current in and out of circuit with the sections is to be considered. The switching devices are located in watertight boxes, placed along the line of route at intervals of every forty feet. Each box is hinged on brackets in its manhole so that it can be easily inspected. The connections are made with copper-carbon contact switches, operated by electro-magnets, which are extremely simple in construction. The breaking of the circuits is made absolutely without spark or arcing by an ingenious electrical device. These magnetic devices operate equally well when cars are run in either direction, and are positive in their action.

For carrying the cars over switches, crossings, etc., of other railways, and at other points where the continuity of the conductor rail must necessarily be broken, the inventors of this system have avoided all complicated switch mechanism in a novel way. This is by the use of a storage battery which necessarily need not be of large capacity, since it is only required at such times. In fact, with careful judgment on the part of the motorman, the number of places at which the battery may be used can be materially reduced by passing over crossings or switches under headway. The battery employed is of the chloride accumulator type, in which dislodgment of the active material and buckling of plates, the two great drawbacks of storage battery traction to street cars, are impossibilities. This battery, owing to its small capacity, occupies comparatively little space in the car. It is carried under the seats, is connected in parallel with the direct supply of current, and is operated by the same controller, so that no extra controlling apparatus is required, and when not delivering current, the battery is being charged from the central station. This battery is also employed to excite the section magnet of the first section when the car is started, the section being dead when the current is off.

The car shown was built by the J. G. Brill Company, of Philadelphia, Pa., and is equipped with a single thirty-five horse power Lundell motor, geared by chain and sprocket wheels to both axles. The armature is wound in two circuits, so that the controller, which is of an improved series parallel type, can be used. To avoid any sudden strain on the armature from reversing the current or otherwise, an ingenious mechanical device for transmitting power is introduced between the armature and the driving sprocket wheels. Keyed to the former is an iron disk, and pressed against this are two other disks attached rigidly to the sprocket wheels. The friction is regulated by means of a spring bolt and nut, and the tension is so regulated that the disks will slip in case the strain on the armature is more than its normal load. In this way the motor can be reversed without danger of burning out any of the armature coils. A view of the power station is shown in Fig. 4.



FIG. 3.—VIEW OF TRACK—SURFACE CONTACT RAILWAY SYSTEM.

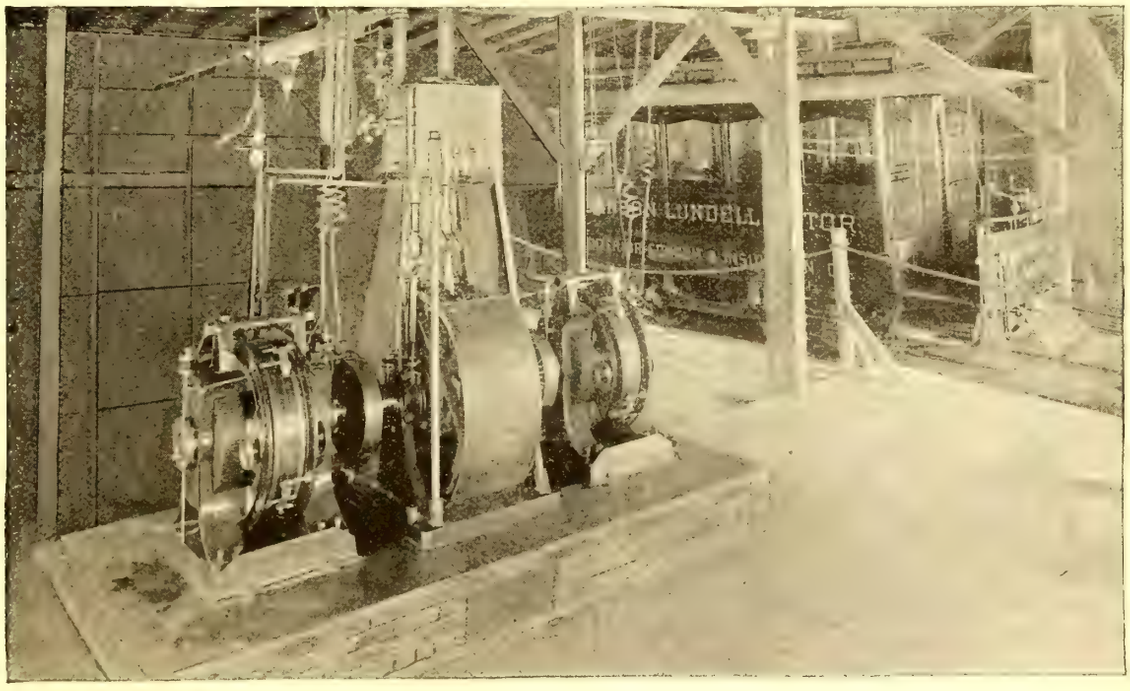


FIG. 4.—ENGINE AND LUNDELL GENERATORS—SURFACE CONTACT RAILWAY SYSTEM.

The underground feeder system of the inventors is also used in the experimental track. The feeders are all enclosed in the telescopic, iron armored, insulating conduits of the Interior Conduit & Insulation Company.

The inventors of the system are well known in electrical circles. Mr. Johnson was one of the pioneers in electric railway work, having been president of the Edison Electric Light Company and the Sprague Electric Railway & Motor Company, for all of the time during which the systems of these concerns were developed. He is now president of the Interior Conduit & Insulation Company, and patentee of many valuable improvements in the electric railway and lighting fields. Mr. Lundell was for a long time connected with the Sprague Electric Railway & Motor Company, and is the inventor of the Lundell type of dynamos and motors.

The Card Electric Street Railway Motor.

The Card Electric Company, of Mansfield, O., whose stationary electric motors are well known, has just put upon the market an electric railway motor equipment which possesses a number of novel features, and which is doing excellent work on several roads. We present, in the accompanying engravings, views of different portions of the motor, from which a very good idea of it can be obtained.

Sufficient power capacity is provided in the motor, so that a single equipment only is required upon the ordinary eighteen foot car, or one of shorter length, and where the grades do not exceed 8 per cent. By using only one motor, it is claimed that an equipment just as reliable and just as convenient to operate is secured, with greater simplicity, less first cost and less cost for repairs. In regard to traction, the company claims that one motor equipment will give all that is required. This is shown in the town of Mansfield, where an electric road equipped with four fourteen foot and five sixteen foot closed cars, two eight seat and two nine seat open cars have been in operation since 1888. There are seven and a half miles of track, and a number of grades, one of which is 7½ per cent., and extends 1,500 ft. The cars are equipped with a modified form of Daft motor, and although only one motor geared to one axle is used per car, no difficulty has been met with in securing traction. In large cities where large cars are used, and trail cars are often necessary to handle the traffic, two motors per car may be necessary, and for such conditions the Card Electric Company is designing a double motor equipment which will soon be placed on the market.

Two views of the motor, with case closed, are given in the accompanying engravings (Figs. 1 and 2). As will be noticed, all the working parts are entirely protected within the cast frame of the motor, and all dirt and moisture is excluded. Fig. 2, which is the rear view, shows the steel bar for strengthening the cast extensions which form the spring supports. The bar rests in grooves cast for the purpose, and is clamped down by two eye bolts fastened by pins between the hinged ribs at the bottom and clips over the top. In this way the strain is equally divided between the four parts, and all danger of breaking after long service through a gradual crystallization of the cast metal is claimed to be overcome. An important feature of the motor is the accessibility of all parts. The motor

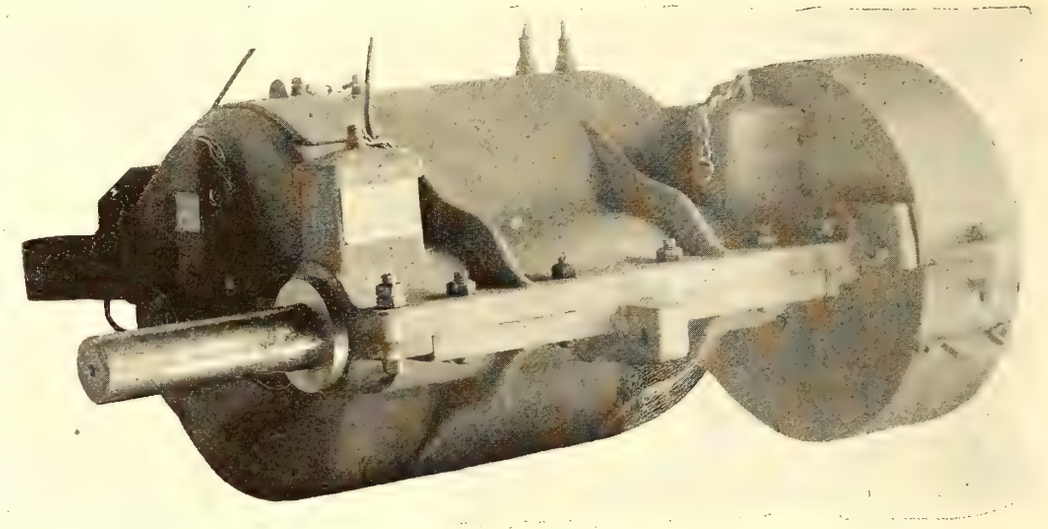


FIG. 1.—FRONT VIEW OF CARD MOTOR.

frame is hinged, and by means of a small chain block fastened to a beam of the car body and to the lower half of the motor case, one man can raise or lower the latter with ease. The armature can then be easily taken out by removing the journal caps.

The armature core is built up of the best magnetic iron, and is slotted to receive the conductors. The slots are insulated with mica, as are also the ends of the core. The shaft is hammered steel four inches in diameter through the core portion, with a one inch square key to prevent turning. The ends are reduced to receive the commutator and oil disk without reducing materially the strength or rigidity of the shaft.

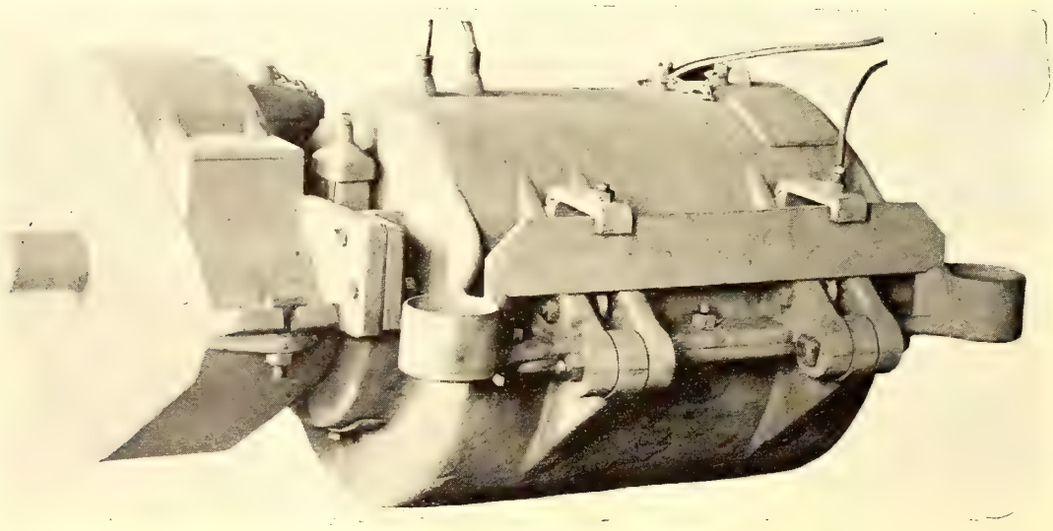


FIG. 2.—REAR VIEW OF CARD MOTOR.

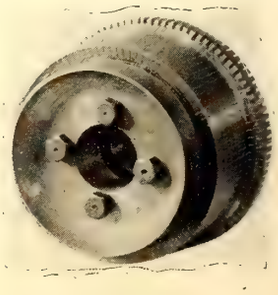


FIG. 3.—COMMUTATOR.

A view of the commutator is shown in Fig. 3. It is simple in construction, and so designed as to be easily removed from the shaft. An important feature of its construction is that between the hubs of the end plates is

located a rubber ring which is of such size that when the commutator is on the shaft it will fit the shaft snugly and effectually prevent any oil passing through to the armature or working its way outward into the commutator. Each of the field coils is wound in two parts and separately covered, the first with muslin saturated with shellac, and then with two windings of waterproof tape. It is then given two coats of insulated compound. After this the parts are bound together with tape and placed in an oven heated by steam to 150 degrees until every particle of moisture is driven out. In winding the wire on the forms each layer is coated with shellac until saturated. The gear case is made of malleable iron, and is hinged so as to be readily removable.

A view of the motor with lower half of case lowered is shown in Fig. 4. This engraving shows a novel feature of the equipment, a commutator turning attachment which will be found most convenient, especially on small roads. Superintendents have found that no matter of what material a commutator is made it will sometimes need turning off. To do this in the old way necessitates the taking of the armature from the motor and sending it to a lathe, perhaps in some machine shop some distance away. Here a careless workman, perhaps, may throw out the centers, and the armature ever after will run eccentric with the shaft and soon be destroyed. In the Card motor equipment the commutator can be turned off without removing the armature from its bearings. The motor case and armature is first lowered and the pinion released from the gear wheel. The pinion is then used as a means for turning the armature. This is done with a leather belt making connection with a pulley and crank handle and the turning attachment shown in Fig. 4. The speed can be made anything desired, and as good a job of turning done as in any lathe.

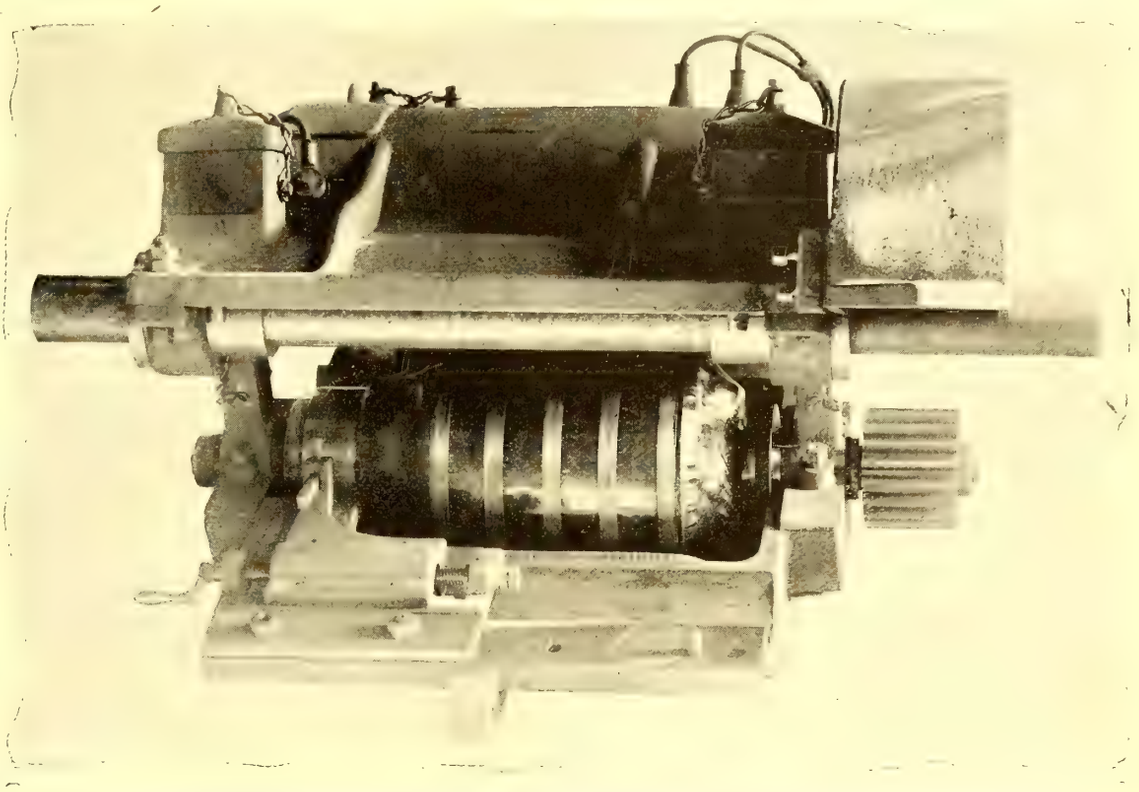


FIG. 4.—CARD MOTOR WITH ARMATURE LOWERED SHOWING COMMUTATOR TURNING ATTACHMENT.

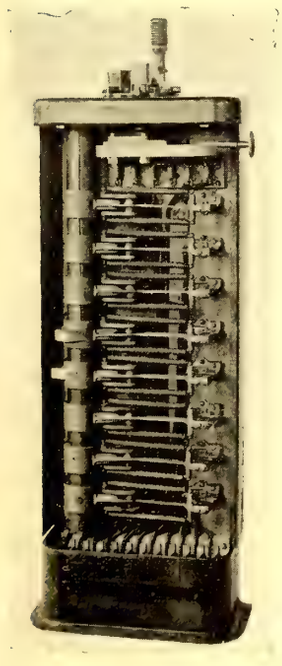


FIG. 5.—CONTROLLER.

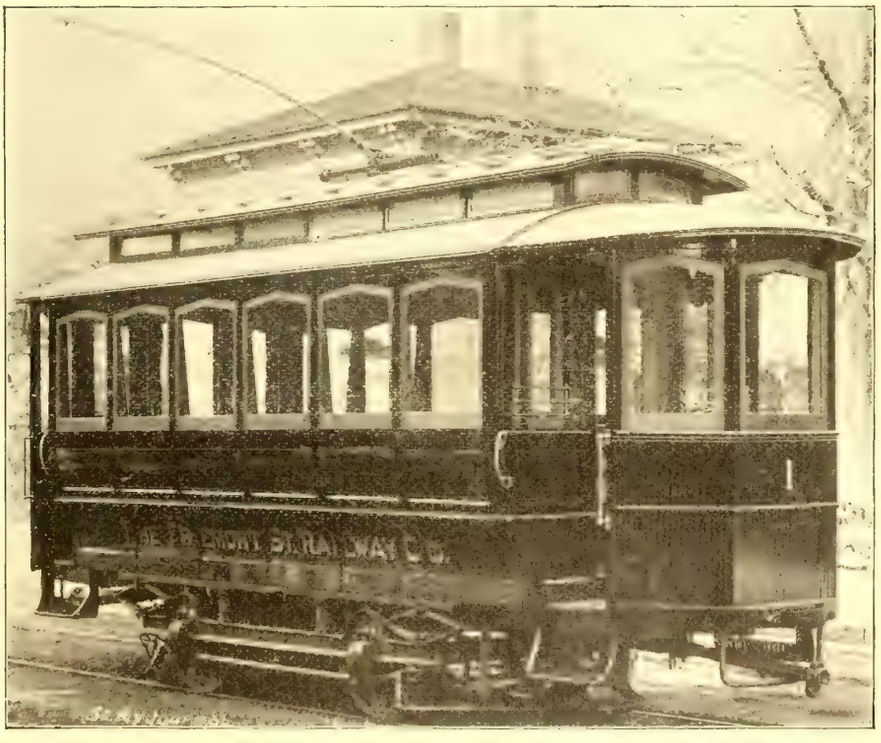


FIG. 6.—CAR WITH CARD MOTOR EQUIPMENT.

A view of the controlling stand is shown in Fig. 5. The operating handle is connected by gears to the switch

cylinder, and immediately under the cover is the reversing switch, the handle extending through the case at the right. On the longer shaft are placed eight cams insulated from it by heavy hard rubber tubing and secured by hard rubber pins. Beside each cam is a switch fastened

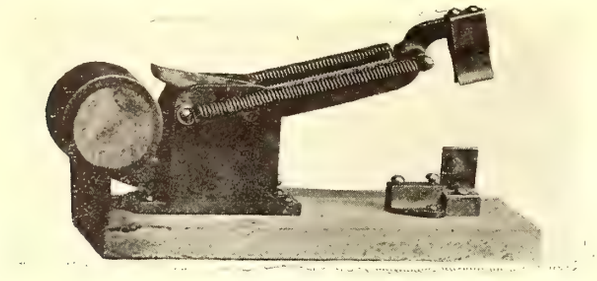


FIG. 7.—CARD CONTROLLER SWITCH.

by a suitable bracket to the back near the shaft. Each switch is provided with contact pieces to engage with clips on binding blocks fastened to the back. The operation of the controller switch can easily be seen from Fig. 7. By it there can be no drawing out of arcs or burning of contacts. Each switch is an exact duplicate of all the others. The cams are made all alike, and there is only one size of machine screw and wood screw used in the entire stand. The flexible method of suspension is adopted, the motor being supported both from the rear and the front and equalizing the weight as much a possible.

Fig. 6. gives a view of a car on the Fremont Street Railway, of Fremont, O., equipped with the Card motor. The truck used was manufactured by the Fulton Foundry & Machine Company, whose factories are at Mansfield. The car also is a product of this city's industry, having been manufactured by S. N. Ford & Company.

Exhibits at the Atlanta Convention.

The secretary of the American Street Railway Association, Wm. J. Richardson, has issued a circular to intending exhibitors, detailing the conditions under which the exhibits will be made at Atlanta next October. As already stated, the exhibit will be held in the Machinery Hall of the Piedmont Exposition Company, of Atlanta, Ga., a plan and engraving of which have been published in the Street Railway Journal.

The building has been engaged for two full weeks, beginning October 10, and ending October 24, thereby giving ample time for the removal of the largest exhibits. Several intending exhibitors at Milwaukee, it will be remembered, were sadly disappointed by the non-arrival of their goods until after the meeting was over. This was in large part due to the congested condition of freight traffic on trunk lines, owing to the World's Fair and the nearness of Milwaukee to Chicago. The secretary, therefore, impresses upon all intending exhibitors the advisability of securing a time limit delivery; better still, to ship in plenty of time.

A blank application for space, copy of rules and a lithographic sketch of the floor space similar to that published in our February issue, will be sent by the secretary to all who desire space for exhibition purposes. This plan shows that the Convention Hall is in the same building and on the ground floor, also that the railroad facilities for freight purposes cannot be surpassed, inasmuch as the tracks on one side run the entire length of the building.

It is stated that some of those who exhibited at Milwaukee have already applied for space at Atlanta, and this the secretary rightly thinks is, perhaps, the best evidence of the value of making exhibits at these annual meetings, where street railway men gather in large numbers from all over the United States and Canada.

Further information can be obtained from N. W. L. Brown, chairman of exhibits, Equitable Building, Atlanta, Ga., or upon application at the secretary's office, 166 Montague Street, Brooklyn.

The Association is anxious to extend every possible facility to intending exhibitors, and all who expect to be represented should make application as soon as possible.

Electric Freight Cars.

The practice of electric railway companies to do considerable freight business in addition to passenger transportation is growing to be more common, and it opens up a line which in many cases may prove to be extremely profitable. We present herewith engravings of two electric freight cars, one a box car, and the other an open car, which have been recently manufactured by the New Castle Car Manufacturing Company, of New Castle, Pa., for just this class of work. The box car shown in Fig. 1



FIG. 1.—BOX FREIGHT CAR.

was built for the McKeesport & Wilmerding Transfer Company, of McKeesport, Pa. It has an eighteen foot body, and is equipped at each end with a regular four foot platform, having brake, dash, etc. The height of the car inside is seven feet, and it is lined with Georgia pine flooring. The car has a sliding door at each end, and also one in the center at each side. The car is mounted on McGuire Columbian trucks and equipped with Westinghouse motors.

The open car shown in Fig. 2, is eighteen feet in length, equipped at each end with a four foot platform, containing brakes, gongs, etc. The flooring is one and a half inch hard wood; the railings are four feet high, and so arranged in sections that they can easily be removed. This car is built for a trail car, and mounted on McGuire

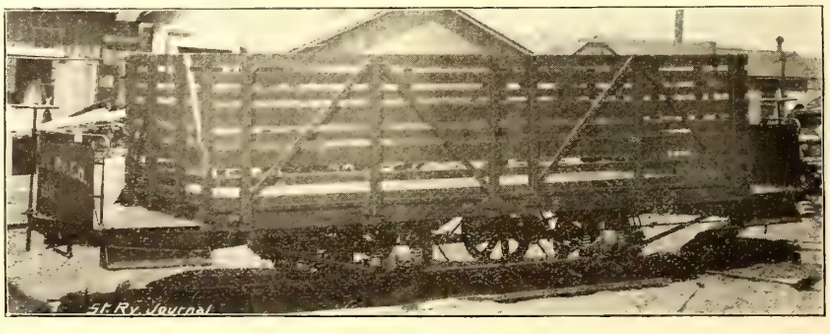


FIG 2.—FREIGHT TRAIL CAR.

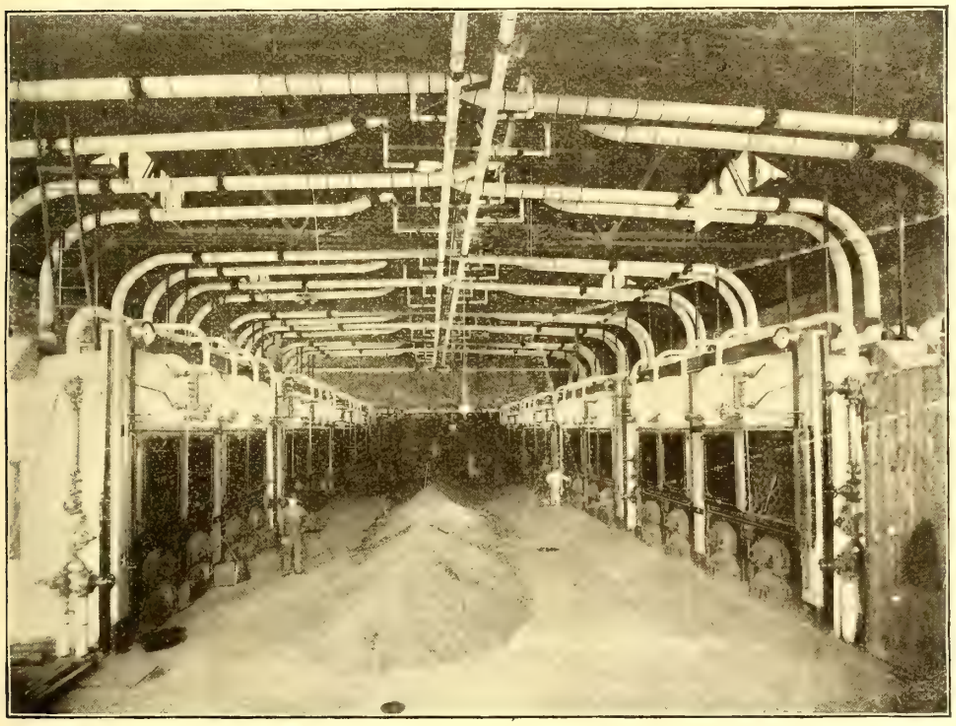
trail car trucks, and is intended to be used in hauling garden truck from Neville Island to Pittsburgh.

The electric line for which these cars have been built connects with the West End Railway, of Pittsburgh, and the cars will be used to enable the farmers along the line of route to market their products in Pittsburgh. By their means freight can be shipped within a few rods of the market house in Pittsburgh and, of course, at the smallest possible expense.

The Jackson Street cable line of the Sioux City Railway Company was changed to an electric line last month.

Boiler Plant of the Southern Station of the Brooklyn City Railway.

A description was published in our last issue of the coal handling apparatus of the southern station of the Brooklyn City Railway. A view of the boiler room of the station is presented on this page. This street railway company will have installed, on the completion of its eastern power station, sixty-four water tube boilers, 250 H. P. each. At the southern station, steam is taken from drums over each boiler to two twenty inch mains through eight inch wrought iron bends—these appear making the arch of white seen in the view. An interesting feature of the pipe work at this station is that all flanges, eight inches and above, are permanently joined by a double row of rivets. The main pipes are all in duplicate, and doubly connect both to the boilers and to the engines. The feedwater mains are also run double.



BOILER ROOM—52D STREET STATION OF BROOKLYN CITY RAILROAD CO.

The three plants at present operated by this company will generate, when completed, 21,000 H. P.

All of the exposed steam surfaces, and also the feedwater system and the steel flues have been insulated with magnesia coverings, by Robert A. Keasbey, of New York.

This station is especially interesting as being one of the largest, and among the best and most thorough installations of non-conduction covering that has been applied to what is practically a single establishment.

A Danger Signal for Electric Roads.

The Lindell Railway Company, of St. Louis, has adopted a very ingenious signal on its Washington Avenue line, at Grand and Lucas Avenues. There is a double track curve at the point mentioned. About the center of the curve, overhead, is a signal lamp with a red semaphore on one side and a white one on the other, at right angles to the first. It is so arranged that when a car approaches the curve from either direction, the red light appears to a car coming the other way, and thus prevents two from rounding the curve at once, averting a collision. The whole device is worked by the trolleys, and the points, one on each street, at which they strike the piece communicating the current to the lamp mechanism, are at an equal distance from the curve, and thus the car nearer the curve has the right of way. The trolley of the latter, on reaching the middle of the curve, strikes another point which turns the white light towards the car on the other track, signifying that the way is clear, and that it can come ahead. The lamp also serves as a danger signal to vehicles and pedestrians crossing the tracks at this point. It is lighted up by an incandescent lamp.

San Francisco Cable Sheaves.

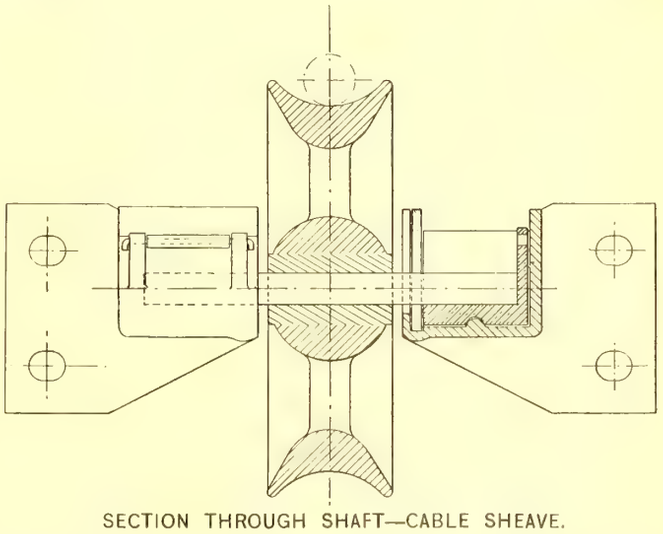
The engraving herewith shows in vertical section, through its shaft, a type of cable sheave which has given excellent results on two of the cable railways in San Francisco.

The speed of all the cables in that city, excepting two, is eight miles per hour, or 704 ft. per minute. Now as the usual size of carrying pulleys is from ten to twelve inches diameter, this makes their speed 230 to 275 revolutions per minute. The sheaves are spaced thirty feet apart, and the weight of the one and a quarter inch steel rope, supported by each sheave, is seventy-five pounds. As a mile of double track requires 352 sheaves, the items of first cost, lubrication and renewal have been very carefully considered by the railroad companies.

To sum up, the conditions under which each sheave runs are, therefore, these: 220 to 270 revolutions per minute for eighteen to twenty hours every day in the year, supporting a weight of about seventy five pounds. The sheaves are, of course, under ground, and get a great amount of dust and grit, and, in rainy weather, mud and water.

The form of sheave and box shown was adopted about three years ago after a thorough trial, a pulley with these boxes being placed on the road and run for fourteen months with one filling of lubricating compound.

The sheave is made of old steel wire cable melted up, which produces an exeeedingly hard and brittle casting, so hard in fact, that a soft iron hub center has to be inserted in the mould so that the sheave can be bored. This boring is absolutely the only machine work required.



SECTION THROUGH SHAFT—CABLE SHEAVE.

The arms are made curved to prevent cracking when the metal cools, as there is very little strength in this kind of material. The rim is heavy and acts as a flywheel, so that when the rope is raised from the sheave by the grip of a passing car, the wheel does not lose its speed, and when the rope again falls there is no dead wheel to set in

motion. This thick rim and hard material also insure a long run before the sheave is worn out by the cable. The rim is made three inches wide, so that there is little danger of the rope falling off. The shaft is cold rolled, so it requires no turning.

The main portion of the box is cast iron, and is bolted directly to the wrought iron yoke which carries the track and slot rails. The bolt holes are made slotted one way in the casting, and punched slotted the opposite way in the yoke, so that the box can be adjusted in all directions.

The babbit is cast separate and dropped into the box; it is a loose fit, but centers on the tapering sides. When it becomes worn out it is easily removed with a hook, and a new one dropped into its place. The old babbits are melted and recast, so that there is no waste.

The babbit forms a half bearing, which is all that is needed, as the pressure is always downward. The top of the box is filled with heavy lubricating compound, which rests directly upon the shaft. There is a wooden slip in the front end of the box to prevent the compound from working out or the dust from getting in. The cover is of sheet iron and is hinged. When the rope jumps off the sheave, as it sometimes does, it runs on this smooth cover, and so is not injured, until the next car passes and replaces it.

The flange for bolting is placed central, so that one box does for either right or left side of the pulley.

New 2,000 H. P. Walker Generators.

A special feature of the electrical work of the Walker Manufacturing Company is the construction of large, direct coupled generators. A recent machine built by this company, has a capacity of 2,000 H. P., ten poles, and runs at a speed of eighty revolutions per minute. The manufacturers will make three sizes of generators on this plan, namely 1,500 H. P., 2,000 and 3,000 H. P. capacity.

The bed plate of the machine is cast in one piece, and rests on a solid stone or brick foundation which is made a part foundation of the engine. From this foundation is built the enormous masses of iron which go to make up the completed machine. The engine shaft carries the armature and commutator directly attached to it. The Walker Manufacturing Company also manufactures the large shafts and flywheels for many of the engine builders, and it is very convenient for a purchaser of a direct coupled plant to have the entire engine, shaft, flywheel, armature and steel magnets made at the same place, as they are all fitted together in the shop, and everything is made fast, and put in good order before shipment.

These are probably the largest power transmitting dynamos made in the world, and no pains are spared in making them perfect in every particular. They run from no load to full load, and even 50 per cent. overload, without the slightest sparking at the commutators, or heating in any of its parts, and run quietly, without the noise so common to large generators. The brushes are all moved at one time by the hand wheel fastened to the base of the machine. The lower brushes and also part of the machine are reached by steps leading down into the pit below, so that every convenience for operation is provided for.

The facilities of the Walker Manufacturing Company for making large castings enables it to make every part of these machines. Each individual casting is made as large as is practicable to carry on freight cars and to erect in plants. This company is bringing about a new era of large power transmitting machinery for both street railroad work and long distance transmission, and is also going largely into electrical apparatus for elevated railways and interurban and cross country railroad apparatus. These machines are arranged to be direct coupled to either vertical or horizontal engines, and also arranged to be attached to both tandem and cross compound and triple expansion engines.

Earnings of Street Railroads.

The following table has been compiled by L. W. Serrell, M. E., from the reports of the railroad commissioners of different states. It shows the comparative statistics of twenty-one street railway companies in towns of 50,000 inhabitants, or less, and in different sections of the country. It gives the population of the various cities mentioned, the number of times the population is carried per annum, the ratio of the operating expenses to the gross receipts, etc.

Operations of 21 Electric Roads in Towns of 50,000 Inhabitants or Less; Compiled from R. R. Commissioners' Reports.

Name of Road or City.	Population 1890.	Capital Stock.	Bonds.	Miles Track.	Gross Earnings.	Operating Expenses.	Net Earnings.	Passengers Carried.	Times Pop. Carried per Annum.	Gross Earnings per Capita.	Ratio O E / G E	Remarks.
Auburn, N. Y.	25,858	50,000	200,000	5.5	$36,729	26,473	10,256	765,749	30	$1.50	72	Elec., June 30, '93.
Amsterdam, N. Y.	17,264	250,000	170,000	7.5	44,598	32,399	12,199	586,914	35	1.75	.....	Elec., June 30, '93. Furnish elec. power. Receipts from same $19,500.
Findlay, O.	18,674	200,000	200,000	8.5	45,855	30,829	15,025	917,100	48	2.40	67	Elec., 1891.
Des Moines, Iowa	50,093	1,000,000	600,000	34	186,054	113,956	72,006	3,836,125	76	3.80	60	Elec., Dec. 31, '91.
Erie, Pa.	40,634	400,000	200,000	23	125 648	70,529	55.118	2,636,620	64	3.20	59	Elec., Dec. 31, '91.
Fitchburg, Mass.	29,302	167,000	39,000	13	94,672	64,816	29,856	1,430,465	49	2 45	68	Runs to Leominster. Pop. 7,266. Elec., Sept. 30, '93.
Galveston, Texas	29,084	1,000,000	300,000	38	156,448	101,378	55,069	3,071,789	106	5.30	65	Elec., Dec. 31, '91
Gloucester, Mass.	21,262	180,000	60,000	8	52,694	35,860	16,834	1,047,296	50	2 50	68	Elec., Sept. 30, '92.
					58,736	37,446	21,290	1,171,670	55	2.75	64	" " 30. '93.
Harrisburg, Pa.	39,385	125,000	... .	11	107,459	66,489	40,969	2,127,672	55	2.75	62	Elec. June 30, '91.
Jamestown, N. Y.	*25,000	1,000,000	300,000	18	75,949	65,723	10,226	1,719,620	.....	.....	.....	Elec., June 30, '93; *Pop. estimated. Road runs to Cayuga Lake.
Norwalk, Conn.	20,000	70,000	60,000	3½	11,646	4.698	6,948	232,926	46	2.30	.....	Elec., 4 mos. operation, from July 4th to Nov. 4th, '93.
Pawtucket, R. I.	27,502	200,000	.....	12	62,249	52,727	9,522	1,222,435	44	2.20	84	Part horse & elec., Dec. 31, '91.
Schenectady, N. Y.	18,393	300,000	300,000	5.2	74,143	54,890	19,253	745,416	40	2.00	.....	June 30, '93. Furnish elec. power. Receipts from same, $38,000.
Taunton, Mass.	25,488	100,000	.....	13	44,963	40,014	4.949	862,005	34	1.70	88	Horse, Sept. 30, '93,
Springfield, Mass.	58,186	1,000,000	.....	34	391,173	291,559	99,614	7,551,473	130	6.50	74 Taxes Incl'd'd	Elec., Sept. 30, '93. Run to Chicopee, 14,007 pop. included.
Brockton, Mass.	39,021	250,000	300,000	22	142,082	99,963	42,119	3,010,831	77	3.85	68	Elec., Sept. 30, '92; has branches to Avon, Holbrook, Whitman, Randolph.
Augusta.....10,521 Hallowell..... 3,147 Gardiner..... 5,481	19,152	.....	... .	.....	41,349	27,464	13,885	826,940	41	2.05	66	Elec., June 30, '93.
Waterville.....7,091 Fairfield.....2,500	9,591	... .	.....	.....	16,519	12,749	4,411	330,380	34	1.70	77	Elec., June 30, '93.
Plymouth.....7,292 Kingston.....1,582	8,874	70,000	35,000	6¼	28,711	19,859	8,852	504,115	56	2.80	69	Elec., Sept. 30, '93. Has $12,000 surplus.
Glens Falls.....10,386 Fort Edward... 3,242 Sandy Hill..... 3,662	17,290	120,000	100,000	8	37,669	26,665	11,004	693,955	41	2.05	70	Elec., June 30, '93.
Attleboro.....7,575 N. " .....6,727 Wrentham.....2,742	16,044	60,000	50,000	6½	38,688	30,493	8,195	775,876	47	2.35	77	Elec., Sept. 30, '93.

The Brownlee Injector.

This injector, which is handled exclusively by the Young Lock Nut Company, of New York, is giving excellent results on a number of stationary and locomotive boilers, and has a number of advantages. The special points of excellence claimed for this injector are: That it is strong and simple; it may be attached either to the boiler or to the steam pipe; shaking and jarring will not cause it to break; it will lift hotter water than the usual forms employed; variations of the steam pressure will not cause it to break; if a check valve or feed pipe leaks, the plug as designed acts as a check and prevents the boiler from emptying; any part may be removed without it being sent to the factory, the parts being made interchangeable.

A special feature of the injector is the absence of valves, the only part approaching a valve being a conical way-plug, by which the operation of the injector can be controlled.

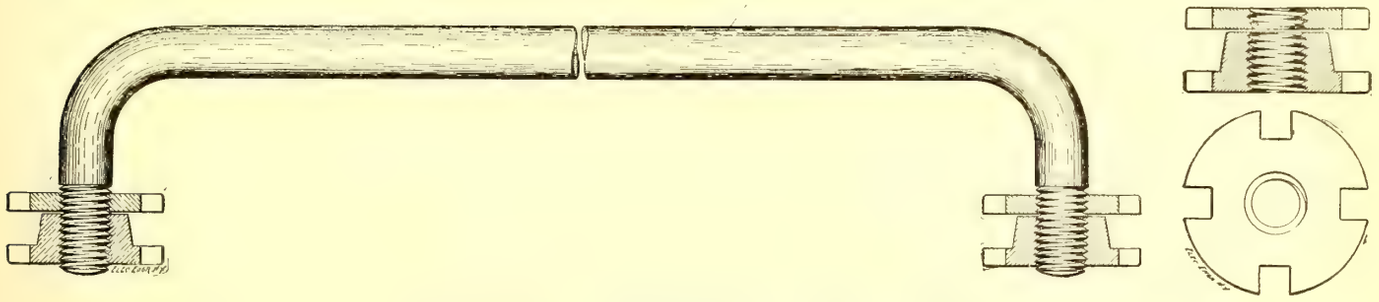
The Johnston Rail Bond.

Reference is made elsewhere in this issue to the new type of rail bond invented by A. Langstaff Johnston, engineer of the Hestonville, Mantua & Fairmount Passenger Railway Company, of Philadelphia, Pa., and manufactured by the Car Equipment Company of that city.

The peculiarity of the bond consists in the method of connection with the web of the rail. This is made by providing the bond with two nuts, one of which is cone shaped. These are brought up tight to make perfect electrical connection, and by their amount of surface provide a contact surface at the rail, having twelve times the cross section of the bond itself. This gives no points of increased resistance to produce places of low electro-motive force along the line, and as the bond makes a perfectly watertight connection, there can be no deterioration in the conductivity at these points. Fig. 1 shows the bond complete, and Fig. 2 view of nuts employed. As will be seen, the system is applicable to any size of bond wire.

The bond has been used exclusively on the line of the Hestonville, Mantua, & Fairmount Passenger Railway and on other roads.

To get perfect electrical contact with the web of the rail, it is necessary to face the latter immediately surrounding the hole, in order that the contact ends may have a clean, bright surface against the side of the rail. The Car Equipment Company, the manufacturer of this bond, has made special tools for facing the rail for the contact of these nuts, by which the work is admirably accomplished.

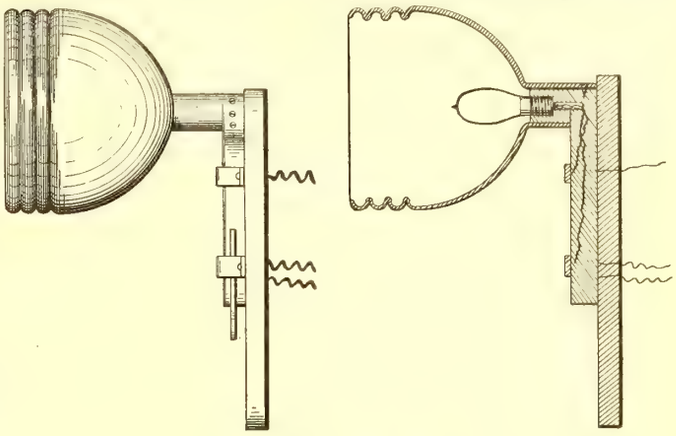


FIGS. 1 AND 2.—JOHNSTON RAIL BOND AND NUTS.

An Electric Headlight.

The Changeable Electric Headlight Company, of Syracuse, N. Y., has recently put upon the market an electric headlight, which is shown herewith. The principal argument which has been advanced against electric headlights of the past has been that when the trolley was off the wire, or the car had left the track, the headlight, which was an important part of the equipment of the car, went out.

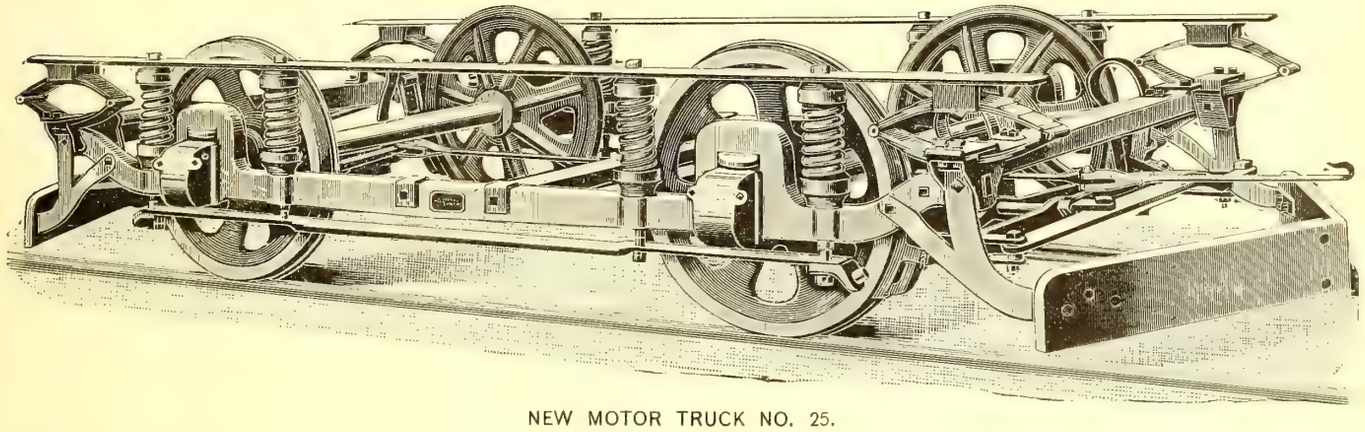
While this argument might have some weight in the early days of electric railroading, the Changeable Electric Headlight Company believes that it is no longer of importance, and that the advantages of an electric headlight far outweigh any disadvantages. The arrangement is very simple, as shown. The headlight can be changed from one end of the car to the other easily. The chief advantages are that the expense of cleaning an oil lamp and chimneys is avoided, and that the light costs practically nothing for maintenance.



ELECTRIC HEADLIGHT.

New Motor Truck.

We present herewith an engraving of a motor truck, No. 25, manufactured by the Dorner & Dutton Manufacturing Company, of Cleveland, O. The truck has solid forged side frames made from refined iron and without bolts or nuts. On these frames are carried the cross bars for motor supports and brake rigging. Round pressed rubber springs are used between the axle box yokes and the top of the journal boxes to prevent any strain and jolts to the truck and car body when passing over rail joints and crossings. These springs also go far toward preventing the pounding of the rail joints.



NEW MOTOR TRUCK NO. 25.

The car body is supported on eight spiral and four elliptical springs arranged in the manner shown. The ends of the side frames are inclined upward to allow truss braces for long car bodies.

The truck has a compound lever brake, the leverage being twelve to one. Attachable brake shoes with malleable iron heads, and cast and wrought iron surfaces are used. The journal boxes are dust tight and self oiling, and are equipped with phosphor bronze bearings. The axles are of the best forged steel or iron, and free from welds. Extra heavy wheels complete the equipment.

THE Slate Belt Electric Street Railway Company, of Bangor, Pa., was organized April 27 with a capital stock of $200,000. Thos. H. Seem of Bangor, is the president of the company. Other stockholders are Wm. A. Winsboro, Geo. W. Mackey and Charles N. Miller, all of Bangor.

The Works of the Curtis Electric Manufacturing Company.

The operation of electric motors, and the conduct of electric apparatus under service, are familiar to our readers, but comparatively few, perhaps, are familiar with the details of manufacture. A trip through a well equipped motor manufactory will reveal to many street railway managers that the care and attention to details required in the manufacture of generators and motors is greater than many appreciate. A representative of the STREET RAILWAY JOURNAL had recently the pleasure of inspecting the works of the Curtis Electric Manufacturing Company, of Jersey City, N. J., whose apparatus is now meeting with extended use, and from whose factory motors are now being turned out at a rapid rate.

The Curtis works are situated on Pacific Avenue, Jersey City, directly on the line of the Newark branch of the Central Railroad of New Jersey, and about one mile from the main terminus of the road. The works occupy a single building, 75 × 100 ft., and constructed especially for the purpose for which it is now used. It is five stories in height, and has a steel frame and floor beams, with corrugated iron sides. The building is isolated from any other, so that the workmen have practically perfect light and air, while at night, when work is being carried on by artificial light, the building presents a brilliant spectacle.

On entering the ground floor of the factory, the visitor enters the business office of the company, near which are the quarters of the treasurer and bookkeeping departments. Passing through these he enters the main shop where all the heavy machine work is performed, and where the completed motors are shipped. A spur from the Central Railroad of New Jersey runs entirely through the shop, and freight cars can be here loaded with motors by a swing crane. On the occasion of our recent visit we noticed a number of motors being shipped to Brooklyn to complete the recent order for 120 equipments from that city for the Brooklyn Heights Railway Company, also a number of motors destined for Baltimore, Philadelphia and other cities.

Along the western side of this room are located the heavy planers, most of which were built by the Pond Machine Tool Company, of Plainfield, N. J. Here are brought the rough steel castings which form the frame of the Curtis motor. Close to these planers are a number of Niles radial drills on which the fields are drilled. Both planers and drills are provided with special features for the work to which they are devoted. The third operation to which the castings are subjected is that of boring the fields. This is accomplished on boring mills. Each of these borers turns out a field in nine hours. It should be mentioned that all handling of heavy castings is done by a series of traveling cranes, mostly of the Harrington make, by which a field can be transferred from any portion of the works to another. At the south end of the building are located a number of heavy Bliss punches for stamping out the armature disks from sheet iron, each armature core containing over 900 disks. Some of these punches are employed for stamping blanks from the sheets, and others for slotting and cutting keyways in the disks. Close to these punches the work of armature manufacture is



FIG. 2.—TAPING DEPARTMENT—CURTIS WORKS.

completed by hydraulic presses, manufactured by R. Dudgeon, of New York. This compresses the disks required for an armature under 15,000 lbs. pressure, after which, and while the pressure is on, the disks are bolted together on the shaft.

The stock room of the company is also located on this floor. It occupies the southwest corner of the building, and all material received by the works, whether it be a car load of coal, or box of mica, has to pass through this department and be recorded. All records of shipments are made here also.

From this floor we will next pass to the third floor, upon which are located all of the light machine tools. All of the armature work and all of the pinion and gear turning and cutting is done here. The machines for this class of work are located along the east side of the building, and the lathes here are from the works of Pratt & Whitney, Brown & Sharpe, and the Niles Tool Works, and are the very finest

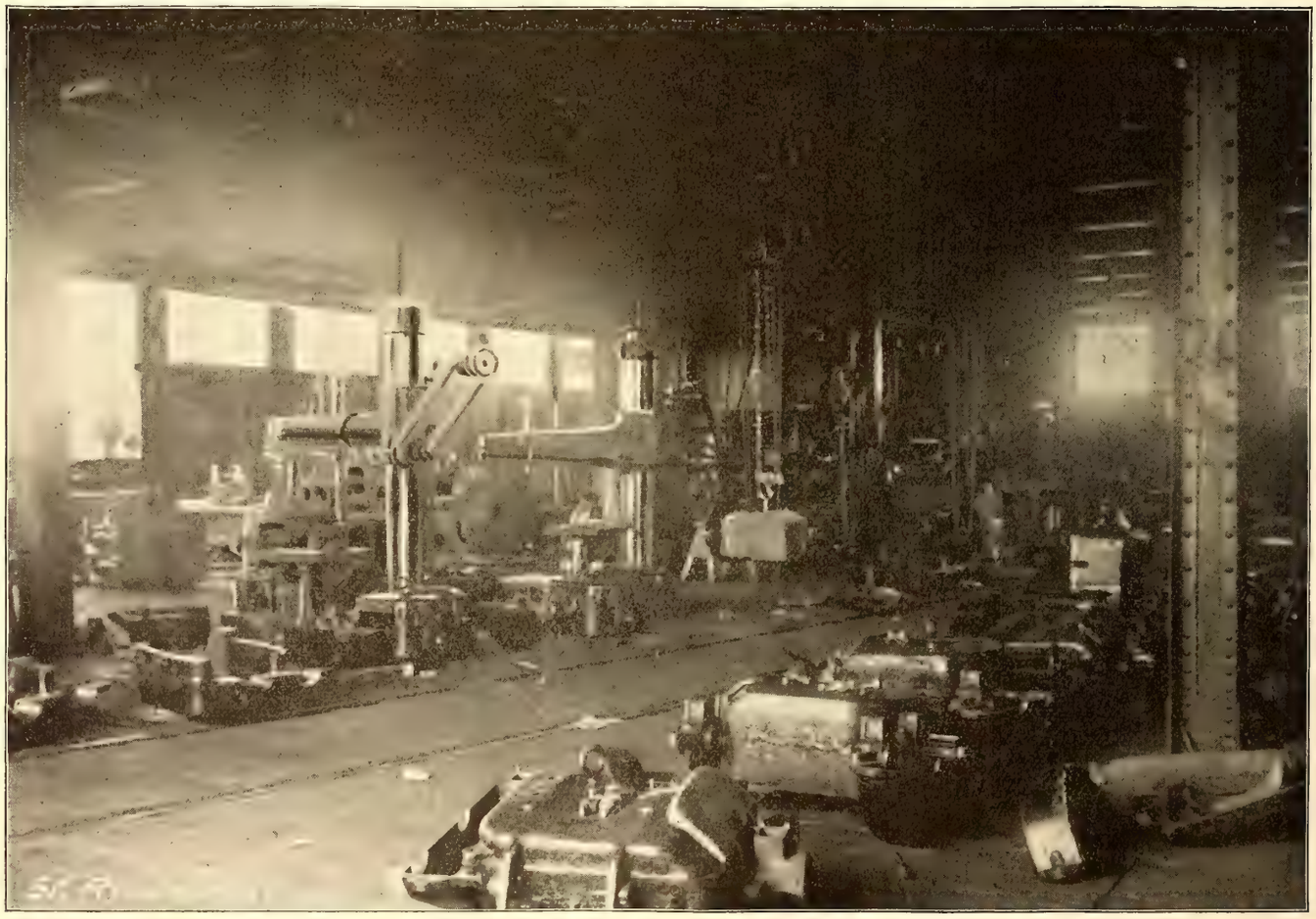


FIG. 1.—SHIPPING DEPARTMENT, MAIN FLOOR—WORKS OF THE CURTIS ELECTRIC MANUFACTURING CO.

tools made to-day. The pinion blanks are here cut to gauge, are bored, reamed, faced, keyseated and slotted. The shafts are turned here also, all this work being done to gauge, and all parts being interchangeable. Among the machines noticed here are Beaman & Smith millers, for milling the split gear faces, Lodge & Shipley gear lathes, for turning up the gear blank, reaming it out and facing it up, automatic gear cutters, a Niles slotter, Brown & Sharpe vertical chucking machines, and a pinion tooth cutter of the same make, capable of cutting two pinions at the same time. All the bolts, pins, rails, bushings, pinions, etc., are also manufactured in this department.

The machine tools for copper and brass work are located at the northern end of this floor, among them being a number of tools for finishing up the commutator bars, slotting controllers, a number of complicated lathes, manufactured by the American Tool Company, of Providence, which is capable of performing the work of some half dozen other tools, such as cutting, facing, milling, threading, tapering, etc. In the northwestern part of this floor the controllers are assembled, and the commutators placed on the armatures and finished up preparatory to testing.

The northeast portion of this floor is partitioned off for a tool room. Here are kept the standard calipers and other measurements for all the work done in the factory. All of these gauges are returned to this department every night, and before being given out in the morning, are tested with a standard set, which is kept locked up and not even allowed to be used in the tool room. This portion of the work is carried on by the most expert mechanics, and the gauges, calipers, etc., are standardized by Brown & Sharpe verniers, which are set by a magnifying glass, and which shows variations of .00025 of an inch. All the special tools used in the factory are manufactured here. The slotting punches for the presses are kept here, and all tools come to this department to be sharpened. The equipment of this department includes Pratt & Whitney lathes, shapers, drills, Brown & Sharpe grinding machines and other tools of all kinds, etc.

The floor above this, which is the top floor, is devoted to the assembling of the commutators and the manufacture of the rheostats. It contains a cutting machine for manufacturing the rheostat strips from sheet iron, and a folding machine by which these strips are given their proper shape, after which the sheet mica for separating the laminæ is slipped into place.



FIG. 3.—CONTROLLER DEPARTMENT—CURTIS WORKS.

We have now followed both the field and armature in their processes of manufacture until they are ready to be wound with their electrical conductors. This work is performed on the second floor of the factory. All coils used for both armature and fields are machine wound, and of course all winding is done before the coils are set in

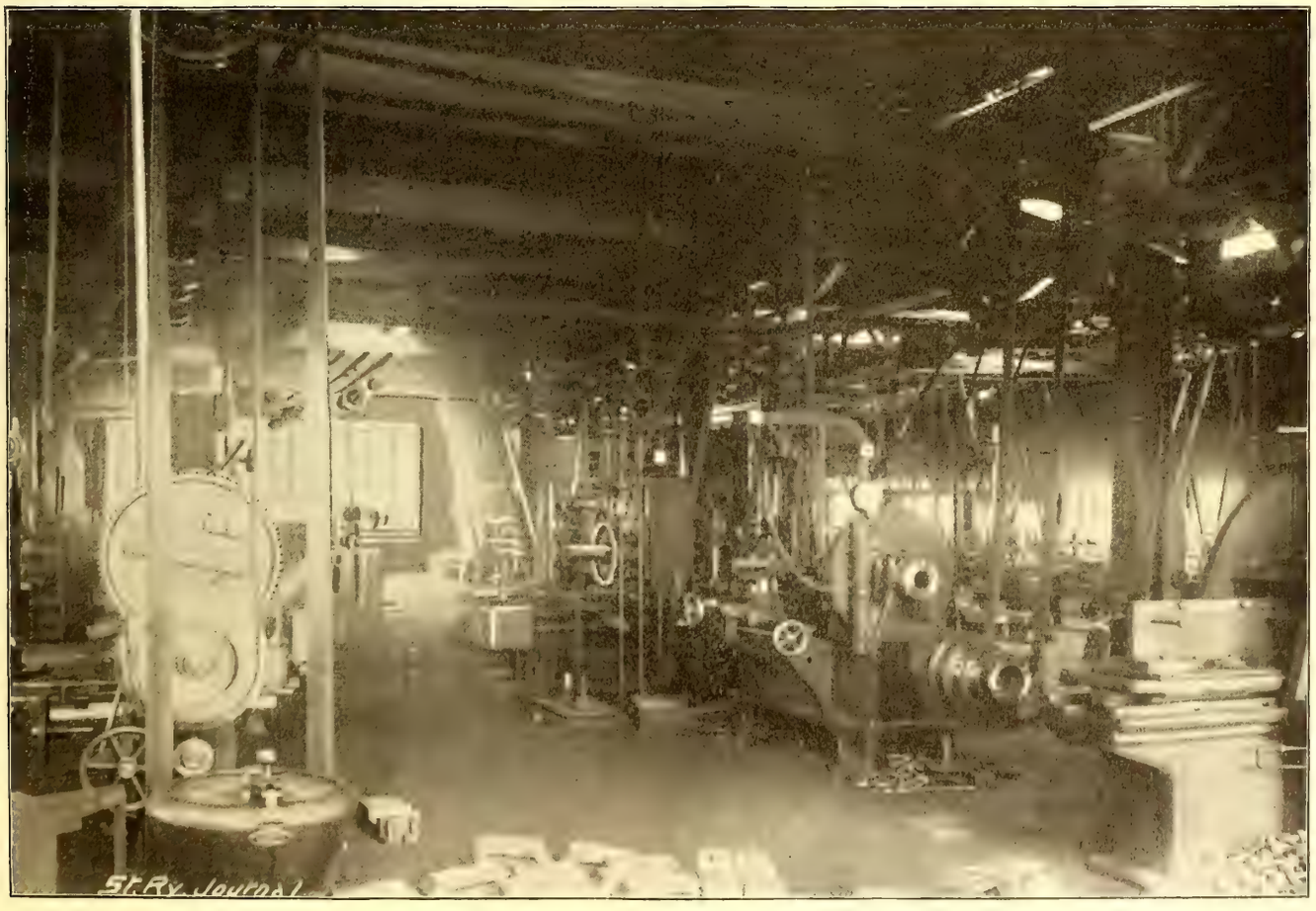


FIG. 4.—LIGHT MACHINE SHOP—WORKS OF THE CURTIS ELECTRIC MANUFACTURING CO.

place. The armature coils, after coming out of the form on which they are wound, are first shellacked, then dried. They are then wound with several coverings of insulated tape, then bent on a special machine into the proper form to fit the armature. The next stage is to assemble the coils on the armature core where they are clamped in place by a plate and nut, threaded on the shaft. Wooden strips are then driven in above the coils and tied down with binding wire. The commutator is then slipped on and the lead wires soldered to the commutator bars. The commutator is insulated from the head of the armature by mica cloth, and is held in place on the shaft by a long key and heavy nut. By oil guards and grooves cut in the armature shaft oil is prevented from coming out on the commutator.

The field spools, after being wound on this floor, are bent into the proper shape on a forming machine, are then taped, then enveloped with sheet mica, then wound with another coil of tape. They are then shellacked and placed in the baking room to be dried.

The final stage is now reached, that in which the apparatus is tested before being sent out for service. This is accomplished in the



FIG. 5.—WINDING ROOM—CURTIS WORKS.

basement of the building. The motor is mounted on a shaft in the position in which it will operate. It takes current from a 500 volt generator, which it also drives as a motor by means of a countershaft, the auxiliary power being taken from the driving shaft of the building. This portion of the work is most carefully carried on, and complete records of every test are preserved by the company.

In the basement is also located the steam plant for operating the factory. This consists of two Babcock & Wilcox boilers of 125 H. P., which supplies steam to a McIntosh & Seymour engine. This engine is at present overloaded, and will soon be replaced by one of 150 H. P. capacity. The heating plant, consisting of a Sturtevant blower, which drives air through a nest of steam pipes, and the lighting plant, comprising a 300 light machine, are also located on this floor.

Throughout the entire work the greatest care is taken to insure the very best results, and to this is largely due the excellent reputation enjoyed by the Curtis motors. The company is always glad to receive visitors interested in street railways at its works and to allow them to inspect the various processes of manufacture.

The Works of a Large Wrought Iron Bridge Company.

The works of the Wrought Iron Bridge Company, which are situated at Canton, O., comprise one of the best equipped shops for the handling of heavy material in this country, and a trip through the immense establishment of this concern will be found both interesting and instructive. As the work of this company is well known in power house construction, a brief description of some of the most interesting features is published herewith.

A distinctive feature of the plant is the transmission of power by electricity. Instead of using the old fashioned, cumbersome and power consuming shafting and belting, the power from the engine room is distributed among the various departments electrically. The Wrought Iron Bridge Company is said to have been the first bridge company to adopt this method of transmission. It is giving good satisfaction, and the superintendent says that he would have no other. Twenty-two motors altogether are used, and the company has never suffered five minutes' delay on account of accident to dynamos or motors.

The plant is built on a tract of land, twelve acres in extent, in one of Canton's suburbs. It is located on the Coshoston and Zanesville branch of the C. C. & S. R. R., and independent switches are run to the works from the Baltimore & Ohio Railroad, and from the Pittsburgh, Ft. Wayne & Chicago Railroad, thereby giving it excellent shipping facilities. Electric cars run within seven minutes' walk of the office, and it is understood that they will, in the near future, run directly by the company's ground.

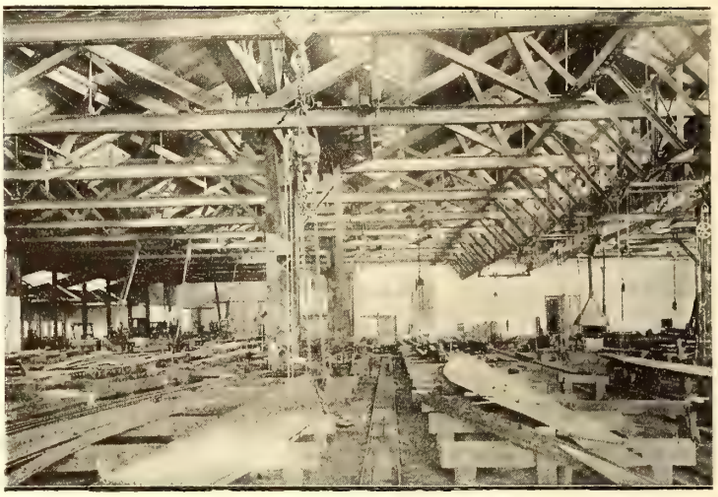


FIG. 2.—INTERIOR OF NEW WORKS OF THE WROUGHT IRON BRIDGE CO.

The main switch track from the railroad enters the ground at the northeast corner, and from it switch off other tracks which distribute the material to the different departments. The stock house and skids are accessible by narrow gauge tracks, on which suitable cars convey the material to the shops, as requirements demand. The material for built up members is conveyed to the shops on the north track, unloaded on adjacent skids in the shop, laid off and marked for punches and shears. The material then passes from the punches and shears to the straightening machines or conveying rolls, then to the assemblers, and

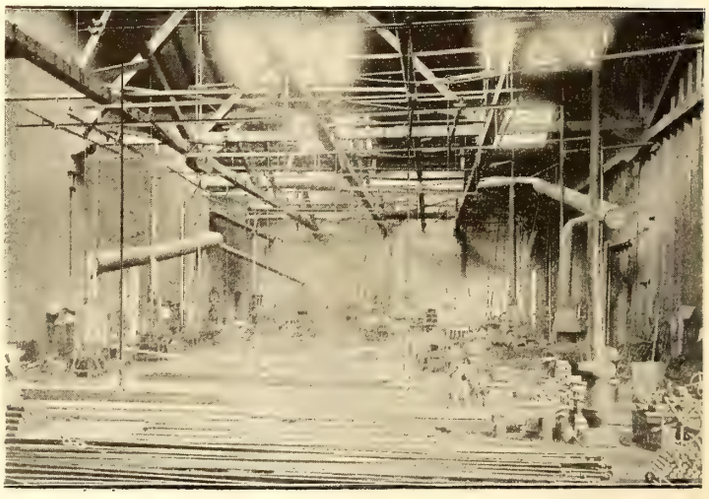


FIG. 3.—SMITH SHOP—WROUGHT IRON BRIDGE CO.

from the assemblers to the reaming tools. From the reaming tools it passes to the riveters and riveting machinery; then to the planers, fitters and drills; lastly to the storage department, when it is ready for shipment.

The several operations through which the material passes are carried on by machinery especially designed for the work performed, and the progress of the material while undergoing manufacture is from north to south. When it arrives at the south side it is in a finished condition ready to be loaded on cars for transportation to its destination.



FIG. 1.—NEW WORKS OF THE WROUGHT IRON BRIDGE CO.

The main railroad switch track enters the shop on the south side, four feet below the level of the main shop floor. For fourteen feet on each side of the track for a considerable distance, arrangements have been made for the storage of finished work, thus permitting the operation of painting and loading to be carried on under cover. The plant has a total loading capacity of 500 ft. of track.

The main building covers a square area 256 ft. on a side. Of this the first thirty-one feet in depth from the north side is divided into smaller departments. All but 188 × 64 ft. on the southeast end is used as a main shop for the manufacture of built up members. A space 150 × 64 ft. at the southeastern end of the building is used for a forge shop. This is connected by narrow gauge tracks with the yards, stock house and main shop. Each line of trusses every sixteen feet apart is built with a lower member adapted for the use of a trolley, giving every trolley, except on the column lines, a travel across the entire shop of 225 ft.

The engine room is 38 × 64 ft., and contains besides the engines, the electric power generators, incandescent and arc light dynamos, air compressors, receivers, pressure and heating fans. The engines were built by the Russell Engine Company, of Massillon, O., and General Electric generators are in use. The boilers are of the Hazelton or Porcupine type, and are giving excellent satisfaction. A Bunnell feedwater heater and purifier, manufactured by the Bradley Manufacturing Company, of Syracuse, N. Y., is employed, extracting all lime or other foreign matter from the water before it passes into the boilers. The furnace is equipped with the Murphy smoke consumer. The exhaust steam, besides heating the feedwater, is used during the cold weather for the heating of the works.

The Wrought Iron Bridge Company has laid the foundation for solid growth by providing the best of facilities for economical manufacture, and with the advantages which the company possesses its managers feel certain that they will receive a fair share of the street railway business.



FIG. 4.—ENGINEERS' ROOM—WROUGHT IRON BRIDGE WORKS.

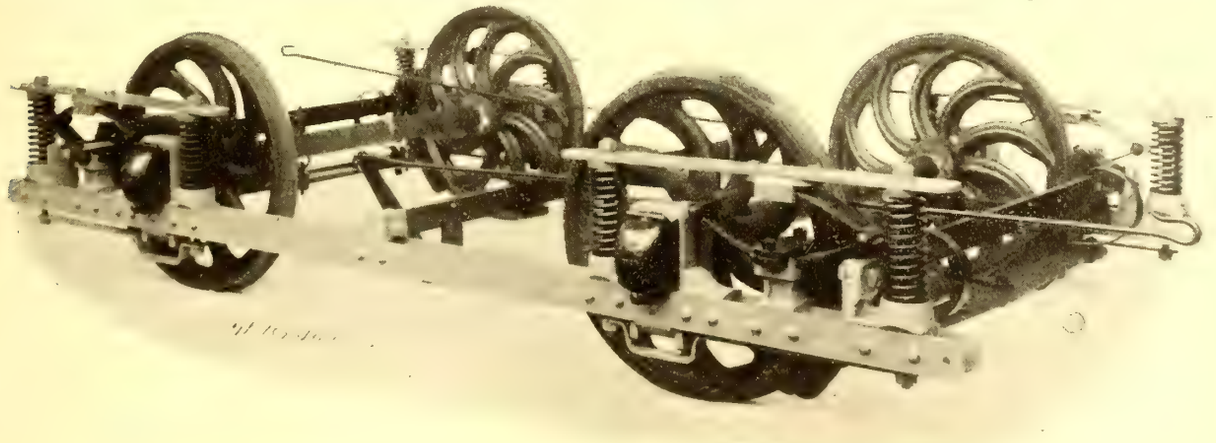


FIG. 5.—DRAFTING DEPARTMENT—WROUGHT IRON BRIDGE WORKS.

New Elliptical Spring Truck.

The accompanying engraving shows a new elliptical spring truck put upon the market by the Sheppard Manufacturing Company, of Louisville, Ky., and called by its makers their No. 3 motor truck. In general design the truck is similar to others made by this company, except that there is the addition of the four elliptical springs shown.

As will be noticed, the truck uses a coil or spiral spring outside of the elliptical spring, differing in this respect from the usual arrangement. In the opinion of the managers of the company, this disposition is far superior to the ordinary method and has shown in practice most excellent results. On the track the car rides easily and steadily, and the oscillation is reduced to a minimum on good track, while on a rough roadbed there is none of that disagreeable jar, resulting from too stiff elliptical springs, placed at the extreme end of the spring base. The company looks forward to a large sale of this truck.



NEW ELLIPTICAL SPRING TRUCK.

Electric Welding of Rails in St Louis.

The Johnson Company, of Johnstown, Pa., shipped one of its two electric welding equipments to St. Louis during the latter part of the winter, and rail welding has been going on ever since it has come upon the ground. The Baden & St. Louis Railroad is the company for which the work is being done, and as its management is anxious to have the road completed as soon as possible, so as to catch the summer travel to Calvary and Bellefontaine cemeteries, welding has been going on night and day, two shifts of men being required for the purpose.

The process of electrically welding rails in this case is as follows: The tender car goes ahead of the welding car to prepare the rails for the process. To make a good weld it is absolutely necessary that the ends of the rails come in contact at all points, and to insure this they are ground with an emery wheel. In case the rails are too far apart, a clean cut shim, or thin section of a rail, is placed between the two, fitting tightly and insuring a good weld. Babbit metal clamps are then applied to the joint, holding the ends evenly and tightly together. The welding car then comes along with its own power, it being provided with two motors, and the traveling crane with the welding apparatus is lowered, so that the joint is between the two jaws of the welder. Two pieces of steel of the same quality as the rails are put one against the lower half of their channels on one side and the other on the lower half of the other side.

The jaws of the welder, whose inner faces are of Babbit metal, then come together, being actuated by a hand wheel, and hold the two pieces of steel tightly to the joint. The alternating current General Electric dynamo is then started up, but the current is not transmitted to the welder until the dynamo is at full speed. When the current is turned onto the welder the steel pieces rapidly become molten, and at the end of an average of four minutes they have formed a homogeneous mass with the rails. The same process is gone through with the upper halves of the rails, and in this case also the average time required for a weld is four minutes. When the welding is finished a ridge formed

across the head of the rail during the process is hammered down while in a soft state. The average time consumed at each joint is about ten minutes, that is, from the time the current is applied to the joint till the time the welder is removed. To insure good work care is taken to keep the voltage constant at the power station of the Cass Avenue & Fair Grounds Railway, whence current is obtained. All joints are gone over and inspected to be made reliable. Current is supplied to the car through a trolley wire strung along the line, and is transformed on the spot from a constant to an alternating current.

The Peckham Automatic Life and Wheel Guard.

An automatic life and wheel guard, combining simplicity, lightness and strength, was recently placed on the market by the Peckham Motor Truck & Wheel Company, and is shown in the accompanying engravings.

The guard is constructed of one inch wrought pipe, and carries a wire screen, five feet eight inches long and thirty inches wide. It is attached to the guard plank by two cast iron brackets, in which are pockets for two spiral springs, one of which allows an upward movement, in case of striking an immovable object. The rear extension is bolted to the truss bar of the truck, and is provided with three holes, so that it is easily adjustable, and can be carried at any distance above the track. It is inclined at a slight forward angle, so that in striking any movable object the springs allow the screen to drop to the track.



FIG. 1.—CAR EQUIPPED WITH PECKHAM'S FENDER.

The cut, Fig. 1, shows the fender as applied to one of the cars of the Consolidated Traction Company, of New Jersey.

The Manchester (N. H.) Street Railway Company has been granted permission by the City Council to equip its lines with electricity.

Compound, Duplex, Double Plunger Pump for Boston.

The accompanying engraving illustrates a pump which was recently built for the West End Street Railway Company, of Boston, by the Deane Steam Pump Company, of Holyoke, Mass., and which differs in a number of particulars from the standard type of that company. It is of the compound, duplex, double plunger pattern, with eleven inch, high pressure steam cylinders, twenty-four inch low pressure steam cylinders, eleven inch water plungers and eighteen inch stroke. The general arrangement of the parts of the machine is of the well known duplex style. There are two plain slide valve steam engines and two double acting pumps, each pump and its engine so arranged by the side of and connected with the other that the steam valve of each is operated by the steam piston of the other. In this way great certainty of action and a remarkably uniform delivery from the pump is secured.

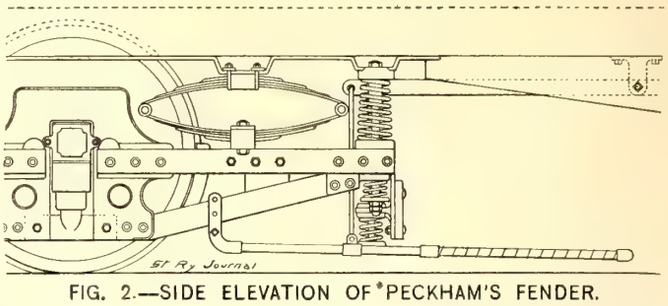
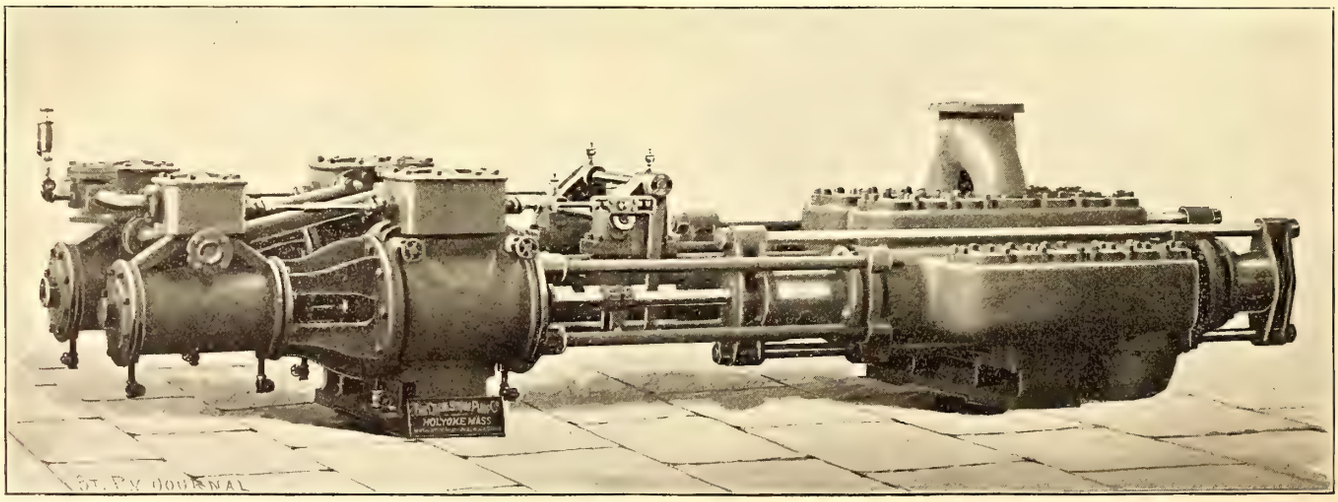


FIG. 2.—SIDE ELEVATION OF PECKHAM'S FENDER.

The machine has water cylinders of special design, each being cast in one solid piece very thick and heavy. The valves are of rubber of special composition for heavy pressure, and are arranged in separate chambers, each having its individual cover, thus affording the greatest strength and most convenience. The plungers have outside stuffing boxes, so that any leak can readily be detected and instantly adjusted. This machine is especially recommended to work against a heavy pressure. The pump at the station of the West End Street Railway Company is feeding boilers of 6,000 H. P. capacity with 200 lbs. pressure.

"Deane" independent condensers and boiler feed pumps are used in the following street railway power stations: Union Railway Company, New York; Lynn & Boston Railway; Worcester, Leicester & Spencer Street Railway; New Haven, Conn.; Springfield, Mass.; Holyoke, Mass.; Titusville, Pa.; Lowell, Mass.; Brockton, Mass.; Atlanta, Ga.; (Brooklyn) Atlantic Avenue; Nashville, Tenn.; Bethelem, Pa.; Toledo, O.; Pittsburgh, Pa.; Cleveland, O.; Galesburg, Ill.; Weston, W. Va.; Hartford, Conn.; Northampton, Mass.; Providence, R. I., and many others.



COMPOUND, DUPLEX, DOUBLE PLUNGER PUMP FOR BOSTON.

New "American" Engine.

We present to our readers on this page illustrations and description of a high grade automatic engine, built by the American Engine Company, of Raritan Avenue, Bound Brook, N. J., a company organized in 1893 with a capital of $200,000. This company bought from the American High Speed Engine Company its fine plant, and adopted the name of "American Engine Company."

The claims made by the manufacturers are as follows: This engine possesses the remarkable features of retaining all the simplicity of the single valve engine while distributing the steam as in the Corliss and other complicated engines, which give the highest attainable steam economy.

Fig. 1 is a view looking at crank side of the engine. The foundation is protected from oil and water by a bead which extends around the outer edge of the base and conducts the oil, etc., to a pit under the crank disk, from which it is drawn out through a pipe and saved for filtering to be used again. The bed plate from the cylinder to the main bearing extends above the center line of strains, ensuring perfect rigidity and freedom from springing.

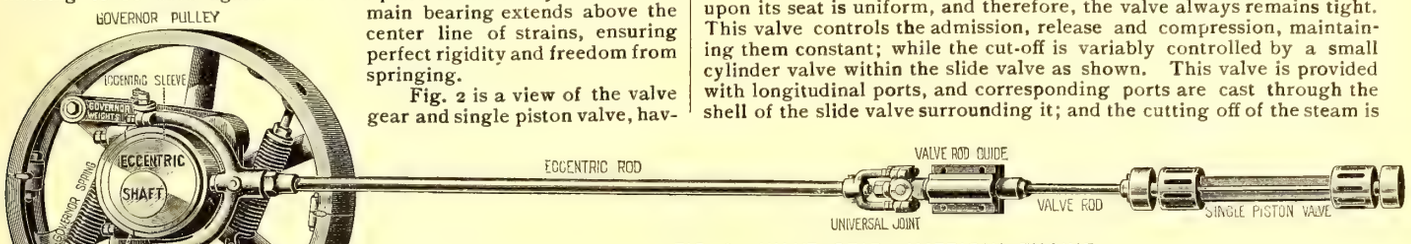


FIG 2.—VALVE GEAR—AMERICAN ENGINE.

Fig. 2 is a view of the valve gear and single piston valve, having the usual annular ports, one at each end, which control the admission of steam to the cylinder, the release and compression being controlled by the ends of the valve. The peculiarities of this valve gear are: First, the eccentric is fixed to the shaft, which makes the reciprocations of the valve invariable, thereby giving a constant admission, constant release, and constant compression. Second, the automatically variably cut-off is produced as follows: In addition to the annular ports, this valve is provided with longitudinal ports, and corresponding ports are cast in the stationary sleeve which is within the steam chest. As the inner ends of the valve are closed, steam, in order to get into the cylinder, must pass through these longitudinal ports, and will so pass when the ports in the valve coincide with the ports in the stationary sleeve; and the flow of steam to the cylinder will be cut off when these ports do not coincide.

This opening and closing of these longitudinal ports call for a twisting motion to be imparted to the valve. This is accomplished by the eccentric sleeve, mounted upon the eccentric having a diagonal, V shaped groove turned in its periphery, to which is fitted the eccentric strap. This sleeve is connected with the governor weights by links in the usual way of connecting eccentrics. As the sleeve revolves with the eccentric, being carried around by the governor weights, a twisting motion is imparted to the eccentric strap and through the eccentric rod and valve rod to the valve.

It will therefore be seen that the valve has two motions; one, an invariable reciprocating motion, the other a twisting motion, which is invariable in degree, but variable relative to the reciprocating motion. This variation is accomplished by the rolling of the sleeve on the eccentric, whenever the governor weights change their position as a result of a change in speed.

The experience of this company with piston valves condemns their use in a horizontal position. For, notwithstanding they are perfectly balanced against steam, their weight produces friction which causes wear, and soon results in leakage. The company will use them in its vertical compound and triple expansion engines, in which the weight will be supported by the valve stem in a vertical position, doing away with friction and consequent wear.

The type of valve used in the horizontal engines, consists of a flat face slide valve bearing upon a flat seat, against which it is held by the steam pressure. The valve travel is invariable; hence the wear upon its seat is uniform, and therefore, the valve always remains tight. This valve controls the admission, release and compression, maintaining them constant; while the cut-off is variably controlled by a small cylinder valve within the slide valve as shown. This valve is provided with longitudinal ports, and corresponding ports are cast through the shell of the slide valve surrounding it; and the cutting off of the steam is accomplished by twisting, or rotating the valve which opens and closes the longitudinal ports. No change whatever is required in the valve gear to actuate this valve.

The exhaust steam passes directly to an exhaust pipe cast on the under side of the steam chest, the ends only being joined to the steam chest, so that the exhaust does not come into contact with any live steam surfaces, except the ends of the main valve. The live steam is conveyed by a pipe into the steam chest through the top at the center, and is prevented from passing the ends of the valve to the exhaust by packing strips, one bearing against the steam chest cover, the other against the top of the steam chest, being kept in contact with these surfaces by the steam or by small springs when the steam is turned off

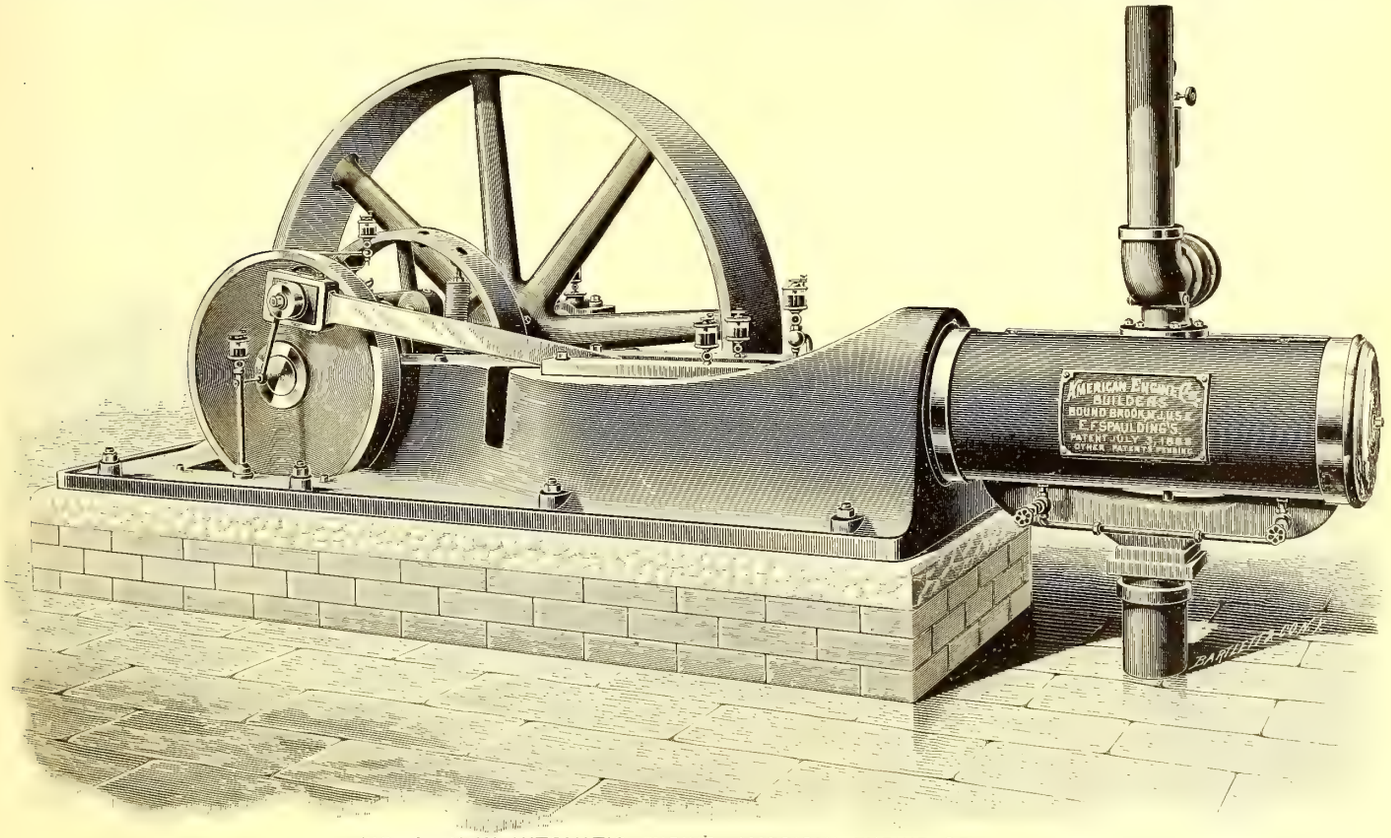


FIG. 1.—NEW AUTOMATIC ENGINE—AMERICAN ENGINE CO.

A corner piece is so constructed as to effectually close the joint where the packing strips meet at the corner. These strips are made of the same material as the valve, and are secured from moving away from the valve seat proper by a pin, but are free to move out of the groove in the valve (as wear may occur) against their bearing surfaces.

GOVERNOR FLOWER has signed the New York rapid transit bill referred to in our issue of last month, and the question as to whether the railway will be built by the money advanced by the city will be decided at popular election next fall.

The Arnold System of Electric Power Station Construction.

In building an electric power station the two principal objects to be kept in view are low first cost, consistent with the best economy, and absolute reliability. The system described herewith, which is a radical departure in central station construction, claims to secure both of these requisites, together with less cost in operating expenses; less real estate occupied; absolute flexibility; less depreciation and greater ease in handling than is usual in power plants heretofore installed. We will first describe the system as applied to an electric railway plant having a capacity of 2,000 H. P., such as would have been ample to drive the Intramural Road at the World's Fair.

Referring to Figs. 1 and 2, engines No. 1 and No. 2 are cross compound, condensing engines, having a rated capacity of 1,000 H. P. each. Generators No. 1 and No. 2 have a rated capacity of 750 K. W. each. The armatures of the generators are mounted upon steel quills, Cc, running in independent bearings, Pp, so arranged that they are free to revolve independent of either engine and of each other. Through these quills, and supported at its center bearing, D, extends a steel or wrought iron shaft, carrying upon its ends circular cast steel or iron disks, Ff, securely keyed to the shaft. The engraving shows the engines connected to generators with magnetic clutches which operate as follows: Attached to the end of the engine shafts, Aa, are circular cast iron or cast steel disks, Hh, carrying in recesses copper coils, Oo, which are connected to brushes, Qq, by means of rings, Rr, in such a manner as to permit a current of electricity to be passed through the coil while the disks are in motion. Around the vertical face of disks, Hh, near the peripheries are carried cast steel or iron rings, Ii, which are held in position on disks, Hh, by means of three gudgeons or bolts, equally spaced around the periphery of disks, Hh. Rings, Ii, are normally held against disks, Hh, by small spiral springs surrounding the gudgeons or pins. Attached to quills, Cc, are cast iron or steel disks, Jj, carrying two coils of copper wire, Mm, Nn, which are connected to brushes, Kk, so as to allow a current to be passed through the coils when the disks are in motion. If a current of electricity is passed through the coil, M, a magnetic field will be created around it which will have a tendency to attract disk I, and clasp it securely to disk I, so that power can be transmitted from one disk to the other by friction so long as the current travels through coils, M. Engine No. 1 can now drive generator No. 1 directly connected, and in like manner engine No. 2 generator No. 2, thus forming two direct connected power units. Shaft E lies idle in bearing D, and is not used except in case it becomes necessary to drive either generator from the opposite engine, or both generators from the same engine. It will also be seen that either generator or both generators are available from either engine.

By having two engines with the high pressure cylinder of one, and the low pressure of the other direct connected to the work, the plant is arranged to operate economically with any load varying from 500 to 2,000 H. P., and it is practically impossible to shut down the plant on account of any accident that would be liable to happen.

It will be observed from Fig. 1 that the main shaft of both engines is cut in the middle and the two parts joined together by means of positive jaw clutches, operated by steam cylinder. Thus when the load is light, engine and generator No. 1 are shut down. Cylinder D of engine No. 2 is cut off by means of the jaw clutch, and no portion of the plant operates, except the high pressure cylinder of engine No. 2, directly coupled to generator No. 2. This cylinder can be run condensing and the plant operated with economy, until the road requires more power, when the low pressure cylinder is brought up to speed and connected in with the high pressure cylinder without stopping the plant.

In case it becomes necessary to make repairs on the high pressure cylinder of engine No. 2, while the road is demanding full power of engine No. 1, high pressure steam may be admitted to the low pressure cylinder of engine No. 1, which it will be noticed from Fig. 1, is placed next to the generator. By working high pressure steam in the low pressure cylinder of this engine it will give its full power, thus driving its generator.

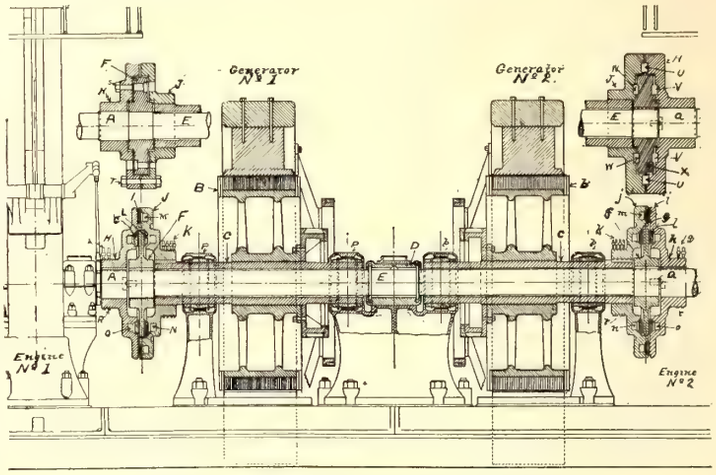


FIG. 2.—SECTION SHOWING CLUTCHES.

In order to prevent wear on the rings of the magnetic clutches above described, the following method of electrically starting the generators is covered under this system: Suppose engine No. 1 and its generator are operating, and engine No. 2 and its generator are standing idle, and it becomes necessary to throw generator No. 2 upon engine No. 1, in order to repair something on generator No. 1. Instead of starting engine No. 2 to bring generator No. 2 up to speed, or allowing the friction of the magnetic clutch to bring the latter up to speed, the following method is adopted: Current being produced from generator No. 1 is passed through the armature and fields of generator No. 2, in such a manner as to make a motor of it, until the armature attains the same speed as that of generator No. 1, when current is passed through coil, *n*, clamping disk, *f*, to disk J, without wear on the clutch mechanism.

In case it ever becomes necessary to increase the capacity of the power station designed under this system, it is done by adding two more generators to the right of engine No. 2, having similar connections to generators Nos. 1 and 2, thus making four generators available from engine No. 2. The third engine is added as the power is required.

The small engravings in the upper right and left hand corners of Fig. 2 show different forms of mechanical clutches which can be substituted for the magnetic clutches above described, if necessary. In a railway plant, the fact of having to stop the station for a few minutes at the time of changing from one engine to another is not so serious as in a lighting plant, and the above clutches have been designed for

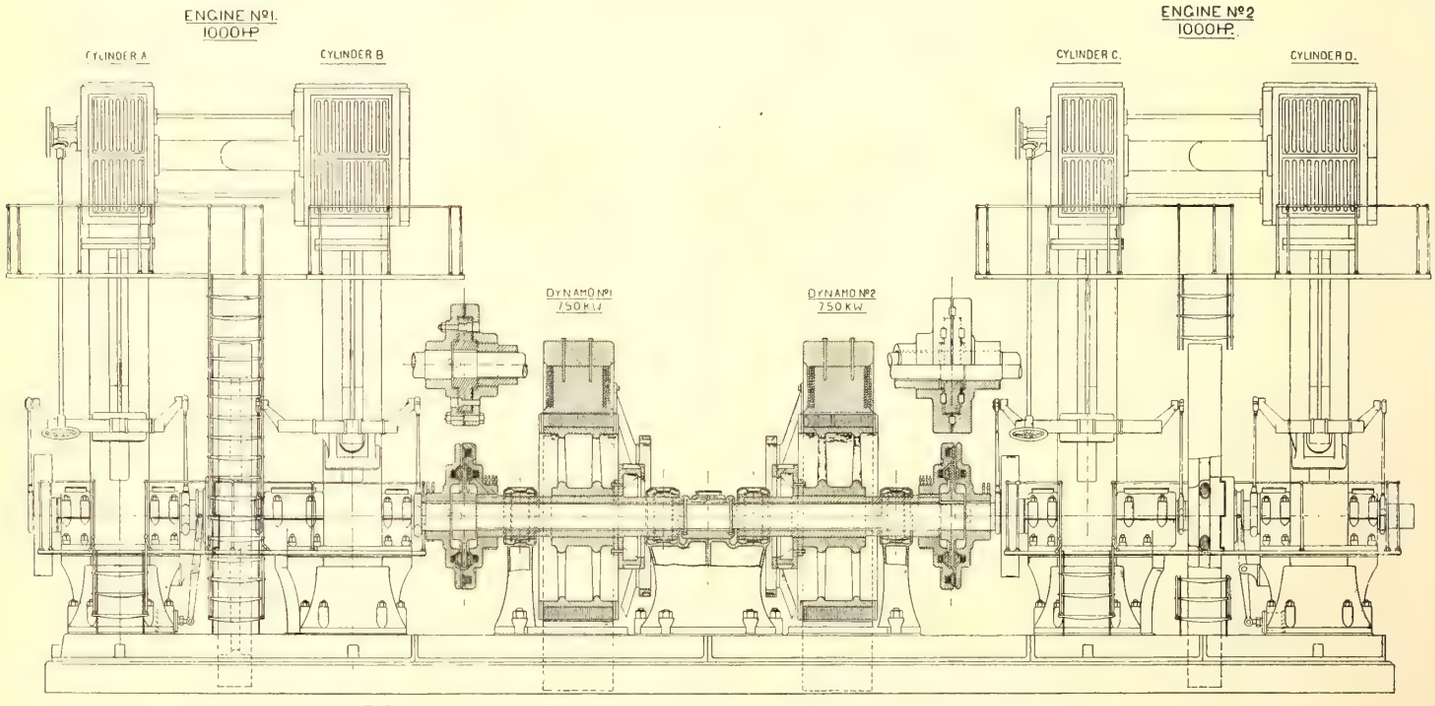


FIG. 1.—LONGITUDINAL SECTION OF ENGINES AND GENERATORS.

substitution for the magnetic clutches in case the conditions were such as not to warrant installing the magnetic clutches.

In the left hand view, H is a disk securely keyed to engine shaft, A, of engine No. 1. J is a circular disk securely keyed to quill, C, of generator No. 1. F is a circular disk keyed to the common shaft, E. If it is desired to drive generator No. 1, three bolts, T, spaced equidistant on the circumference, are used to bolt disks, H and J, rigidly together, the same as cable railway plants are operated. Engine No. 1 is thus driving generator No. 1 directly connected, without any wearing parts, except the bearings of the two machines. In case it becomes necessary to drive generator No. 2 from engine No. 2, bolts, S, are inserted as shown, thus rigidly connecting disk, H, to disk, F, and revolving shaft, E. Bolts, S, can be reversed so that disk, F, will be rigidly bolted to disk, J, permitting shaft, E, to drive generator No. 1 from engine No. 2, thus performing all the functions of the magnetic clutch as described above.

The right hand view is another form of clutch commonly used in cable railway plants. Disks, H and J, are keyed to the engine and generator shafts, respectively, and disk, X, is keyed to shaft, E. If it is desired to drive generator No. 2 from engine No. 2, two steel or wrought iron keys are inserted in recesses, U U, thus rigidly connecting the disk, H, to disk, J. By inserting the wedges in recesses, V V, shaft, E, is made to revolve from engine No. 2, and by inserting the edges in recesses, W W, generator No. 2 is caused to revolve from shaft, E, thus making the plant interchangeable in all directions.

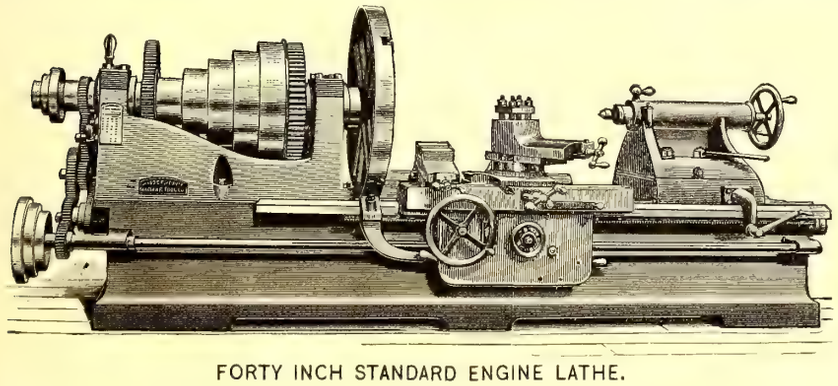
The entire plant is mounted upon cast iron bed plate construction, cast in sections and thoroughly anchored, the same as first class cable railway power construction of the present day. An important feature of the system is the fact that any standard make of dynamos and engines can be utilized, thus necessitating no radical departure from the present lines of manufacture. For this reason, many of the present plants can be rebuilt to conform to this system, and utilize a large part of their old equipment. This system, as described, was designed by B. J. Arnold, of Chicago.

Forty Inch Standard Engine Lathe.

A view of a forty inch standard engine lathe designed and built by the Lodge & Davis Machine Tool Company, of Cincinnati, O., is shown herewith. The bed is extra deep, well braced its entire length, and rests direct upon the foundation, securing perfect solidity under a heavy strain. The headstock has a long bearing on the bed; the cone pulley has five steps and is strongly back geared. The spindle is of large diameter, made from a high grade of steel, and is accurately ground to a perfect fit on a Universal grinding machine. The boxes are made from the best phosphor bronze. The end thrust is against hardened steel rings accurately ground, and provision is made for taking up the slightest wear. The carriage is heavy, and has long wearing surfaces both on the bed and cross slide. The apron is secured to it in a manner to lend additional stiffness, and the carriage is securely gibbed both front and back.

All the feeds of the carriage can be thrown in and out, or reversed from the front of the apron. The carriage is also provided with a stop which automatically throws out the feed, and which can be set at any point along the ways. This is very convenient for turning or boring, and also prevents the lathe from being damaged by any carelessness of the operator.

The lead screw is situated on the inside of the bed, where it is protected from dirt and chips. In this position it secures a central pull to the carriage, and obviates that twisting tendency which invariably takes place in lathes where the screw is placed on the outside of the bed. The compound rest is provided with power cross and angular feeds, adapting the lathe to all kinds of taper turning and boring. It is so constructed that the feeds work independently, and cannot be thrown in at the same time.



FORTY INCH STANDARD ENGINE LATHE.

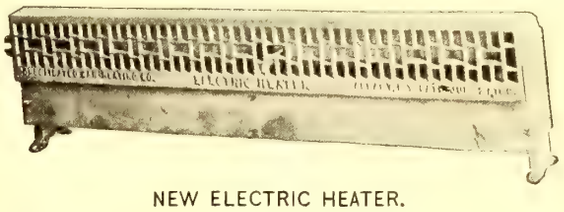
THE St. Louis County Street Railway Company, of St. Louis, Mo., of which J. B. Greensfelder is president, has opened its new line from Wellston, on the St. Charles Rock Road, to Eden, Lucas, Hunt and Natural Bridge roads to Normandy. Until the traffic justifies operation by electricity the line will be operated by horse power.

The Cleveland (O.) & Akron Electric Railway Company, with a capital stock of $300,000, has been incorporated.

New Electric Heater.

We present herewith an engraving of a new type of metal case heater recently put upon the market by the Consolidated Car Heating Company, of Albany, N. Y. This heater comes through the riser, the iron grating of the heater fitting in the panel of the riser. This, as will be seen, keeps the heater under the seat and entirely out of the way of passengers' feet and ladies' dresses.

The first cars to be equipped with this heater are those of the Norwalk Horse Railway Company, of Norwalk, Conn., which is now being changed from horse to electric power, and which will use, in connection with the heater, the temperature regulating switch of this company. The heaters are now being put on at the works of J. A. Trimble, of New York, who is manufacturing the cars.



NEW ELECTRIC HEATER.

$250 in Prizes.

The Chicago General Street Railway Company, having the construction of a permanent plant in operation, writes us that it invites outline drawings and general specifications of a model plant for the immediate use of twenty motor cars and twenty trail cars. The construction should be suitable to permit an increase in capacity to forty motor cars as occasion may require. The lot will have a street frontage on the south of 450 ft., on the east an alley frontage of 550 ft., on the west a street frontage of 300 ft., on the north the diagonal frontage abuts a steam railway from which a switch may be extended to any portion of the lot where convenience or economical operation may require.

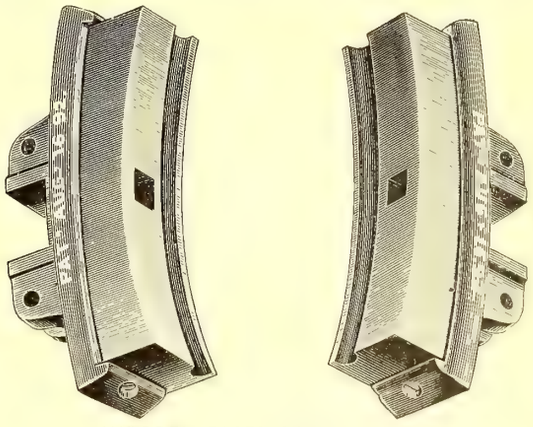
The street railway tracks may enter the lot at the northeast corner, and will also extend along the entire south frontage. Water can be extended from a city water main to any portion of the lot. The drawings must show the location of all necessary buildings, the position of Corliss engines, boilers, machinery, coal tracks, pits, and all other desirable features for a model plant.

For the first plan selected $100 will be paid, $75 for the second, $50 for the third and $25 for the fourth. The company reserves the right to reject any and all plans, and will be the sole judge of the merits of each. All plans should be sent to the vice president, C. L. Bonney, on or before the first day of July, 1894. Each plan should be identified by a special mark or assumed name, the real name and address of the contributor being, as usual, sent on a separate paper, enclosed in an envelope bearing the name appended to the plans.

Wooden Faced Brake Shoes.

The engraving herewith shows a wooden faced brake shoe which has just been put on the market by Wm. Wharton Jr., & Company, of Philadelphia, and which is claimed to be superior to metal. The wooden shoe, it is also claimed, brakes better and wears the wheel less than metal, and its use is, therefore, advisable outside of the question of expense. The wood can be put in and taken out readily, and runs no risk of displacement in service. The block is made of oak cut across the grain, thus exposing the ends of the fibres to wear, which prevents the tearing out of the ends and sides, and presents a surface to the wheel which has greater tenacity than any metal.

These shoes are in use on a number of well known street railways, which have become thoroughly satisfied of their high efficiency and economy. The manufacturers have samples which have run 6,000 miles, with average stops and quite heavy grades.



WOODEN FACED BRAKE SHOES.

Car Trimmings.

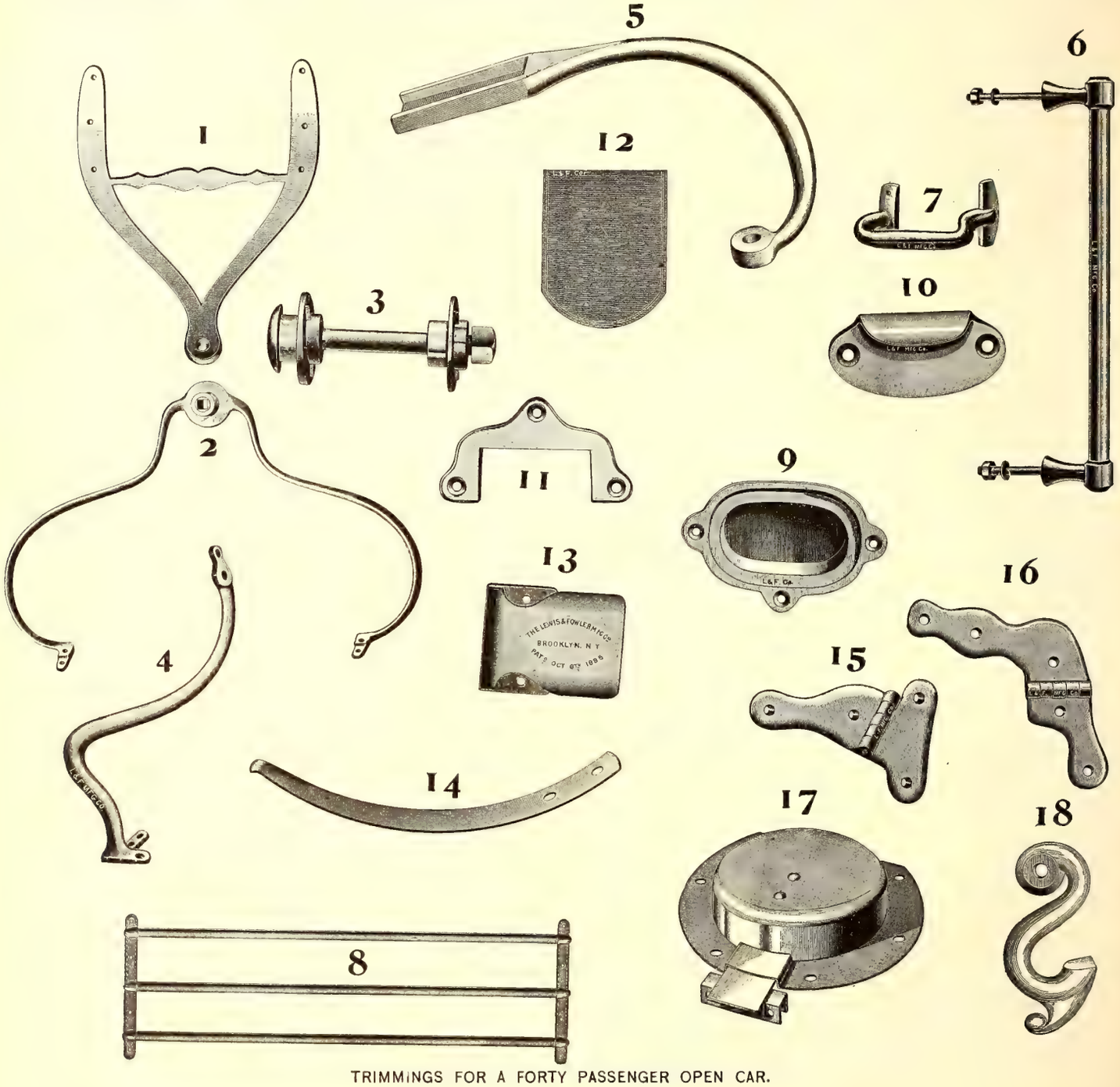
A comparatively small, yet most important, part of a car equipment is the "trim." Car trimmings are now usually made of bronze, and the number required varies naturally with the style of car. We present herewith engravings of all those used on a standard, forty passenger, open car having six reversible and two stationary seats, such as shown on page 395.

The manufacturer of the trimmings shown, the Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., devotes one special department in its extensive works, located on Nostrand, Park and Flushing Avenues and Walworth Street, Brooklyn, to the manufacture of car trimmings and supplies large quantities to street railway companies for the repair of cars as well as the great number required in the works themselves in the manufacture of cars. The officials of the company tell us that the trimming department of the company's business has been especially busy recently, indicating that many companies are reconstructing their old cars instead of purchasing new ones.

The process of manufacture of trimmings is most interesting. To insure the excellence of the metal used, the Lewis & Fowler Manufacturing Company makes its own bronze, in the composition of which 1,000 lbs. of copper, and a proportionate quantity of spelter, tin and lead are used a day.

The moulding of the trimmings is, of course, the initial process in their manufacture. The moulding is done in iron boxes with a specially prepared moulding sand. In the moulding room of the Lewis & Fowler Manufacturing Company, ten furnaces are required to mould the metal. Each furnace yields three "heats"—as the crucible holding molten metal is called—a day, and each "heat" contains from fifty to sixty pounds. After being cooled the moulded pieces are taken to the filing and drilling departments where twenty-five men are employed in removing from the rough castings burrs, warts and other imperfections to be met with, and in drilling holes for the screws, countersinking, etc.

The polishing then follows, and in this department the pieces are ground on graded emery wheels and belts against which they are held by hand. They are then polished on linen buffers which make 2,300 revolutions per minute. In this department of the Lewis & Fowler works, twenty-two men are employed in the operation of twelve emery wheels, two emery belts and ten buffers. The trimmings are then bright and shining and are lacquered and baked.

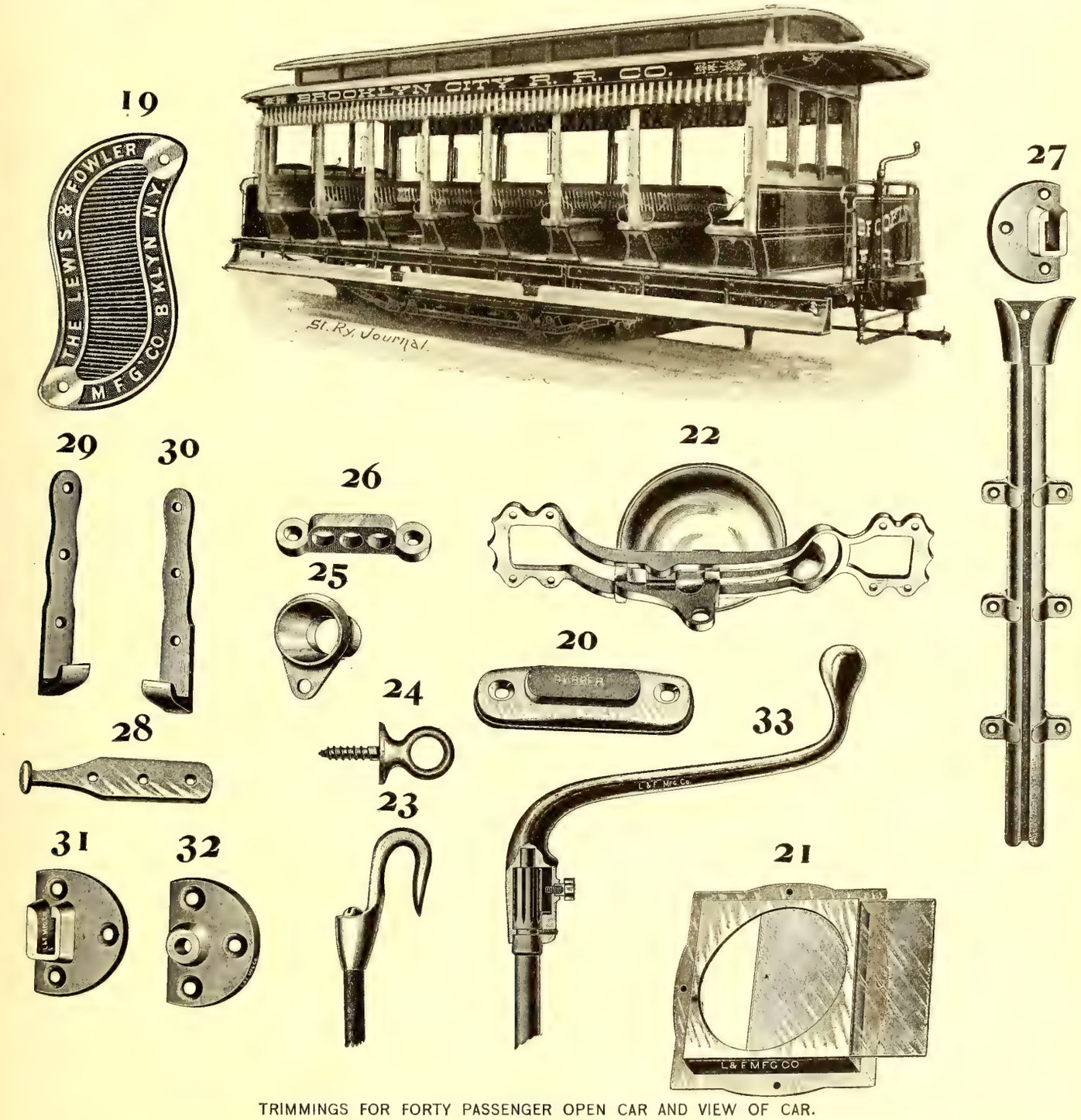


TRIMMINGS FOR A FORTY PASSENGER OPEN CAR.

The cuts on this and the next page show the following parts, the figure in the bracket after the name of the piece showing the number required for the forty passenger, open cars hown: No. 1. Reversible seat arm (twelve). No. 2. Reversible seat handle (twelve). No. 3. Bolt for reversible seat handle (twelve). No. 4. Stationary seat handle (four). No. 5. Dash grab handle (four). No. 6. Pillar handle (sixteen.) No. 7. Motorman's handle for access to roof of car (one). No. 8. Window guard (two). No. 9. Lower sash lift (six). No. 10. Upper sash lift (six). No. 11. Blind lift (six). No. 12. Leather for blind lift (six). No. 13. Sash spring (six). No. 14. Blind spring (six). Nos. 15 and 16. Lamp box hinge (four of each kind). No. 17. Lamp box drip cup (two). No. 18. Lamp box hook (two). No. 19. Match striker (two). No. 20. Reversible seat back casting with rubber (twelve). No. 21. Color signal ring (two). No. 22. Signal bell (two). No. 23. Bell strap hook (two). No. 24. Strap guide (ten). No. 25. Strap bushing or thimble (two). No. 26. Strap fastener (two). No. 27. Bronze tube

to be set in pillar for operating roller curtain. No. 28. Roller curtain guide. No. 29. Roller curtain stop, left hand. No. 30. Roller curtain stop, right hand. No. 31. Fixture for spring roller curtain. No. 32. Fixture for spring roller curtain (twenty-eight required of each curtain fixure). No. 33. Patent ratchet brake handle (two).

The car trimming department of the Lewis & Fowler Manufacturing Company, which has attained extensive dimensions, is yet only a comparatively small part of the extensive business of this company which manufactures practically every article required for the rolling stock of a street railway company, except motors and other parts of the electrical equipment.



TRIMMINGS FOR FORTY PASSENGER OPEN CAR AND VIEW OF CAR.

The growth of this company presents an example of what business ability can do when the products manufactured are of substantial worth. The first appliance to be manufactured by this company was the Lewis & Fowler car register which has now been adopted on nearly 600 different railways, and of which 19,000 are in use. It is interesting to note that in spite of recent competition the Lewis & Fowler register retains its long enjoyed popularity, and among some recent orders awarded last month was that for the equipment of the cars of the Union Railway Company, of Providence, R. I.

In the Lewis & Fowler Register, the care which this company uses in the manufacture of all its appliances is exemplified, No one has tried harder to beat this register than the manufacturers, and they claim that the device is as perfect in its prevention of fraud as human ingenuity and skill can accomplish. The register, though containing many attachments necessary for securing against dishonest tampering is exceedingly durable, and there are several companies which have been using the registers for sixteen years, and still report them as reliable and perfect as when constructed.

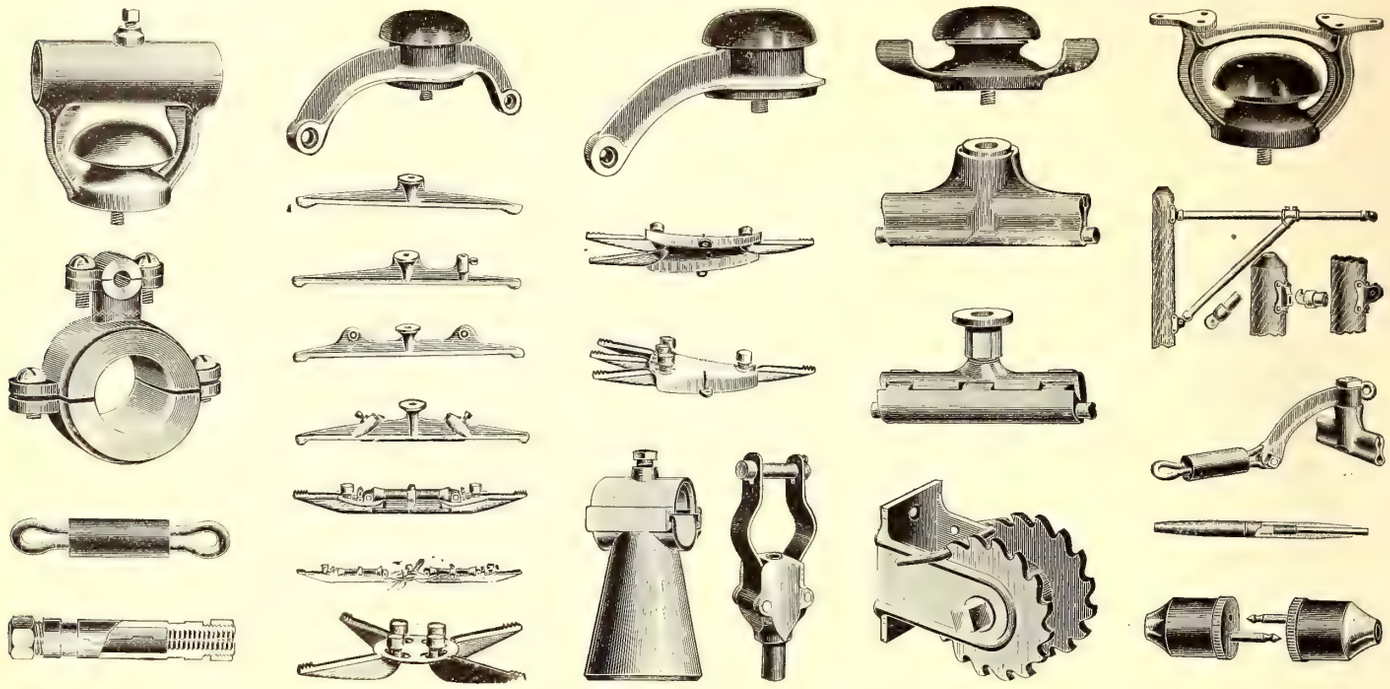
Annual Report of the Westinghouse Electric & Manufacturing Company.

The report of the directors of the Westinghouse Electric & Manufacturing Company was presented at the annual meeting in Pittsburgh May 16, and showed that the company's net profits for the fiscal year foot up $1,640,809.11. This was after charging to operating expenses large sums for alterations and additions to plant, and interest and discount. The company received on its World's Fair lighting contract $399,000, and $88,704.47 for extras. Much is expected from its long distance power transmission business when the three 5,000 H. P. generators are in operation at Niagara Falls. The company has $3,671,965 in preferred stock, $5,165.481 in assenting stock, and $179,150 in common stock. There are 20,000 shares in the company's treasury.

THE New York Board of Aldermen has granted to the Sixth Avenue Railroad Company, which is controlled by the Metropolitan Traction Company, the right to extend its road through Lenox Avenue, from 110th Street to the Harlem River.

A Complete Line of Overhead Construction Material.

The Ohio Brass Company, of Mansfield, O., manufacturer of overhead line material and other devices for electric railways, has recently put upon the market a large number of new trolley appliances, which are meeting with good success. A number of the principal appliances dealt in by this company are presented herewith.



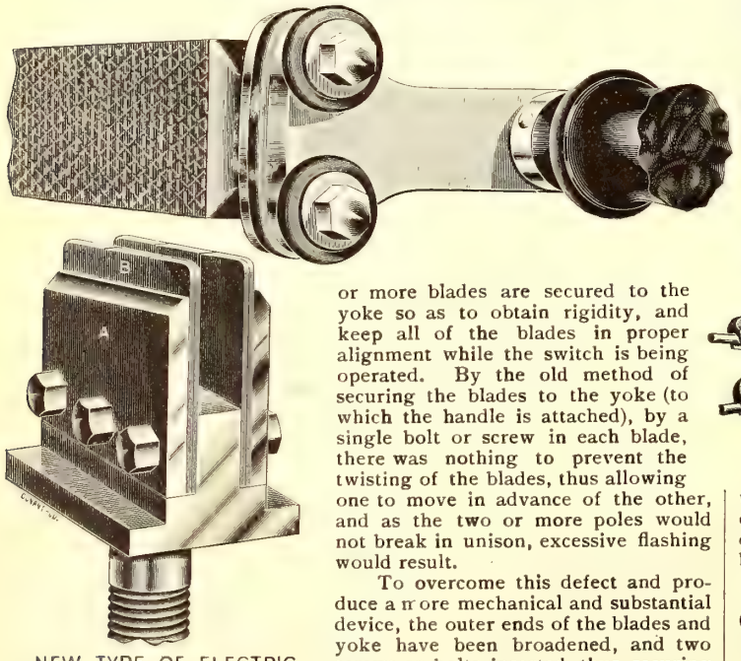
SAMPLES OF OVERHEAD MATERIAL—OHIO BRASS CO.

This company, on account of its special facilities for manufacturing and thoroughly testing its goods, is able to furnish the very best material, and its large and rapidly increasing business shows the confidence that the railway companies have in appliances manufactured by it.

New Type of Electric Switch.

We herewith illustrate one of the latest improvements in the switch line by the W. S. Hill Electric Company, letters patent for which have just been issued bearing the date of April 24, 1894.

The first feature of the invention is the manner in which the two or more blades are secured to the yoke so as to obtain rigidity, and keep all of the blades in proper alignment while the switch is being operated. By the old method of securing the blades to the yoke (to which the handle is attached), by a single bolt or screw in each blade, there was nothing to prevent the twisting of the blades, thus allowing one to move in advance of the other, and as the two or more poles would not break in unison, excessive flashing would result.



NEW TYPE OF ELECTRIC SWITCH.

To overcome this defect and produce a more mechanical and substantial device, the outer ends of the blades and yoke have been broadened, and two screws or bolts inserted, thus securing the parts so rigidly that the blades must at all times moves in unison, and all the blades leave the contacts at the same instant.

The second feature consists in backing up the regular flexible contacts, B, by what they term "reinforcing plates," A. It has heretofore been the custom to use nothing but the copper strips, B, and these of necessity being flexible, were liable to spring apart by constant usage, thus impairing the contact and causing the parts to heat. By the method shown the flexibility is maintained, and on account of the reinforcing plates the flexible contacts are always held in proper position; consequently the electrical connection between blade and contact is always kept perfect.

It will also be seen that the carrying capacity of the flexible plates, B, are increased by the reinforcing plate, A, to the maximum of any other part of the circuit, preventing loss of current in the switch, and heating and destruction of its contacts.

Hundreds of these switches are now in use, and the value of the above inventions is becoming more and more apparent as the test of time is applied.

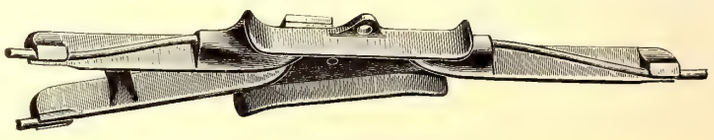
Annual Meeting of the American Institute of Electrical Engineers.

The tenth annual meeting of the American Institute of Electrical Engineers was held at Philadelphia, May 15-18. The officers elected were: President, Professor Edwin J. Houston, Philadelphia; treasurer, George M. Phelps, New York, each for one year. Vice-presidents (for two years), Professor William A. Anthony, Vineland, N. J.; Francis B. Crocker and James Hamblet, New York. Managers (for three years), A. E. Kennelly, Philadelphia; William D. Weaver, Charles S. Bradley and William B. Vansize, New York.

The papers read included one on lightning arresters, by A. Jay Wurts, of the Westinghouse Electric & Manufacturing Company, one on storage batteries, by W. W. Griscom, and others.

New Overhead Switch.

Among a number of specialties lately brought out by the Mason Electric Company is the new overhead switch illustrated. It will be noticed that the running part of this switch is on a line with the trolley wire. There being no depression, cars can be run on full speed without any liability of the trolley wheel leaving the line. The advantages of this switch are recognized by practical men, and it is being adopted by a number of the leading roads.



NEW OVERHEAD SWITCH.

Open Slot Electric Conduit for the Metropolitan Traction Company.

As mentioned in our last issue, the Metropolitan Traction Company, of New York, will build a section of open slot electric railway conduit on one of the uptown avenues of New York City to give the system a practical test. Sections will be installed both by the General Electric Company and Siemens & Halske Company of America.

Trucks.*

BY JOHN C. GEORGE, *President Raleigh, N. C., Railway Company.*

Possibly no factor necessary to the successful operation of electric traction is so little understood, and so little considered by the average street railway magnate, as that portion of the car which we hardly dignify by the name of truck. And yet upon its proper construction and adaptation to varying conditions of traffic, largely depends the life and efficiency of both motors and track, to say nothing of the car bodies themselves. From the public point of view a road's success is in no small measure dependent upon the efficient construction of this vital component. Apart from all questions of good service as to time, speed, regularity and the numerous other necessaries of a well conducted road, it is a recognized fact in all large cities, that there are two classes of citizens to whose wishes any road must cater for purely financial reasons, and incidentally for æsthetic ones: First, to its actual patrons, who demand that they shall be carried smoothly and comfortably, and the number of whom varies almost directly in accordance with the degree of comfort afforded. Second, to its prospective patrons, to which class belong that great array of dwellers along the route, where the incessant din of rocking, pounding cars raises in the minds of the hearers a feeling of such intense antagonism to the road that its receipts are really seriously affected. The patronage of this class probably varies inversely as the square of the noise. While I do not pretend to maintain that a bad truck is responsible for all the ills to which a motor car is subject, I am firmly convinced that too little attention is paid to it, and still more convinced that if street car companies would show more consideration for the comfort, safety and convenience of their passengers and the public generally, it would redound very greatly to their advantage.

To take its construction in detail, the important features of a good truck may be summarized in a discussion of frame, journal boxes and bearings, wheels, axles, brakes and guards.

Frame.—Of frames, while there is an endless variety of construction, there are really but two types; one where the entire structure of the truck is self-contained, all provision against teetering either end or side, being made in the truck itself, the body simply resting upon it; the other, where the sills of the car body form practically an integral part of the complete car, neither body nor truck being a complete entity. As is natural, both types have their adherents, and while it is still a somewhat open question as to which is superior, the trend of modern practice is in favor of the self-contained truck, and it is specially to be recommended that the fastening of the body to the truck be effected by the least possible number of bolts and nuts, so as to afford the greatest ease in removal. The frame should be so hung upon the axle or journal boxes as to afford ample play for perpendicular motion, while at the same time be supported by springs so arranged and proportioned as to reduce the rapidity and strain of such motion to a minimum. As far as possible, the top and side bars should be in one piece, and steel has been found more efficient for these parts than iron. Under all circumstances it is most important to prevent oscillation as far as possible, as apart from the question of comfort, it is amply demonstrated that where this is prevented, the motors suffer less deterioration, the wheels have a longer life, the track joints stand up better, and the car operates on a slippery track and through snow with much better results. While these remarks apply more especially to the four wheel, rigid truck generally used on cars from sixteen to twenty-two feet in length for urban traffic, the salient features are equally applicable to the double truck and radial type used for larger cars, and specially in suburban traffic. There seems to be little question that for fast work, *i. e.*, above ten miles per hour, either a double truck or a radial is superior to any type of rigid, short wheel base truck.

Journal Boxes and Bearings.—This question has been practically settled by the adoption, by the leading makers and managers of the general type now recognized as "Standard" by the Master Car Builders' Association, and the form is too well known to require any special description. It is only necessary to insist upon an adequate thickness of the brasses, and upon lubricating boxes easy of access and capable of carrying sufficient grease to avoid the necessity of frequent refilling.

Wheels.—The question of wheels, which is really of the utmost importance, is still a vexed one; and again no standard exists either as to size or material, but the tendency on the better class of roads is more towards the thirty inch wheel, which is amply high to give a a clearance of three and seven-eighths inches even on the M. P. 50 type of the G. E. motor, probably the lowest hanging motor on the market, and, of course, more on the other types. The thirty-three and thirty-six inch wheels are open to two serious objections. First, the car body is raised to too great a height from the ground; second, the weight is very considerably increased, and as the hammer blow varies directly as the weight, at a constant speed, the wear upon both wheel and truck is materially increased; moreover, there is no question but that the noise is greatly intensified, so that these objections are considered more than sufficient to offset the possibly greater tractive power of the larger wheel. As to the material to be used, if ordinary practice is followed, the chilled cast iron wheels are largely in the majority, chiefly on account of the low first cost, and "because everybody uses them." It has been found by actual test that chilled cast iron wheels wear out steel rails much more rapidly than any other kinds, owing to the fact that the rims, whether hardened by the usual method of pouring against a metallic mould, or "chill," or oil tempered, are much harder than the steel of the rail. Again, it is extremely difficult to produce a homogeneous rim, and even under the most rigid specifications a wide margin is allowed for defects. This, of course, increases the liability to flatten, and certainly causes considerable variation in the points of greatest wear and shortens the life of the wheel, which, owing to the continuous braking, is not more than one-fourth that of its brother in steam railroad service.

The paper wheel, steel tired, for which so much was claimed and expected, does not stand the test, and the experts now bend their energies to obtain a wheel either of solid steel or of iron steel tired, which shall approach as nearly as possible to the structure of the steel in the rail upon which it runs. This is the true solution of the problem; and when we have a Bessemer wheel rolling upon a Bessemer rail, jointless, be it hoped, then we may look for some relief from some of the present troubles incident to the use of those now in service. Several successful attempts have been made in this direction, as the Paige wheel and Vauclain wheel; and where the extra expense can be borne by the road there is no question as to the advisability of their use from the standpoint of both road and patron. Another very usual and dangerous habit has come into practice in respect to the depth of flange. In paved streets with the usual rail head, it is seldom practicable to use a greater depth than three-quarters of an inch, and the majority of wheels either start out with or soon come down to half an inch or five-eighths of an inch. While this affords, perhaps, sufficient margin of safety at a low rate of speed, too many cars are sent out at high speeds over suburban lines, and risks are taken by management and public, which no ignorance or carelessness can excuse. No less than a one and one-eighth inch flange should ever be used where the speed exceeds twelve miles per hour.

Axles.—Again no standard: But there seems no question that the best material is steel, and they should be practical duplicates, in shape, of those in use on steam roads, and of size doubly sufficient to stand any anticipated strain. Anyone who has seen the result of a broken axle will readily appreciate the necessity for an extra allowance of strength in this particular.

Brakes.—In this point of construction lies mostly, not only the danger to human life, but to property in its largest sense. Here faulty construction or failure of operation may wreck the fortunes of any road, not only by destroying its property and those of others, but by mulcting it in exhaustive damages for injuries inflicted upon passengers and public. Even should such extreme penalty not fall to its lot, the average of wear and tear upon the wheels and indeed upon the whole structure of the car, may be greatly reduced by proper braking appliances. This fact has been only too well recognized, and some important improvements have recently been made in this line. It is only necessary, therefore, to call attention to the necessity for having all parts of the braking apparatus of far beyond the really necessary strength. Upon one point, however, the average street car brake shoe is far from satisfactory, both in material and method of attachment, and I strongly recommend the adoption of the soft iron brake-shoe, prescribed by the Master Car Builders' Association, which has proven, not only its efficiency as a brake, but insures a uniform wearing of the wheel rim, and the greatest facility of removal and renewal.

Guards.—As a last resort for the safety of the unwary public, a proper guard should always be provided to prevent the mangling of the unfortunate victim of his own or the motorman's carelessness. Here the proper policy is to discard all makeshifts, and either have a good one or none at all. Among those in the market the one adopted by the Railway Commission of Massachusetts, the outcome of a series of over 200 designs experimented upon, presents undoubted advantages. In conclusion, it need only be said that a good truck is as necessary as a good motor; that every engineer knows it, and that very few directors know a truck when they see one.

*Abstract of a paper read at Johns' Hopkins University.

Street Railway News.

Extensions and Improvements.

Baltimore, Md.—The Baltimore & Randellstown Railway Company, whose offices are at 451 Equitable Building, Baltimore, is proposing to equip four and a half miles with the Barrowes electric system.

Bloomfield, N. J.—The Suburban Traction Company proposes to equip its lines in Bloomfield with electricity.

Bridgeport, Conn.—The Traction Company has given out nearly all its contracts, and in a short time everything will be in readiness to begin the construction of the road. The Washburn & Moen Company, of Worcester, Mass., will furnish part of the wire. The J. G. Brill Company, of Philadelphia, will furnish the trucks, with which all the cars will be equipped. The John Stephenson Company, of New York, will furnish open cars. The firm of Barney & Smith, of Dayton, O., has received the contract for closed cars and also for a number of open cars. Contracts have been signed with the General Electric Company for generators, motors and other parts of the electrical equipment.

Brooklyn, N. Y.—The Brighton Beach Railroad has received from the Board of Aldermen the right it has sought for some years, to extend its road from Atlantic Avenue so as to connect with the elevated railway in Fulton Street.

Cleveland, O.—A short time ago the residents of Linndale began the agitation of an extension of the Cleveland Electric Railway to Linndale. The project is in a fair way to be consummated.

Columbus, O.—The Columbus Central Railroad Company, of Columbus, O., is pushing the construction of its new road. The line will be forty-two miles in length, and the capital $1,500,000. The officers are J. J. Shipherd, president, and Moses V. Neil, vice-president.

Cortland, N. Y.—A franchise has been granted the Cortland & Homer Horse Railroad Company to change its motive power to electricity, and electric cars will soon be used.

Dayton, O.—It is reported that L. D. Smith, representing a street railroad company in Cincinnati, is endeavoring to purchase the Wayne Avenue horse car line, which will then be changed to an electric road.

Freeport, Ill.—An Eastern syndicate composed of Speaker Crisp, Congressmen Haynes and Ryer, of New York, and Mutchler, of Pennsylvania, has recently purchased the Freeport horse railway, which they will convert into an electric system. They have also purchased from L. Z. Farwell his arc and incandescent electric light plant, which they will operate in connection with the electric railway.

Fort Wayne, Ind.—The Centlivre Brothers will greatly improve their street car line this summer. It will be double tracked with T rails, and the cars will be run by electricity.

Green Island, N. Y.—At a recent meeting of the Village Trustees of Green Island the Troy City Railroad Company was granted the privilege of running its cars through the village by electricity instead of horse power.

Hartford, Conn.—The Hartford Horse Railroad Company has awarded a contract to construct twenty-two miles of road running to Windsor, Pequonnock, Rainbow and perhaps to South Windsor.

Kansas City, Mo.—W. J. Smith, formerly president of the Kansas City Cable Railway, has decided to rebuild the old East Fifth Street Railway, equip it with electricity and build extensions.

Nashville, Tenn.—The reorganization of the United Electric Railway Company has been effected. A new charter has been applied for, and under this the name will be the Nashville Electric Railway. W. H. Jackson will be president.

Natick, Mass.—The Natick Electric Street Railway Company is planning an extension of its line through Ashland to Hopkinton.

New Britain, Conn.—Superintendent Breed, of the Central Railway & Electric Company, is contemplating a number of important changes and extensions.

New Glasgow, N. S.—The New Glasgow Electric Company is preparing to build an electric railway this spring or summer, connecting New Glasgow with Trenton on the one side and Stellerton on the other.

New Haven, Conn.—The residents of West Chapel and other streets have petitioned the Fair Haven & Westville Railroad Company, asking that the West Chapel Street branch be extended from Norton Street to Nott Street, or the Boulevard.

New Orleans, La.—The Orleans Railway Company writes us that it is contemplating important improvements.

Niagara Falls, N. Y.—Application has been made to the City Council by the street railroad company for a franchise from the city to build a line on Main Street, from the Falls north to Niagara Street, and west on Niagara Street, to the river way.

Poughkeepsie, N. Y.—The Poughkeepsie City & Wappinger Falls Railway, of Poughkeepsie, N. Y., has ordered ten closed cars from James A Trimble, of New York, and eight open and two closed cars from the American Car Company. All the cars will be mounted on Peckham trucks and will use Sterling registers.

Springfield, Mass.—The Board of Directors of the Springfield Street Railway Company has authorized President Olmsted to apply for a location for the new Thompsonville and Liberty Street extensions; also to petition the Aldermen for permission to extend the line from the junction of Locust Street through Longmeadow to the state line.

Stillwater, Minn.—The bondholders who have purchased the street railway will organize a company with $75,000 capital stock, to be known as the Stillwater Electric Railway Company.

Westerly, R. I.—Business men here are agitating the scheme of having the electric road extended north, to connect with White Rock, Potter Hill and Ashaway with Westerly.

New Roads.

Akron, O.—The Akron & Cuyahoga Falls Rapid Transit Company, of Akron, filed its certificate of incorporation on May 11. The capital stock is $300,000. The company will build an electric street railway from Ravenna, through Kent and Akron and to the village of Barberton. The incorporators are Robert J. Randolph, Thomas F. Walsh, W. E. Hall, Edwin F. Voris, E. L. Babcock.

Boyertown, Pa.—It is expected that the work of constructing the electric road from Black Bear and Reading to Boyertown will be commenced in the near future. The line from Boyertown to Black Bear will be about fourteen miles long.

Buffalo, N. Y.—The scheme for belting Grand Island with an electric railway was ratified lately by a large meeting of Grand Island property owners, and work is to be commenced at once.

Butler, Pa.—The Butler Traction Company was incorporated on May 10, 1894, for the purpose of constructing and operating an electric street railway in Butler County, with a capital stock of $75,000. The president of the company is Joseph Hartman, of Butler, Pa., and others interested are J. G. Smith, John V. Ritts, Chas. Duffy and John Berg.

Calais, Me.—The Worcester Construction Company, of Worcester, Mass., has taken the contract to build about eight miles of street railway here. This place will be connected with St. Stephen, across the river.

Cincinnati, O.—Work has been commenced on the electric railroad between this city and Dayton. The company has been organized as the Cincinnati & Dayton Traction Company.

De Pere, Wis.—Edward Morton, the projector of the street railway company at Green Bay, has applied to the Common Council for a franchise allowing his company to operate within the limits of the city.

Elwood, Ind.—A company has been organized at Elwood looking to an electric line connecting Elwood, Alexandria, Anderson and Frankton.

Elyria, O.—An effort is being made to secure an electric road between here and Cleveland, by way of Dover and North Ridgeville. The right of way has been secured.

Hamilton, Ont.—The Hamilton, Grimsby & Beamsville Railway Company has applied to the Barton Township Council for the privilege of laying its tracks on Main Street, from Sherman Avenue to the bicycle grounds.

Homesdale, Pa.—The Homesdale Electric Railway Company was incorporated on May 21, with a capital stock of $100,000, for the purpose of constructing and operating an electric street railway in the borough of Homesdale, Wayne County, Pa. The president of the company is Lorenzo Grambs, of Homesdale, and others interested are Eben H. Clark, W. N. Alberty and M. M. Treadwell.

Indianapolis, Ind.—According to present appearances, the Indianapolis & Broad Ripple Rapid Transit Company, will not commence the construction of its road.

Jamaica, N. Y.—At a recent meeting of the Board of Highway Commissioners, A. W. Hart, president of the Long Island Electric Railroad Company, presented a petition, asking permission to build and operate a double trolley line on Liberty Avenue, from the Brooklyn city line to Jamaica, and on the Jamaica and Merrick road, from Jamaica to the township line at Foster's Meadow.

Johnstown, N. Y.—There is talk here of building an electric railroad from Amsterdam to Johnstown and back to Amsterdam again by way of Gloversville, Mayfield, Broadalbin and Hagaman's.

Kansas City, Kan.—Application has been made for a charter for the Quindaro Park Electric Street Railway Company. The incorporators are C. C. Dail, Isaac P. Moore, W. J. Huffaker, J. C. Klamm, L. F. Bird, A. F. Smith and C. B. Forword. The capital stock of the company is placed at $200,000.

The Eighteenth Street Railway Company, which is said to represent the Metropolitan Street Railway Company, has applied to the City Council for a franchise to operate a single track electric line from the present terminus of the 5th street line in Kansas City, Kan., north on 18th Street to Chelsea Park.

The County Court has granted a franchise to the Westport & Waldo Electric Railway Company for a double track electric railway from the southern limits of Westport, on Oak Street, to 75th Street and thence west to Broadway. The road is to be finished within a year.

Lock Haven, Pa.—The contract for constructing the Lock Haven Street Railway has been awarded. The line will be six miles long and will connect the towns of Castenea, Millhall and Flemington with this city.

Marion, O.—The Electric Street Railroad has been incorporated, with a capital of $100,000. The officers consist of Edward Durfee, president and treasurer; Gottfrey Leffler, vice president, and George Turney, secretary.

Media, Pa.—The directors of the Media, Middletown, Aston & Chester Electric Railway Company recently held a meeting here. A strong move will be made to get ready to build the line.

Nashville, Tenn.—Gilbert F. Brown, Thomas Taylor, F. M. Cruzen, Frederick W. Hunter and L. G. Noel have applied for a charter of the East Nashville Electric Railway. The charter is an amendment of the old Maplewood charter, and is simply to build a line of road out the Granny White Turnpike, to connect in Waverly Place with the Overland Railway.

New Haven, Conn.—There is a project on hand for an electric road to lead from the terminus of the Fair Haven & Westville road at Grand Avenue to the village of Montowese. During the last legislature a charter was granted to certain citizens of Montowese to construct a road from Grand Avenue to Montowese Avenue on North Quinnipiac Street. The charter was granted under the condition that unless the Fair Haven & Westville Horse Railroad Company construct a line from Grand Avenue on North Quinnipiac Street to Davenport Street before July 1, 1894, then the aforesaid citizens of Montowese may construct a road on North Quinnipiac Street to Montowese Avenue. The capital stock of the company is $75,000, and they have power to increase it to $150,000. The officers of the corporation are as follows: President, Theophilus Eaton; secretary and attorney, C. T. Driscoll.

Newark, N. Y.—A proposed ordinance has been received by the Village Trustees from the Newark & Wayne County Traction Company, asking for a franchise to lay tracks and erect poles and wires for the operation of a street railway.

Newburgh, N. Y.—The Newburgh & Orange Lake Railroad Company has been incorporated for the purpose of constructing a street railway four and a half miles long, from Broadway and Haines cross roads, in Newburgh, to Orange Lake, for the purpose of carrying passengers, freight, baggage and mail; capital $100,000. Some of the directors are Joseph M. Dickey, William C. Dickey and C. M. Huyett of Newburgh, and Benjamin Norton and Henry Newkirk of Brooklyn.

Oshkosh, Wis.—An extensive street railway franchise, covering a number of the principal streets of the city, has been granted to J. K. Tillotson by the city authorities.

Philadelphia, Pa.—The Buttonwood Street & Fairmount Park Street Railway Company was incorporated May 9 with a capital stock of $30,000. Henry L. Everett, of 2,222 Locust Street, Philadelphia, is the president of the company. Other stockholders are Robert Everett, Jr., Charles C. Highley and M. J. Reynolds, all of Malverns, Pa.

THE Central Electric Railway Company, of Philadelphia and Delaware County, was incorporated May 9, with a capital stock of $60,000, to construct and operate an electric street railway in the counties of Philadelphia and Delaware, Pa. William J. Pollock, of Philadelphia, is president of the company. Other stockholders are Lewis G. Dutton, Wm. Bradley and Thomas Bradley, all of Philadelphia.

THE Northern Electric Street Railway Company was incorporated May 11, with a capital stock of $150,000. Walter N. Boyer, of Philadelphia, is president of the company. Others interested are Radcliffe B. Mills, Wm. H. Hirst and John R. Bannan, all of Philadelphia.

THE Citizens' Clearfield & Cambria Street Railway Company was incorporated on May 10, with a capital stock of $6,000, for the purpose of constructing and operating an electric railway. The president of the company is J. J. Sullivan, of 1705 Spring Garden Street, Philadelphia, Pa., and others interested are F. Weckerby, of St. Davids, Pa., Robert C. Brewster and George S. Gandy.

THE Citizens' East End Street Railway Company was incorporated on May 10. with a capital stock of $15,000. The president is J. J. Sullivan, of 1705 Spring Garden Street, Philadelphia, Pa., and others interested are G. S. Gandy, Robert C. Brewster and Wm. Henry Lex.

THE Citizens' North End Street Railway Co. was incorporated on May 10, with a capital stock of $36,000. The president of the company is J. J. Sullivan, of 1705 Spring Garden Street, Philadelphia, Pa., and others interested are F. Weckerby, Robert C. Brewster and Wm. Henry Lex.

THE Brown & Parrish Street Railway Company was incorporated on May 10, with a capital stock of $15,000. The president of the company is J. J. Sullivan, of 1705 Spring Garden Street, Philadelphia, Pa., and others interested are Jas. F. Sullivan, Geo. S. Gandy and Robert C. Brewster.

THE Diamond Street Passenger Railway Company was incorporated May 16, with a capital stock of 6,000. Henry C. Moore, of 624 North 22d Street, Philadelphia, is the president of the company. Other stockholders are McClelland Hirsh, D. C. Golden and Thos. B. Foot, all of Philadelphia.

THE Montgomery Avenue & Berks Street Railway Company was incorporated May 17, with a capital stock of $15,000. Frank L. Lyle, of 1833 Master Street, Philadelphia, is the president of the company. Other stockholders are H. R. Shultz, F. A. Lee and J. C. Hughes, all of Philadelphia.

THE Girard Avenue Passenger Railway Company was incorporated May 17, with a capital stock of $9,000. Henry C. Moore, of 624 North 22d Street, Philadelphia, is the president of the company. Others interested are D. C. Golden, H. C. Murphy and Jos. L. Lugar, all of Philadelphia.

THE Brown Street Railway Company was incorporated May 17, with a capital of $18,000. Frank L. Lyle is the president of the company. Other stockholders are H. R. Shultz, F. A. Lee and Edward D. Cook, all of Philadelphia.

THE Northeastern Railway Company was incorporated May 17, with a capital of $250,000. Frank L. Lyle, of Philadelphia, is the president of the company. Others interested are H. R. Shultz, J. C. Hughes, F. A. Lee, and E. D. Cook, all of Philadelphia.

Pittsburgh, Pa.—The Sylvan Avenue Passenger Railway Company was incorporated May 14, with a capital stock of $12,000. James D. Callery, of Pittsburgh, is the president of the company, and others interested are John C. Reilly, W. M. Keech and Wm. V. Callery, all of Pittsburgh.

Rahway, N. J.—The New Jersey Traction Company has made application to the City Council for privilege to lay tracks on Westville Avenue as far as St. George Avenue.

St. Louis, Mo.—The St. Louis & Kirkwood Railway Company, better known as the Houseman Air Line, has awarded to the Suburban Construction Company the contract for its proposed line, from the southwest corner of Forest Park to Meramec Highlands.

IT is reported that preparations are being made by the Forest Park & Clayton Electric Railway Company to equip and operate the line shortly; and that arrangements have been made with a city street railway to lease and operate the line as a branch of its system.

Skowhegan, Me.—There are said to be good prospects of an electric railroad from Skowhegan to Norridgewock. Amos F. Gerald, I. C. Libby and S. A. Dinsmore are interested in the project.

Tamaqua, Pa.—The Inter-County Street Railway Company was incorporated April 27 with a capital stock of $200,000, to construct and operate an electric street railway from Tamaqua to Summit Hill, Carbon Co., Pa. Charles F. Hogue, of Philadelphia, is the president of the company. Other stockholders are S. Friedberger, G. H. Lang and J. C. Dedier, all of Philadelphia.

Toledo, O.—J. H. Ainsworth, J. Ellery Eaton and J. A. Dawson, promoters of the Monroe Electric Railroad, recently appeared before the County Commissioners and asked for a franchise allowing them to lay their tracks to the Michigan state line.

Troy, N. Y.—The long talked of plan to construct an electric railroad between Sandlake and Albia is again revived, and is now in a fair way of construction. The Troy & New England Company, which holds the charter, has virtually decided to begin work soon. The plans are to run passenger and freight cars from River Street, in Troy, to Sandlake.

Truro, N. S.—A project is on foot to construct an electric railway from Hazel Hill to Camso, a distance of three miles. There is also talk of establishing a similar line between the pulp mill at Milton and Liverpool Town, a distance of six miles.

Waldo, Me.—There is a good prospect that the proposed electric railroad between Bangor and Stockton Springs will be constructed as far as Frankfort this year.

Westerly R. I.—A petition of the Pawcatuck Valley Street Railway Company has been presented to the Town Council, asking permission to use the public highways for an electric railway, from the railway station in this town to Watch Hill.

White Plains, N. Y.—The citizens of White Plains are discussing the question of an electric street railroad which will connect the Hudson with the Sound.

Crawford Fenders.

The popular interest in fenders seems to be constantly increasing as the number of patents constantly being taken out for different kinds of fenders, and the increased space devoted to the fender question in the daily and technical press, testify. An interesting visit was recently paid by a representative of the STREET RAILWAY JOURNAL to the factory of the R. A. Crawford Manufacturing Company, 35 Water Street, Pittsburgh. These works have a capacity of 1,500 safety appliances per month, and are being run to their full capacity filling orders to meet the requirements of the company's rapidly growing trade. A large addition is now in progress of construction, and the company is turning out a large number of appliances monthly.

As is well known, the Crawford safety appliances are of two types: The fender proper, suitable for all suburban roads and those city lines running upon streets where the vehicular traffic is not very heavy, and the wheel guard carried on the truck directly before the wheels, and which does not take up any additional room on the street. If deemed desirable, companies can equip their cars with both safety appliances, insuring the greatest degree of safety.

Among the recent orders closed by this company is one with the Rochester (N. Y.) Railway Company, for 300 pick-up fenders. This company made a full investigation of the subject of fenders before adopting that of the Crawford Company, so that the latter concern feels justified in regarding this order as a most flattering testimonial to the value of its devices. Other companies which have adopted the Crawford pick-up fenders for their entire equipment are: The Pittsburgh & West End Passenger Railway Company, of Pittsburgh, Pa.; the New Orleans Traction Company, of New Orleans, La.; the Citizens' Street Railway Company, of Indianapolis, Ind.; the Williamsport Passenger Railway Company, of Williamport, Pa.; the Pittsburgh Traction Company, of Pittsburgh, Pa.; the Central Traction Company, of Pittsburgh, Pa.; the Duquesne Traction Company, of Pittsburgh, Pa.; the Citizens' Electric Traction Company, of Pittsburgh, Pa. and the Philadelphia Traction Company. Over 800 wheel guards have been delivered to the latter company.

These fenders have made a most excellent record in saving life, and in most of the cities where they are in use have already proved their practical value in this way.

New Sperry Electric Equipments.

The Sperry Electric Railway Company, of Cleveland, O., has sold twenty equipments for the Price Hill line of Cincinnati. The company also reports, among recent orders, one to the Chicago General Electric Railway Company of fifteen equipments, and among recent shipments seventeen equipments to the Waterbury Traction Company, of Waterbury, Conn., and the first installment of 125 equipments for the People's Traction Company, of Philadelphia.

The motor equipment of this company was described by Mr. Sperry at the last meeting of the American Street Railway Association, at Milwaukee, and possesses a number of novel and interesting features.

National School of Electricity,

The National School of Electricity has been organized in Chicago with Thomas A. Edison as dean. The object of the school is to give instruction in electrical engineering, and is the outcome of a demand for a school of this description made upon the chief of the electrical department during the World's Fair at Chicago. The president of the school corporation is J. P. Barrett; vice president, J. L. Little, and treasurer, E. L. Powers.

Rapid Transit Situation in Detroit.

The municipal authorities of Detroit have for some time been endeavoring, through the courts, to compel the Citizens' Street Railway Company of that city to cease running its cars, and to remove its tracks from the streets, on the technical ground that the franchise under which the road is operating, and which was conveyed to it by its predecessors, was improperly extended to the year 1909 by the Com-

mon Council of 1879. Judge Taft, of the United States Circuit Court, recently decided the point against the railway company, and made the giving of a $10,000 bond a condition of a stay. The Baker Street and Cass Avenue lines are not affected by this decision. In rendering his decision, Judge Taft expressed the hope that the city would not take advantage of the railway company on technical grounds, and advised a compromise for the city's benefit and reputation. His decision has been appealed from by the Street Railway Company.

The trouble began as far back as 1891, when the validity of the extension of the contract by the Common Council, in 1879, was called into question by the city authorities. The point raised seems to be a purely technical one, and the city authorities, and particularly Mayor Pingree, manifest an unaccountable hostility toward the railway company. The citizens of Detroit, being keenly alive to the benefits of rapid transit, and realizing that the Citizens' Street Railway Company is in a position to give them the best possible service if unhampered by the local authorities, favor the cause of the railway company.

Pending the hearing of the appeal that has been taken from Judge Taft's decision, the city authorities prepared an ordinance granting to the railway company the right to maintain and operate its plant. This ordinance was submitted to the railway company, but rejected because of the onerous and unfair conditions it imposed, such, for instance, as requiring the sale of eight tickets for twenty-five cents, the tickets to be sold on the cars and to entitle the holder to a transfer to any of the company's lines, or, in the event of one of its cars not appearing within fifteen minutes, to the first car of any other company that starts on the track to which the transfer was issued. The railway company would also be required, under the proposed ordinance, to pave and keep in repair the streets through which it runs its cars. The Common Council reserved the right to establish a road on any street or streets, and in the event of the refusal of the Citizens' Street Railway Company to operate such road, the right to operate it could be granted to any other company, and would carry with it the privilege for such other company to run to the center of the city over the tracks of the Citizens' Street Railway Company.

This matter is still in a most unsatisfactory condition. It is expected, however, that the Common Council will be prevailed upon to accept an amended ordinance, which is being prepared by the Citizens' Company, and under the conditions of which the interests of all concerned will be conserved without injustice to either side.

Fenders Adopted in Paterson and Hoboken.

After prolonged and severe tests, in competition with other life saving devices, the Foster fender has been ordered for all of their cars by the Paterson (N. J.) Railway Company and the North Hudson County Railway Company, of Hoboken, N. J.

In our April issue we published an illustrated article describing this fender and the practical tests to which it was subjected on the North Hudson County road. It is therefore familiar to our readers. The Paterson tests were equally as severe and successful, and were conducted under the direct supervision of the officials of the road. The superintendent and the master mechanic expressed themselves as highly pleased with the apparatus, and Mr. McAdoo, the general manager, said before the tests were commenced: "This company desires to get the best fender obtainable, and for that reason has been making a test of those on the market. Our opinion as to which of these fenders is the best will be indicated by our order."

The Foster fender can be attached to either the truck or the car body. One of its special features is that when ready for action it is only three inches from the track. When the guard is struck by a human body it releases a cradle which runs forward before the body can fall to the ground, and receives it as it drops. This cradle runs on wheels on the crown of the track, and when in action is consequently at an elevation of not more than two inches from the roadbed. The guard is so constructed that should there be danger of a collision with a vehicle, the motorman can by means of a small rod, which is attached to the dashboard, lock the guard and prevent it being thrown into action. In the Paterson tests the car was run at its maximum speed over the roughest portions of the road and through poorly paved streets, but no trouble whatever was experienced from the oscillation or jarring of the car.

The Foster Automatic Safety Guard Company, which manufactures this fender, reports that negotiations are pending with other large railway companies that are desirous of equipping their cars with the device.

A Well Known Detective Service.

Thiel's Detective Service is one of the oldest, best known and most efficient concerns of its kind in the country. It was established in St. Louis in 1873. The care, skill and energy with which it accomplished the work entrusted to it soon won for Thiel's service a national reputation, and resulted in so great an increase in its business that it became necessary to establish branch offices in various parts of the United States. The New York office was opened in 1875, and was quickly followed by the establishment of offices in Chicago, St. Paul, Portland and Kansas City. The most important of these branch offices is of course the one located in New York. It is in charge of T. E. Lonegan, whose experience and sound judgment eminently fit him for the responsibilities of his position.

The operations of Thiel's Detective Service are largely confined to corporations, such as steam and street railway companies; and of this particular class of work it probably has more than any other detective agency in the United States. It has successfully handled some of the largest and most troublesome strikes that have occurred, notably, in 1877, those on the New York Central, the Lehigh Valley and the Erie railroad companies, and, more recently, the labor troubles on the Great Northern Railroad. It has also been conspicuously successful in street railway work, not only in breaking up strikes and protecting the property and interests of the companies, but also in checking conductors' returns, investigating damage claims and rendering other valuable and confidential aid in the detection or prevention of fraud of any description.

"We believe," said Mr. Lonegan, "that 'prevention is better than cure.' All strikes are brought about by a few disgruntled individuals, who talk their fellows into believing that their employers are imposing on them, and that a strike is the only thing that will right their wrongs. Our method is to detect these mischief makers and weed them out before they can accomplish much harm. In this way we prevented trouble on the Broadway road, the Baltimore Traction Company, and the Citizens' Railway Company of Indianapolis."

Personal.

Mr. Harry De Steese, of the Milwaukee Street Railway, was in New York last month.

Mr. W. F. Carleton, of Carleton & Kissam, sailed for Europe on the "Teutonic" May 2, for his health.

Messrs. C. L. Black, A. L. Hough and J. R. Prentiss of the Brush Electric Company were in New York last month.

Mr. C. K. King, of the Ohio Brass Company, of Mansfield, O., was East last month, and spent some time in New York.

Mr. Frank X. Cicott, manager of the railway department of the Pettingell-Andrews Company, was in New York last month.

Mr. W. S. Rogers, special agent of the Sperry Electric Railway Company, of Cleveland, O., was a visitor in New York last month.

Mr. O. T. Crosby, late general manager of the railway department of the General Electric Company, and now of the Crosby-White Company, sailed for Europe last month.

Mr. Malcom D. Peckham, brother of Mr. Edgar Peckham, of the Peckham Motor Truck & Wheel Company, died last month from injuries received from an assault by a former employe.

Mr. G. J. Melms, formerly general manager of the Milwaukee Electric Railway Company, has been appointed technical director of the municipal light and railway plant of Frankfort, Germany.

Mr. R. C. Brown, electrical engineer of the West End Street Railway Company, of Boston, has resigned that office to accept a similar position with the Montreal Electric Railway Company.

Mr John MacCormack has severed his relations as agent of the Heine Safety Boiler Company, of New York, and has been appointed general sales agent of the Stirling Company, with offices at 126 Liberty Street, New York.

Mr. Wm. Sharpe, M. E., of the Yeats Engineering Company, of Chicago, was in the East during May, introducing the Chicago trolley base, manufactured by his company. Mr. Sharpe reports that this device is meeting with excellent success.

Mr. A. W. Field, of the Peckham Motor Truck & Wheel Company, has resigned his position as vice-president of that company to take charge of the Boston office of the company. Mr. H. C. Soop, of Kingston, N. Y., has been elected in his place.

Mr. J. R. Chapman, general manager of the Grand Rapids Electric Railway Company, of Grand Rapids, Mich., has been appointed manager of the proposed and constructing electric lines on the North and West Sides, Chicago, belonging to the Yerkes syndicate.

Mr. Daniel J. Dowdney opened an office, May 1, at 171 Broadway, as New York agent of the McGuire Manufacturing Company, of Chicago. Mr. Dowdney was formerly engaged in active railway construction on the Broadway and Third Avenue lines, in New York City.

Mr. A. K. Baylor, of the General Electric Company, has been appointed assistant engineer of the railway department of that company, with headquarters at 44 Broad Street, New York. Mr. Baylor was for many years engaged in the technical departments of the Lynn works of the Thomson-Houston and General Electric Companies where he won a deserved reputation as an electrical engineer.

Mr. Joel Hurt, president of the Atlanta Consolidated Street Railway Company, has been spending some time in New York and Boston. Mr. Hurt is a thorough believer in the future of the South, and spoke most encouragingly of street railway prospects of Atlanta. He is looking forward with pleasure to the Convention next October, in his city, and will have much of interest for all the visiting street railway men.

Mr. Chas. H. Wilson, who has been connected with the General Electric Company since its organization, and who was previously identified with the Thomson-Houston Company, has been appointed assistant general manager of the railway department of the General Electric Company, with headquarters at Schenectady. Mr. Wilson's long experience in the electric railway field, and his extended acquaintance with street railway men throughout the country, eminently fit him for his new position.

Mr. Franklin C. Randall, who for the past two years has been connected with the J. G. Brill Company, of Philadelphia, Pa., as representative for the New England States, New York and Canada, has been appointed Chicago representative of that company. He was born at Taunton, Mass., September 5, 1857, and is well known and popular with street railway managers. He attended the Boston

public schools and was graduated from the Boston English high school in 1875.

Mr. Randall had a natural fondness for the railway business, and after his graduation entered into the motive and car department of the New York & New England Railroad. He afterwards became connected with the car department of the Boston & Lowell and Boston & Maine Railroads. Mr. Randall later devoted his attention to cars for street railway service, and was appointed, at first, foreman, and later superintendent of the Tripp Manufacturing Company, manufacturers of electric motor trucks and metallic packing. He left this position several years ago to connect himself with J. G. Brill Company. His successor in the New England territory as representative of the J. G. Brill Company, is Mr. George M. Haskell. Mr. Randall's Chicago office will be in the Monadnock Block.



F. C. RANDALL.



G. M. HASKELL.

Mr. G. M. Haskell, who is to be Mr. Randall's successor, will have headquarters in New Haven. He was born at Wakefield, Mass., July 15, 1867. He entered the employ, about five years ago, of the Thomson-Houston Electric Company, with whom he was continuously connected until his connection with the Brill Company. He was sent some time ago to Central America in the interests of the Thomson-Houston Company and remained one year in San Salvador. He was later located in New York, at the main office of the General Electric Company. He has had wide experience in the street railway work and a large acquaintance especially in the East, where he is to represent the Brill Company.

Mr. James E. Grist, mechanical engineer of the Philadelphia Traction Company, whose portrait we take pleasure in presenting to our readers on this page, was born in Boston, England, October 10, 1864. He is the son of B. W. Grist, vice-president and general manager of the Pennsylvania Iron Works Company, and came to this country with his parents at the age of seven years. He inherited a fondness for mechanical and engineering pursuits from his father, and entered, when twelve years old, as an apprentice, the works of the latter, who was then the head of B. W. Grist & Company, Ltd., of Reading, Pa. James Grist served in this apprenticeship until the age of twenty-one, then worked two years as a journeyman, after which he was appointed foreman of the shop. This position he held until the time of the absorption of B. W. Grist & Company, Ltd., by the Pennsylvania Iron Works Company, when he was appointed to the same position in the latter company. Several years later he was appointed superintendent of the Pennsylvania Iron Works Company.



JAMES E. GRIST.

Mr. Grist remained in this capacity until Jan. 1, 1894, when he resigned his position to open an office, as consulting engineer, in the Betz Building, Philadelphia. Soon afterwards, however, Mr. Grist was offered, and accepted, the position which he how holds, that of mechanical engineer of the Philadelphia Traction Company. His duties are complete charge of all the motive power and mechanical equipment of the Philadelphia Traction Company, including the general direction of all the machine shops and car shops of the company.

He is thoroughly versed in mechanical engineering, and a most assiduous worker in his chosen profession. His successive appointments to posts of increasing responsibility and trust are a fitting testimonial to his ability and worth.

New Publications.

Directory of Electric Light Central Stations and Electric Railways in North America. Issued quarterly by *Electrical Industries*, Chicago.

Directories of the electric light central stations and electric rail ways were formerly published in each issue of *Electrical Industries*, but the publishers of this paper have decided to make it a separate publication. The Directory is convenient in form and should prove most valuable to all who have occasion to refer to these lists.

A Few Plain Facts Concerning Water Tube Boilers. Published by Abendroth & Root Manufacturing Company, of New York.

This handsome circular gives, in detail, views of the well known Root water tube boiler, methods of construction and theory. Some excellent records made in tests are shown, and one special chapter is devoted to showing the circulation, and another on the facilities for cleaning. The pamphlet is handsomely printed and bound and is written in an attractive and, at the same time, technical style.

Catalogue of the Curtis Railway Motor, Manufactured by the Curtis Electric Manufacturing Company, of Jersey City, N. J.

This catalogue contains full description, with general detailed illustrations, of the railway motor of the Curtis Electric Manufacturing Company, which has been adopted on a number of roads, as mentioned in this issue. Views of the series-multiple platform controller, with and without casing, waterproof rheostat and other parts of the equipment, are given. The frontispiece is a handsome view of the exterior of the Curtis factory in Jersey City, to which intending purchasers are invited to inspect the works and the quality of the material and workmanship put into the company's apparatus. The catalogue is from the press of Bartlett & Company.

Permanent Pan-American Exhibit.

The Pan-American Company, of New York, is the outcome of the Pan-American Congress held in this country several years ago, and which was attended by delegates from all three Americas. The object of the company is to be of benefit to manufacturers and promote trade between this country and the South American and Central American republics. To this end the company has secured the Industrial Building corner of 43d Street and Lexington Avenue, where it will maintain a permanent exhibit of manufacturers' samples, and which will be conducted on the same lines as the foreign commercial museums of Brussels and Liverpool, which are important factors in the development of European export trade. The exhibit occupies the six floors of the Industrial Building, comprising 270,000 sq. ft. of floor space, and the revenue of the company is derived solely from the leasing of this to manufacturers for exhibition purposes.

In addition to this branch of its work, the company will act for subscribers in the capacity of a traveling salesman, and to collect all information through its foreign correspondents and traveling representatives that may be of value to the interest that the manufacturer represents. Officers and agents of the company having a knowledge of the Spanish language will make trips through the various portions of Spanish America solely in the interests of American manufacturers who are subscribers to this enterprise, introducing their goods and collecting information for them. The company has resident agents in each of the larger cities of Spanish America, South Africa and Australia, with whom the subscribers are at liberty to correspond at all times. The company also issues a monthly foreign trade review and weekly bulletin.

The personnel of the company is an exceptionally strong one, and its directors include gentlemen who have been conspicuously identified with the Latin-American commerce and the needs of these countries Among the street railway manufacturers who have already availed themselves of the advantages offered by this company are the J. G Brill Company, the Baltimore Locomotive Works and others.

Electric Launches for Street Railways.

Everybody who visited the World's Fair will bear testimony to the good service done by the electric launches on the lagoons. It was one of the most delightful features of the fair to ride in them. At night, when illuminated by their own electric lights, they made one of the most beautiful features of the famous South Basin, or Court of Honor. Since the fair closed these boats have been sought after, not only in this country, but in various other parts of Europe. One is now running on the canals of Venice; another is in use in Germany; another is owned by Lord Aberdeen, and is now running on Rideau River, at Ottawa; one has been purchased by Cornelius Vanderbilt for use at Newport; nine were purchased by the Park Commissioners at Chicago, and may now be seen in daily use there; some were purchased by Mr. Plant, and were in use all winter at Tampa Bay; two have been secured by A. Meinecke, Jr., of Milwaukee; one has been secured by the Hartman General Electric Company, Duluth, Minn.; another is in use at Salem, Ill, the property of Dr. Wellman; and so on.

The Electric Launch & Navigation Company recommends them for water termini of street railway companies. They may be readily charged from any source, including the trolley. They are about thirty-six feet long, and have a comfortable seating capacity for thirty people. The weight being evenly distributed they are very seaworthy. They ought to be a great attraction on summer nights, for they can be illuminated by varied colored electric lights, furnished from their own batteries. They are almost noiseless in their action, and are, of course, free from the noisomeness of oil, steam, and the like.

Obituary.

H. W. Tallant, vice-president and general manager of the Fort Worth (Tex.) & Arlington Heights Railway Company, died in Denver on May 15. Mr. Tallant was born of English parents in the city of Baltimore. He moved to Denver, and became acquainted there with H. P. Chamberlin, resulting in his going to Fort Worth, and taking full charge of the Chamberlin Investment Company's extensive interests in that locality. His energy and enterprise soon made him one of the leading citizens of Fort Worth, and he became prominently identified with many improvements that added to the prosperity and importance of that thriving community. Among the important enterprises which, under his skilled management, were crowned with success were the Fort Worth & Arlington Heights Hotel Company, the Fort Worth & Arlington Heights Street Railway Company, the Arlington Heights Electric Light Company and the Arlington Heights Water Company. Mr. Tallant was well known in street railway circles, and his death is mourned by hosts of friends throughout the country.

Electric Signals for Street Cars.

When the motive power for operating a street car is electricity, it seems as if the same power ought to be used to ring the electric signal bells and alarm gongs used on the cars. Such, at least, is the opinion of the Dewey Electric Signal Company, of 26 Cortlandt Street, New York, whose system consists of a signal bell at each end of the car under the hood, and an alarm gong on the roof of the car, both of which are operated by current taken from the main line or trolley.

The signal bells used by the conductor for signaling the motorman to start or stop the car are operated by simple push buttons, conveniently located at different points throughout the inside of the car, and under the hood at each end, which enable the conductor to communicate easily and instantly with the motorman. The unsightly strap or cord, which is usually employed to operate the signals, or the use of primary or secondary batteries, which are inconvenient, unreliable and expensive, is avoided.

By another push button operated by the motorman's foot, a continuous ringing alarm gong is operated. The gong is arranged to continue ringing until the foot is removed, thus doing away with the continual up and down movement of the foot, and enabling the motorman to devote his entire attention to the controller and brake.

The amount of current necessary to operate the signals is scarcely noticeable, and their operation is entirely independent of the conditions of the motor circuit. The system has been subjected to rigid tests on cars in actual service and has fulfilled all requirements.

Equipment Notes.

The New York Electrical Works, of New York, have been appointed exclusive Eastern agents for the Yeats Engineering Company.

J. Bradford Sargent, of Boston, Mass., agent for the Stirling water tube boiler, has secured new offices at 8 Oliver Street, having moved from his old quarters at 620 Atlantic Avenue.

M. T. Davidson, of Brooklyn, the prominent steam pump builder, finds a good demand for the Davidson pumps, and his large works at 43-53 Keap Street are running full time with full number of hands.

The Gleason & Bailey Manufacturing Company, of New York, has sold the town of Key West, Fla., two handsome, four wheel, horse, hose carriages. This company has also sold an improved hose wagon to the town of Braintree, Mass.

The Worcester Construction Company, of Worcester, Mass., has secured a large contract for street railway construction in Calais, Me. About eight miles of road will be built. The city will be connected with St. Stephens across the river.

The J. G. Brill Company, of Philadelphia, Pa., has moved its Chicago office from Phœnix Building to the Monadnock Block. The company has appointed as its Western representative, F. C. Randall, as mentioned elsewhere in this issue.

The Ellis Car Company, of Amesbury, Mass., whose factory was recently burned, writes us that it has moved its heavy wagon business to another factory on Friend Street. The company will continue the manufacture of its well known electric snow plows.

The Wales Manufacturing Company, of Syracuse, N. Y., manufactures a fare box which retains its popularity among street railway companies without trouble. The other specialties of the company, such as its self oiling trolley wheel, electric headlights, punches, etc., are seen on many roads of the country, and are everywhere giving satisfaction.

The W. S. Hill Electric Company, of Boston, Mass., has shipped during the present month two orders for switches to one company, that weighed over eleven tons, and notwithstanding the unprecedented hard times the company's gross sales for the past nine months average nearly 75 per cent. more than for the corresponding months of a year ago.

Edwin Harrington, Son & Company, manufacturers of machine tools, portable hoists, etc., have published a little book entitled "A Few Words on the Handling of Dynamos, Generators and Motors." The object of this is to present to the users of these the advantages of the Harrington cranes, and illustrations are given of the different types of cranes manufactured, appliances, etc.

The Steam Gauge & Lantern Company, of Syracuse, N. Y., has won its suit against the C. T. Ham Manufacturing Company for infringing letters patent granted to Charles J. Higgins, and owned by the Steam Gauge & Lantern Company, of New York City. The patent covers the lantern now in general use, and known as the tubular hinged or tilting lantern, and the decision is an important one.

James A. Trimble, of New York, the well known manufacturer of cars, has closed a number of orders recently, among which Mr. Packer, who has charge of this department of the James A. Trimble business, mentions one with the Poughkeepsie City & Wappinger Falls Railway Company, of Poughkeepsie, N. Y. This company will use ten closed cars mounted on Peckham trucks. The company is building some cars also for the Norwalk Traction Company.

W. H. Beatty, who has been connected with the sales department of the Novelty Electric Company, of Philadelphia, for the past five years, is now with the Hubley Manufacturing Company, of Lancaster, Pa. The Hubley Company supplies electrical specialties of all kinds, and in the interests of this company Mr. Beatty has gone on an extensive Western trip. He will stop at all the principal cities, and, with the excellent electric railroad specialties which this company manufactures, will, no doubt, receive many orders.

A. Groetzinger & Sons, of Allegheny, Pa., write us: "Our trade continues to be first class, as it has been since the first of the year; orders are plenty, and we have our hands full in filling the same promptly. Our customers and friends, old and new, have many kind words of praise to say regarding the excellent qualities of "Dermaglutine" pinions, and their continued patronage speaks for itself. Present indications are that our 1894 trade will far exceed any previous year's business." This firm deserves the success which it has attained.

The Central Electric Heating Company, of New York, has sent us, just as our last form is on the press, some interesting figures showing the results of the company's heaters in the electric heating of cars. These show that the cost of operating the American electric heaters depends largely on the cost of current, and this varies greatly in different localties. The average cost, however, is estimated at about twenty-five cents per car day. Taking into consideration the many advantages derived from their use, the railroad manager will consider this a very reasonable figure.

F. W. Webster and R. H. Beach have lately formed a copartnership, under the firm name of Webster & Beach, and have opened handsome offices in the Edison Building, 44 Broad Street, New York. They are prepared to supply practically all kinds of material and supplies used in the construction of electric railways, excepting dynamos, motors and cars. Both Mr. Webster and Mr. Beach are well known in street railway circles, as well as in the electrical field, having been up to a recent date prominently identified with the General Electric Company. They are well fitted by long practical experience for the enterprise in which they are embarked, and we predict for them a large and profitable business.

The Southwark Foundry & Machine Company, of Philadelphia, Pa., reports through its St. Louis agents, Messrs. Boyce, 22 Laclede Building, that city, that it is at present installing three 750 H. P. Porter-Allen automatic engines in the new power station being erected for the Compton Heights, Union Depot, & Merchants' Terminal Railway Company, of St. Louis. These are to be operated in connection with three Westinghouse generators of 750 H. P. capacity each. This company has some time ago filled an order for the Lindell Railway Company, of the same city, for the Porter-Allen automatic engine, and the above order is the result of the unqualified success attained with and approval of this type.

The Sterling Supply & Manufacturing Company, of New York, since its reorganization in February last, has been doing a very satisfactory business, and among its orders may be named the following: The entire equipment of registers for the Third Avenue cable system, of New York; the Atlanta Traction Company, Atlanta, Ga.; the White Line Street Railway Company, Dayton, O.; the Poughkeepsie City & Wappinger Falls Street Railway Company, Poughkeepsie, N. Y.; the further order from the Citizens' Street Railway Company, of Indianapolis, Ind., the sand box equipment for the Consolidated Traction Company, of Jersey City, N. J., and the City & Suburban Railway Company, of Baltimore, Md.

The Carpenter Enamel Rheostat Company is moving its factory from Bridgeport, Conn. to Hoboken, N. J., in the new factory building erected by John C. Crevier, at the 14th Street Ferry terminal. This company is continually improving the design and construction of its apparatus, and, on account of its rapidly increasing business and improvements in methods of manufacture, is making a great decrease in the cost of production, the benefit of which it is giving to its customers by very marked reductions in the prices. A sweeping reduction in the cost of the standard rheostats is announced this week, the reduction running as high as 45 per cent. in some instances. The officers of the company are H. Ward Leonard, president; L. B. Gawtry, vice-president; Charles E. Carpenter, secretary and treasurer.

Wm. Wharton, Jr., & Company, of Philadelphia, Pa., report, through their St. Louis agent, A. W. Slee, 500 American Central Building, that city, that their "Integral" crossings, switches, frogs, and other special work, are meeting with great success in the St. Louis territory. Many orders for these have been received lately, among them a number of crossings for electric lines over cable lines. The Wharton Company is now supplying seventy-eight pound, standard girder rails and fishplates plugged for six bolts to the new 18th Street and Cherokee Street lines of the Union Depot Railroad Company, of St. Louis. Rails and special work were also supplied to the Missouri Railroad Company, for its new loop in the downtown district of St.

Louis. The Wharton patent chair, with movable plug, was used in the latter work.

The Fishkill Landing Machine Company, of Fishkill, N. Y., builders of the improved Fishkill-Corliss horizontal and vertical engines, has been established since 1853. The works of the company at Fishkill-on-the-Hudson, N. Y., are large and finely equipped, and but three minutes walk north of the Fishkill station of the New York Central & Hudson River Railroad, a track of which runs through the yards. The company has admirable facilities for receiving and shipping, both by rail and by water, having in addition to extensive dock frontage, connection with the West Shore; New York, Lake Erie & Western; New York, Ontario & Western; New York & New England, and the Newburgh, Dutchess and Connecticut railroads. Business is good with the company.

The Johnson Company, of Johnstown, Pa., with St. Louis agents, Messrs. Littlefield & Meysenburg, Bank of Commerce Building, that city, is laying three miles of electrically welded rails for the Baden & St. Louis Railroad. One of the company's electric welding cars and tender were shipped on from Johnstown during the winter, and have been steadily at work, night and day, since their arrival. It is reported that since the work began here it has been proven that the electric welding of rails is no more of an experimental nature, but has come up to the most sanguine expectations of the rail company. The rails used weigh seventy-eight pounds to the yard. A large number of eighty-one pound girder rails are being supplied by the company to the Lindell Railway Company, of St. Louis, for the new extension of its Taylor Avenue line.

William Sellers & Company, of Philadelphia, Pa., the large manufacturers of cranes, shafting, machine tools, etc., are doing an extensive business with street railway companies. The cranes built by this firm for the Philadelphia Traction Company, whose Market Street station is illustrated in this issue, are described in that connection. Wm. Sellers & Company have also supplied to the 13th and Mt. Vernon Streets station an electric traveling crane, of twenty tons capacity, similar to that in the Market Street station. Wm. Sellers & Co. have also furnished the Philadelphia Traction Company a twenty ton traveling crane for its Sutherland Avenue station, and are now building for the company still another of same capacity for its Ridge Avenue station. They are also building a twenty ton traveling crane for the Delaware Avenue power station of the Electric Traction Company, of Philadelphia.

Carleton & Kissam, of New York, have lately leased the advertising privileges of the Pittsburgh & Birmingham Traction Company's cars at Pittsburgh, Pa., and now control six lines in this city. In this connection it is worthy of note that Carleton & Kissam were among the pioneers of high class street railway advertising in the Pittsburgh cars, and until lately only controlled two lines there. The excellent satisfaction given by this firm to both advertising patrons and street railway companies has had its natural success, and its field is rapidly extending. Carleton & Kissam have kept on the even tenor of their way in spite of a certain competition, and have easily maintained their supremacy of appearance (as they always do), and their landlords have had no trouble or annoyance. Carleton & Kissam will probably secure in the end other Pittsburgh lines, as the railroad officials have ascertained that it does not pay to rent their advertising privileges at figures so exorbitant as to practically prohibit a profit on the investment.

The General Electric Company, of New York, reports the following orders for railway apparatus taken during one week last month from the New York office alone: Brooklyn, Queens County & Suburban Company, 450 motors; Bridgeport (Conn.) Traction Company, 60 motors and generators; Danbury (Conn.) Street Railway Company, 20 motors; New Haven (Conn.) Street Railway Company, 20 motors and generators; Hartford (Conn.) Street Railway Company, 8 motors; Allegheny Traction Company, Pittsburgh, Pa., 30 motors and generators; Jacob Rich, San José Company, 2 equipments and generators; W. B. Ferguson, of Boston, 1 generator; Franklin, Pa., 6 motors; Electric Traction Company and People's Traction Company, Philadelphia, Pa., large marble switchboards. The General Electric Company has also closed the contract for the Poughkeepsie & Wappinger Falls Railway, of Poughkeepsie, covering two 200 K. W., direct connected generators, forty G. E. 800 motors and type K controllers.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., is constantly adding to the number of companies which have adopted its safety appliances, either the wheel guards, pick-up fenders or both. The latest company to show its appreciation of the merits of the Crawford appliances is the Rochester Railway Company, of Rochester, N. Y. A list of the companies which have adopted the Crawford appliances for all of their cars will not be without interest, and is as follows: Wheel guards: Philadelphia Traction Company, Pittsburgh Traction Company, Duquesne Traction Company, of Pittsburgh, Pa., Central Traction Company, of Pittsburgh, Pa., Citizens' Traction Company, of Pittsburgh, Pa., the Terre Haute (Ind.) Street Railway Company. Pick-up fenders: Rochester (N. Y.) Railway Company, Citizens' Street Railway Company, of Indianapolis, New Orleans (La.) Traction Company, Birmingham Traction Company, Pittsburgh & West End Passenger Railway Company, Second Avenue Passenger Railway Company, of Pittsburgh, and the Tarentum (Pa.) Street Railway Company. The capacity of the company's works is now 1,000 appliances, and the company is working full time.

The Hubley Manufacturing Company, of Lancaster, Pa., manufacturer of electric railway and lighting supplies, is manufacturing an entirely new trolley harp which has a number of points which recommend it for street railway service. The harp is constructed of malleable iron and the wheel of bronze, so that both can be made very light, relieving the wear on the overhead line. We understand that the trolley head has been in use on a number of roads with great success, and that it has given special satisfaction on lines where there are a number of low bridges, and where the range of movement of the trolley pole is specially wide. Another specialty which the company manufactures, and which fills a long felt want, is a trolley wire splicing sleeve. By this, in the event of breakage of the trolley wire, the ends of the wire can be spliced in a brief space of time without the aid of any auxiliary appliances. The company also manufactures commutators, axle gear case linings, armature and motor axle linings of either anti-friction or bronze metal, and is rapidly completing a number of specialties in the electric railway trade. W. H. Beatty, formerly of the Novelty Electric Company, of Philadelphia, is now connected with this company.

The Babcock & Wilcox Company, of New York, numbers among its recent orders the following from leading street railway companies: The Nassau Electric Railroad, Brooklyn, N. Y., 1,500 H. P. The Hestonville Passenger Street Railway, Philadelphia, Pa., 1,500 H. P. The Philadelphia Traction Company, Philadelphia, Pa., 2,675 H. P. The order from the Philadelphia Traction Company is the second the Babcock & Wilcox Company has received from that company, the previous order being for 6,000 H. P. The Babcock & Wilcox Company has now equipped with boilers all the trolley lines of Boston and Philadelphia, and all but one in Brooklyn. The Babcock & Wilcox Company reports through its St. Louis agent, Mr. Ashburner, Security Building, that city, the completion of the installation of the Babcock & Wilcox boilers in the power plant of the new Union Passenger Station, St. Louis. This order was received by the company after the hottest kind of competition, and solely on the merits of its product. Patent endless grates are used in connection with the boilers, operated by small upright engines, and simultaneously feed the furnaces with small anthracite coal and haul away the ashes, dumping the latter into the pits in front of the boilers. This is one of the few successful ones of the kind.

The Buffalo Forge Company, of Buffalo, N. Y., writes us that its steam fans are growing in popular favor, and that a number of prominent street railway companies are using these now in their stations. As a result, the owners of such plants can use anthracite coal screenings in the place of soft or hard coal. The apparatus required consists of a blower and engine with accessories. If hard coal, at about $4.85 per ton, is being burned, it is possible to reduce this expenditure to $1.40 per ton, with, it is claimed, just the same results as from the $4.85 expenditure. If soft coal, at about $2.10 per ton, is used, the Buffalo Forge Company claims that hard coal screenings, at $1.40 per ton, can be substituted, and that three-quarters of a ton of hard coal screenings more than equals a full ton of soft coal. These may be considered pretty strong claims, but the company claims they can be substantiated by an investigation of its plants in Messrs. Barnes, Hengerer & Company's Genesee Hotel, "Gold Dollar," and elsewhere in Buffalo. Another thing to consider is, with this system, burning hard coal screenings, the smoke nuisance is abated, as can be seen by an examination of the smoke flues of the plants mentioned. The company also furnishes regulators which can be set for any steam pressure it is desired to carry, and the speed of the fan will be regulated perfectly to produce that steam pressure.

Charles A. Schieren & Company, of New York City, seem to be doing an excellent business, and we notice that their belts are as popular as ever. They have received recently, among other orders, one for seventy-five feet of thirty-four inch, double, perforated electric belting from the Metropolitan Street Railway Company, of San Francisco. The latter company has tried different kinds of belting, and gives the electric perforated a decided preference over all other makes. Chas. A. Schieren & Company have also taken an order for an extra belt, ninety-one feet long and sixty inches wide, from the Brooklyn City Railroad Company. The letter given below from the Electric Railway Company, of Savannah, Ga., and dated May 18, is a sample of the kind of letters received by this company from street railway companies: "Please ship one double, perforated electric belt, sixteen inches, for high speed generator work, diameter of driver seventy-nine inches, diameter of driven thirty inches, distance from center of driver to center of driven nineteen feet six inches; want the belt made endless ready to put on. We are giving you the order for this belt at a much higher price than we can buy for, but we have two of your belts in use in our power house that were bought by the Edison General Electric Company three or four years ago, and they are so far ahead of others we have in use we prefer to pay you more for yours. Please get the belt to us as soon as possible, and see that it is up to your best quality. Your price as per letter is $2.36 per running foot. Ship per steamer. Yours truly, J. S. Collins, President."

The Berlin Iron Bridge Company, of East Berlin, Conn., writes us that the new terminal facilities for the New York, New Haven & Hartford Railroad, at Providence, R. I., will necessitate two large bridges, which will be furnished by that company. These bridges will carry sixteen tracks over Gaspee Street, Promenade Street and Woonasquatucket River. The bridges will be plate girders, resting on abutments at the street line and columns at the curb line. There will be no floor beams or stringers used, but in the place of these will be a metal floor supporting ballast, in which the ties and rails will be bedded. The work will require about 4,500 tons of open hearth steel material. The Berlin Company is to be allowed six months in which to complete the work. This company is putting up a new transfer station for the Washington & Georgetown Railroad Company, at Washington, D. C., also an iron and steel building, seven stories high, for James Pettit, of New York City. The Berlin Iron Bridge Company paid on April 14 its regular quarterly dividend of 1½ per cent. Considering the hard times in all branches of business, especially among manufacturers of structural iron, we think this shows pretty good management,

not to put it any stronger, and is a refreshing change in reports coming from so many quarters of closed factories and "passed" dividends. The Electrical Association, Incorporated, of Waterbury, Conn., has placed the contract for its new power station with the Berlin Iron Bridge Company. The building will be 66 ft. in width, and 183 ft. in length, the side walls of brick, and the roof covered with the Berlin Iron Bridge Company's patent anti-condensation, corrugated iron roof covering.

WESTERN NOTES.

The Lodge & Davis Machine Tool Company, of Cincinnati, O., has secured an order for four large lathes to be used in the new machine shops being built by the Addiston Pipe & Steel Company, of Addiston, O.

Kohler Brothers, of Chicago, have been appointed Western agents of the Walker Manufacturing Company. This firm has represented the Eddy Electric Company for two years and is well known in the street railway electrical field.

L. K. Hirsch, of Chicago, who purchased the Pier Movable Sidewalk, installed at the World's Fair, Chicago, as mentioned in a recent issue, is now taking the sidewalk apart, and is meeting with quite a good sale for the material.

The Wallace Electric Company, of Chicago, has secured a number of large contracts within the last month for its improved railway devices. These appliances are rapidly becoming standard with a large number of roads. They are made of the very best material, and are guaranteed both for strength and insulation.

The Electric Improvement Company, of San Francisco, has recently been appointed general agent for the Fort Wayne Electric Company, on the Pacific slope. This company writes us that it is prepared to execute orders for all kinds of eleetrical supplies, including that required for electric railways, electric lighting and steam plants.

The Wallace Electric Company, of Chicago, has sent us a handsome nickel plated model of the improved combination pole bracket described in our last issue. The model shows the peculiar advantages of this bracket for electric railway work, and is at the same time a handsome office ornament.

The Wrought Iron Bridge Company, of Canton, O., whose works are described in this issue, is the sole manufacturer of the L. S. Pfouts patent flexible trolley bracket and street railway and lighting pole. These brackets and poles, although only recently put on the market, are attracting a great deal of attention and seem to meet with popular approval.

The Wadhams Oil & Grease Company, of Milwaukee, Wis., is the manufacturer of, perhaps, the best and most economical curve grease to be had in the market. It is made soft, of high grade grease and flake graphite, and so soft that it can be easily applied with a stiff brush or a paddle. Cars seem to round the curves easier and with less friction by the use of this, and the many users in this country are most emphatic in their praise of it.

The C. &. G. Cooper & Company, of Mt. Vernon O., write us that they have just shipped an 800 H. P., cross compound Corliss engine to the Nockege Cotton Mills, Fitchburg, Mass., and that they have received an order for two 750 H. P. engines, for the Allentown & Bethlehem Traction Company, Allentown, Pa.; another order received by this company is for three 750 H. P., cross compound engines, arranged for direct attached generators, for the Nassau Electric Railway, of Brooklyn, N. Y. The ultimate power for this road will be about 10,000 H. P.

The Purdue University, at Lafayette, Ind., is now fortunate in having the promise of the most complete engineering laboratory. The former laboratory of this institution was destroyed by fire on the night of January 23, but owing to the untiring efforts of the president and the co-operation of the Board of Trustees, a large amount of money has been secured for its restoration. The university will now have two complete locomotives, with facilities for testing same, and a completely equipped machine shop and forge room, new traction dynamometer, Riehle testing machine, etc.

The Steel Motor Company, of Cleveland, O., has just secured the contract for sixty double car equipments of the celebrated "Steel Clad" motor from the Nassau Electric Railway Company, of Brooklyn, N. Y. These motors have been on the market but a comparatively short time, yet are meeting with much merited success, and the above order was secured on the strength of the splendid record which they have made at Allentown, Pa., under very adverse conditions. The Steel Motor Company is also building its fourth order for the Allentown & Lehigh Valley Traction Company.

The Scarritt Furniture Company, of St. Louis, maker of the Scarritt street railway car seats, reports the car business, as far as street railways are concerned, as very encouraging. The company recently filled an order for the Lindell Railway Company, of St. Louis, which makes over 1,500 Scarritt rattan seats in use on the cars of that railway. The crowning features of the Scarritt street railway car seats are the absence of arms—giving the maximum space—and the neat and inviting appearance they give to the car. Another good point in their favor is that they are reversible, and the backs tilting.

The Buckeye Engine Company, of Salem, O., maker of the famous automatic cut-off engines bearing that name, has established a branch office at St. Louis, in the Security Building. This company has heretofore filled the St. Louis orders from another office, but it has found business so brisk and profitable in St. Louis and vicinity, that it decided to locate a branch office there. There is a large number of Buckeye engines of various speeds in use in St. Louis, not only in street railway and electric lighting power plants, but in a large number of industrial establishments in the city proper and the surrounding territory.

The Heine Safety Boiler Company, Bank of Commerce Building, St. Louis, reports the boiler business as unexpectedly good, considering the hard times. Many orders are at present being filled by the company, among the larger being one for the Washburn-Crosby Milling Company, of Minneapolis, Minn., which calls for 1,000 H. P. of safety water tube boilers, of the Heine type. Heine boilers have achieved great success at the Midwinter Exposition, San Francisco, Cal., where oil fuel has been employed, with the installation of 3,000 H. P. This steam plant supplies all the necessary steam to the entire exposition.

The Mason Electric Company, Pullman Building, Chicago, reports contracts made during the last month for new roads and extensions in Norfolk, Va.; Washington, D. C.; Hammond, Ind.; Galesburg, Ill.; Hazleton, Pa.; Oil City, Pa.; Sioux City, Ia.; Clinton, Ia.; Memphis, Tenn.; Green Bay, Wis.; Omaha, Neb.; San Antonio, Tex.; also an order for some of its line material from Switzerland. The company carries in stock everything needed for complete equipment and maintenance of electric roads, and owing to its long and practical experience in the street railway field, occupies a most commanding position in the trade.

Arthur S. Partridge, Bank of Commerce Building, St. Louis, dealer in electric street railway supplies, reports business in his line as very brisk as far as he is concerned. He recently received a large order from the North and West Chicago Street Railroad Companies, of Chicago, Ill., one of the largest orders ever given. He informs us that his prices on bare copper wire and steel and iron poles cannot be approached. He is also supplying the Baden & St. Louis Railroad with all necessary wire for that company's new line. Mr. Partridge's territory is not confined to the locality round about St. Louis, as the above order for Chicago will readily indicate.

The Charles Munson Belting Company, of Chicago, reports trade as very much improved during the past six weeks. The company has received orders for a number of large belts, and contracts have been awarded it from quite a number of large manufacturing establishments for the entire equipment of belting. The Munson Company has also just completed arrangements with the L. M. Rumsey Manufacturing Company, of St. Louis, to handle the different brands of Munson belts in the Southern territory, and arrangements have also been made with the Revere Rubber Company to have a full line of different brands of Munson belt in stock at its San Francisco and Minneapolis houses.

George Cradock & Company, of Wakefield, Eng., have appointed T. A. Wigham, of the Granier Economic Cupola Company, 714 Bort Building, 17 to 21 Quincy Street, Chicago, Ill., as their agent for the United States. Mr. Wigham intends to make the Cradock cables even better known on this side of the Atlantic than ever before, and the demand for these well known ropes should increase rapidly with the establishment of this American agency. This company has supplied a cable for the section of the North Chicago Street Railway Company, which extends through LaSalle Street. This cable was installed February 11, 1894, and removed May 9, 1894, having worked eighty-eight days—an excellent record.

The St. Louis Register Company, 217 N. 3d Street, St. Louis, maker of the famous Security register, informs us that business is very brisk at the company's present time. The company has a large number of small orders on hand and several large ones, among which may be mentioned that for the West End Street Railway Company, of Boston, Mass., calling for 134 standard Security registers. The company has also completed a large order received from Philadelphia. The street railways of St. Louis have recently contracted with the company for large numbers of its machines, notably the Union Depot Railroad and Lindell Railway Companies. This register has become standard on a number of the principal street railroads of St. Louis.

The Creaghead Engineering Company, of Cincinnati, reports numerous inquiries for its flexible bracket, as well as a number of orders, showing that this device is growing in popularity. The South Covington & Cincinnati Street Railway Company has ordered over a mile of double flexible brackets for double track work for its extension from Newport, Ky., to the Evergreen Cemetery. The Capital Railway of Frankfort, Ky., described in this journal, is equipped with this bracket. The flexibility of this bracket makes it peculiarly suited to high speed suburban roads, and reduces the cost of maintenance as well as the first cost of construction. The Creaghead Engineering Company's 1894 catalogue of electric railway overhead parts, is now ready for distribution, and the company writes us that it will be pleased to mail copies to parties interested in the construction and maintenance of electric roads.

The Brownell & Company, of Dayton, O., well known manufacturers of boilers and engines, have bought the exclusive right to manufacture under the patents of C. M. Giddings, formerly of the Sioux City Engine Works, and have established a department of engineering under the supervision of Mr. Giddings as superintendent. This company will make a specialty of high grade automatic engines, both simple and compound, and has purchased the entire stock of drawings, patterns, finished and unfinished automatic engines of the Sioux City Engine Works. These engines are well known in the trade as the Russell single valve automatic. The highest possible grade of workmanship and finish will be maintained in these engines which have already obtained such a high standing for their close regulation. The Brownell & Company have recently added to its boiler shop equipment a set of twenty foot rolls eighteen inches diameter, capable of rolling the heaviest plate and making twenty foot boilers in two

sheets. This, with the special machinery of the company's own design and make, will put it in the front rank of well equipped boiler manufacturers.

The Bates Machine Company, of Joliet, Ill., has sent us a copy of the award granted to the Bates-Corliss engine at the World's Fair, Chicago, last year. The engine was in Group 69, Class 415. The award reads as follows: "Corliss engine differing in construction in the motion of the valve, which is novel in its construction. Quite a reduction is shown in the number of parts over other Corliss designs. The release is quite light and does not affect the governor. It is free from all springs, and is simple and easily operated. The governor is furnished with safety stop. The bridle rods come from the same pin and pass to the arm with roller attached, but from opposite sides of the pin, doing away with the variation of the movement of the governor and giving positive motion to the valve. The girder is of box type with bulkheads. Corliss engine with novel wristplate valve motion, excellent arrangement of the bridle rods and automatic stop, general construction, design and workmanship." The report is signed by O. Emerson Smith, individual judge, and approved by John A. Roche, president Departmental Commitee, and John Boyd Thacher, chairman Executive Committee on Awards.

The Brownell Car Company, of 2200 North Broadway, St. Louis, is very busy at the present time building "Accelerator" cars for a number of points, among them Baltimore. The durability, lightness, and superior finish of the Brownell cars have pleased the Baltimore street railway companies, and the result is that orders for new cars are awarded to this firm. In almost all cases the "Accelerator" type of car is specified, showing the great popularity it has gained among the traveling public. Where cars are continually crowded, and the maximum number of cars is operated, a large amount of time has been saved on account of the minimum time consumed by a passenger getting on or off a car. The company has recently put upon the market a patent car seat. The sales of the same have already been most encouraging. This seat is illustrated and its merits and good points shown up elsewhere in this issue. The Brownell patent electric motor truck is being continually called for, and its good qualities need but to be mentioned to be appreciated, as they have been known to the street railway fraternity of the country since its first appearance. The Brownell Company writes us that in addition to the recent orders for Accelerators, mentioned elsewhere, the company has received two from Chicago, one for the North Chicago Street Railway Company, and one for the Chicago Electric Transit Company. This makes the fifth order for Accelerator cars from Chicago, showing that the companies there think well of the design.

The St. Louis Car Company, 3023 North Broadway, St. Louis, informs us that its shops are full of work at the present time. This company recently found it necessary to increase its capital stock from $100,000 to $500,000, in view of the large business it is now doing and contemplates doing in the near future. Most of the orders now on hand are for the Eastern states, particularly Philadelphia, Pa., Brooklyn, N. Y., and New York City. The Philadelphia order is from the Electric Traction Company of that city, and calls for 400 cars. These cars are twenty feet long, and each is equipped with two twenty-five horse power General Electric motors. A large order has recently been obtained from the Union Depot Railroad Company, of St. Louis, for twenty-four foot cars to be operated on its new 18th Street and Cherokee Street lines. These will be each mounted on Robinson radial trucks and equipped with two twenty-five horse power General Electric motors. The car company is sending a large number of its extended spring base trucks to various points throughout the country. The general manager for the company, P. M. Kling, is at present trying a new bogie truck after his own designs, which is intended to do away with the necessity for double steps where bogie trucks are used. Forty sixteen foot car bodies are now being spliced, in order to make twenty long cars, for the St. Louis & Suburban Railway Company. These cars are mounted on two four wheel trucks, and some are equipped with four fifteen horse power, others with two twenty-five horse power General Electric motors. They will each seat fifty-two passengers.

The Hoppes Manufacturing Company, of Springfield, O., reports some recent sales of Hoppes live steam feedwater purifiers and exhaust steam feedwater heaters as follows: To the Edison Illuminating Company, Monmouth, Ill., 625 H. P. live steam purifier. Columbus (O.), Electric Light & Power Company, 2,000 H. P. exhaust steam heater. Delaware (O.) Electric Light & Power Company, 500 H. P. live steam purifier. Bay City (Mich.), Union Railway Company, 400 H. P. live steam purifier, also 400 H. P. exhaust steam heater. Oconomowoc (Wis.), Electric Light Company, 200 H. P. exhaust steam heater. Freeport (Ill.), Gas Light & Coke Company, 300 H. P. exhaust steam heater. Citizens' Street Railway Company, Muncie, Ind., 350 H. P. exhaust steam heater. Heat, Light & Power Company, Muncie, Ind., 300 H. P. exhaust steam heater. Muscatine (Ia.) Electric Railway Company, 400 H. P. exhaust steam heater. Columbus (O.), Street Railway Company, 1,000 H. P. live steam purifier. Omaha (Neb.), Gas Manufacturing Company 2,000 H. P. live steam purifier. Elmira (N. Y.) Illuminating Company, 1,000 H. P. live steam purifier. Citizens' Gas & Electric Company, Jacksonville, Fla., 80 H. P. live steam purifier. East River Gas Company, Long Island City, N. Y., 625 H. P. live steam purifier. Edison Electric Light Company, Dayton, O., 750 H. P. live steam purifier. Calumet Electric Street Railway Company, Burnside Crossing, Ill., 1,000 H. P. live steam purifier. Shreveport (La.), Gas, Electric Light & Power Company, 300 H. P. exhaust steam heater. Waco (Tex.) Electric Railway & Light Company, 800 H. P. exhaust steam heater. People's Traction Company, Philadelphia, (two) 3,000 H. P. exhaust steam heaters. Public Lighting Commission, Detroit, Mich., (seven) 300 H. P. live steam purifiers.

List of Street Railway Patents.

U. S. STREET RAILWAY PATENTS ISSUED MAY 1, 1894, TO MAY 22, 1894, INCLUSIVE.

MAY 1.

ELECTRIC CONDUCTOR FOR UNDERGROUND CONDUITS—Daniel E. Conner, Covington, Ky., assignor of one-half to James William Gallup, Cleveland, O. No. 518,939.

An electric conduit, a live wire or conductor, in combination with the contact pieces or links loosely supported below said conductor in a slot in insulating material and exposed below to direct contact of a trolley.

TROLLEY FOR ELECTRIC RAILWAYS—George W. Hooper, Rochester, N. Y., assignor, by direct aud mesne assignments, to James S. Baker, same place. No. 518,952.

A trolley comprising a wheel and axle adapted to turn together, a yoke frame provided with lubricant receptacles closed at their outer ends, bushings fixed in the receptacles and filling openings in the said receptacles, the interior of said bushings communicating freely with said receptacles, and the bushings abutting against the wheel about the axle.

SAFETY GUARD FOR STREET CARS—Stephen Norton, Rochester, N. Y., assignor of one-half to William H. Rice, same place. No. 519,046.

A safety guard for street cars, the combination, with the car, of springs attached to the end of the car, and a cross bar attached to the springs.

PLATFORM GATE FOR CARS—John Krehbiel, Cleveland, O. No. 519,066.

The combination with a platform and gate, a movable step, a spring for normally closing the gate, and means actuated by the step to forcibly open the gate against the tension of the spring.

SWITCH ACTUATOR FOR STREET CARS—Fletcher Sparling, Boston, Mass. No. 518,972.

A switch actuator for street cars, a yielding support connected to the car, and normally elevated, combined with an actuator connected to said support and adapted to be swung laterally and provided with an operating handle, and independent means to positively depress the support and the actuator.

RAILWAY SWITCH—Christopher Froelich, Brooklyn, N. Y. No. 519,082.

An actuating rail, arranged alongside of the track rail, of a fulcrumed counterbalancing lever below the actuating rail, a pivoted switch tongue and mechanism interposed between the actuating rail and its counterbalancing lever and connected with said switch tongue.

ELECTRIC RAILWAY CONDUCTOR SUPPORT—John C. Henry, Westfield, N. J. No. 519,115.

The supports or hangers for the working conductors of an electric railway, of spring material made weaker or less tense on the extreme ends than at other parts, so as to automatically adjust themselves to the varying bends of the working conductors.

CAR FENDER—Samuel C. Kindig, Baltimore, Md., assignor of one-half to Lee Biden, same place. No. 519,128.

A car fender having a frame consisting of side bars and forward end bar, the side bars being pivoted to brackets pendent from the car, provided with a horizontal bolt passing through said brackets and engaging the top of said frame to hold it normally down, and springs for raising it when released by the withdrawal of the bolt.

WHEEL GUARD OR FENDER FOR CARS—James F. Morton, Baltimore, Md., assignor, by direct and mesne assignments, of one-half to William H. H. Anderson and Nicholas S Hill, Jr., same place. No. 519,289.

A wheel fender having supporting bars secured at their upper ends to the car platform, a cradle hinged near its lower end to the lower ends of the said supporting bars and springs to yieldingly hold the upper part of the cradle from or away from the said supporting bars.

ELECTRIC RAILWAY—William B. Purvis, Philadelphia, Pa., assignor of one-half to Halsey J. Tibbals, same place. No. 519,291.

A tube composed of insulated sections, inside and outside tubes formed of non-conducting material and slotted, and a loose electric wire within said inside tube, said parts being combined.

MAY 8.

CONDUIT ELECTRIC RAILWAY—James F. Cook, Mansfield, Pa. No. 519,380.

An underground conductor street railway system having a trolley arm having a horizontal upper arm or arms journaled in bearings secured to the framework of the car, a downwardly extending middle portion made narrower than the arms for passage through a slot, and a lower horizontal arm provided with a wheel, the entire trolley arm being made of two halves secured together, and inclosing a wire in the center.

LIFE GUARD FOR STREET CARS—James Campbell, Brooklyn, N. Y. No. 519,402.

In a life guard for street cars, etc., a V shaped fender suspended on links, a lifting rod formed with a shoulder, and a spring latch, upon the body of the car, for engaging said shoulder on the rod and holding it and said fender in an elevated position.

ELECTRO-HYDRAULIC CAR MOTOR—Charles E. Emery, Brooklyn, N. Y. No. 519,469.

In combination with an electric motor, a series of pumps of different sizes operated thereby, a hydraulic motor operated by the fluid

delivered by such pumps, and suitable valves and connections all operable at will to transmit fluid from the pumps to the hydraulic motor and operate the same at different relative velocities proportioned to the size and number of pumps at the time in use.

Fender for Cars—Arthur H. Jelly, Cambridge, Mass. No. 519,472.

A fender pivotally secured to the car and traveling on the rails whereby it is held radial to the curvature of the track, a curved track against which the supporting swinging arm of the fender bears, said track being supported below and secured to the car step, brake support and car.

Trolley Wire Crossing—Edward H. Allen, Cramer's Hill, N. J. No. 519,519.

A crossing device for electric railways, a central block or plate of insulating material having a series of projecting arms forming continuations of the conductors and provided with clamping devices for engaging said conductors.

Trolley Wire Hanger—Charles F. Strasburg, Lincoln, Neb. No. 519,621.

A trolley wire clamp having a rectangular groove or seat for the trolley wire, substantially coextensive with the body portion of the clamp and continuous.

Safety Car Fender—George C. Schmidt, Baltimore, Md., assignor of one-half to Araham Harman, same place. No. 519,648.

The combination of a car body, a frame movable up and down, that is, to and from the car body; a fender attached to the said frame and comprising a number of resilient spring fingers each rigidly secured at its upper end, but having its lower end free, and means for operating the said frame and fender up and down.

May 15.

Car Provided With Fenders—Arthur H. Jelly, Cambridge, Mass. No. 519,714.

A car fender comprising a unitary or rigid frame vertically hinged at its rear end to a car, and with its front end held normally in a slightly raised position from the roadbed or track, a mechanism within control of the motorman for the release of the fender from said position, and a spring acting at all times as a constantly downwardly forcing spring upon the front end of the fender whereby said front end is held down to its slightly raised position and when tipped is held firmly and constantly on the roadbed.

Electric Railway System—David Mason, Schenectady, N. Y. No. 519,794.

A current main or lead having branch conductors operatively connected with switching levers pivotally secured in alignment with the rails of the track and adapted to be actuated by the wheels of the vehicle, in combination with short sectional conductors or contacts provided with circuit connections for connecting them to the aforesaid branch conductors.

Fender for Street Railway Cars—John B. Bailey, Baltimore, Md. No. 519,803.

In a car a fender comprising side bars which are connected with the car by shackles so as to move both vertically and laterally, springs between the fender and car for supporting the front portion of said fender, and a lever under control of the grip or motorman to be operated at will to shift the said fender laterally, substantially as set forth.

Trolley Wheel—Van Dyke Cruser, Flatbush, N. Y. No. 519,837.

A trolley wheel formed of two parts mounted for movement in the same direction at different rates of speed, as set forth.

May 22.

Car Starter and Brake—Ralph Clegg, Longsight, England. No. 520,134.

A brake drum and a brake applied thereto, a spring contained in said drum to be charged with power by the application of the brake to said drum, a toothed wheel secured to the said drum and gearing into suitable gearing by which, when the drum aforesaid ceases to be retarded by the brake, the rotation of such drum is transmitted to the axle upon which the said drum is mounted.

Electric Railway Trolley—Thomas M. Brown, Cleveland, O. No. 520,156.

In a trolley device, in combination, a base plate, a plate, a contact device carried by said plate, two parallel trolley poles, and universal joint connections between said poles and the two plates.

Safety Attachment for Street Cars—Henry A. Howe, Albion, assignor to himself, and Joseph Norwood, Brooklyn, N. Y. No. 520,233.

The combination with the car platform, of a guard extending forward of the car, pivotal connections on which the guard is free to be swung up or down, springs for holding the guard against rising or falling from a normal position, a connection to the guard and a lever extending above the platform and adapted to being acted upon by the leg of the driver in opposite directions from either raising the guard or for depressing the front edge against the action of the springs.

Safety Car Fender—Frank I. Clark, Baltimore, Md. No. 520,255.

Consists of suitable hangers attached to the car; a fender frame or platform which is normally raised above the street surface; two links pivotally connected by one end to each hanger and by the other end to the fender frame or platform, the pivotal points of attachment to one of said parts being of a greater distance apart than the pivotal points of attachment to the other part—the said links serving to swing the fender backward and incline the front edge thereof downward when an object is encountered; and a spring to automatically raise said fender from the lowered inclined position and maintain it so that its front edge will be elevated.

Electric Railway—Ernst W. von Siemens, Berlin, Germany, assignor to Siemens & Halske, same place. No. 520,274.

In an electric railway system, an overhead tubular conductor extending along the line of railway and having a longitudinal slot, a traveling contact within said tubular conductor, said contact having a yielding or flexible connection extending through the longitudinal slot to an electrically propelled car.

Conduit Electric Railway—William R. DeVoe, Shreveport, La. No. 520,304.

In an electric railway conduit, the combination with the cross ties, of the metallic plates secured to said ties, and carrying post projections near each end, the metallic lining having upward flanges fitted to said posts, and an integral upward flange near one side substantially dividing said conduit into two parts, and cover plates rigidly secured to said posts and supported thereby.

Block System for Trolley Railways—Willard F. Lewis, Swampscott, Mass. No. 520,323.

In a block system for trolley railways, the combination with the trolley wire, and a contact maker arranged at one end of a track section and comprising a pivoted angled arm, D, suspended normally below the line of the trolley wire and arranged to be operated by the trolley and an electrical contact piece against which the arm is swung when operated, of an electro-magnetic releasing device arranged at the other end of the section and controlled by the contact maker, and a circuit closing device arranged to close a signal circuit when released by the electro-magnetic device.

Car Fender—Bernhard Cron and Werner von Münchhausen, New York. No. 520,354.

The combination of a car with a catch, a movable yielding buffer engaged by the catch, propelling springs and a spring actuated rod put in action by the rearward movement of the buffer and to open the catch and liberate the buffer when pressed backward.

Conduit Electric Railway—Guarantee Trust & Safe Deposit Company, administrator of Charles Wm. Siemens, deceased, Philadelphia, Pa. No. 520,356.

In an electric railway system, a continuous underground chamber having a slot at its upper side, channel irons located at intervals within said chamber, chairs carried by said channel irons, a continuous slotted tubular conductor extending through the chamber and insulated from and supported by said chairs, and an electrically propelled vehicle having traveling connection with said conductor.

Transferring Cable Cars at Intersecting Points—John Kratz, Baltimore, Md., assignor of one-half to Joseph H. Pfister, same place. No. 520,364.

In a cable transfer system, the combination of the main cable having a laterally extending loop; a transverse cable; a canted pulley at one end of the loop and an upright pulley at the other end of the loop; a device at one end of the loop for shifting the main cable, and a similar device at the other end of the loop for shifting the transverse cable, as described.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. The Street Railway Publishing Company, Havemeyer Building, New York.

The Lake Shore Route.

The Lake Shore Route, between Buffalo and Chicago, is celebrated all over the world as affording the embodiment of luxury in travel. Its new Day Coaches are sixty feet in length, and will seat fifty-eight people, comfortably. They are fitted with the Gould platform and automatic coupler, Westinghouse air brakes and signal, heated with steam taken from the locomotive, and at night are brilliantly lighted with Pintsch gas, for which purpose five elegant bronze chandeliers depend from the roof of the car.

The interior of the coaches is finished in mahogany, highly polished and paneled. Each coach has a nice lavatory and toilet. The latest models contain separate toilet rooms—one for ladies and one for gentlemen. The car seats are of the style known as the Mason tilting, with high, spring backs and broad seats. They are richly upholstered in crimson plush. The windows, which are of plate glass, are large, and each is fitted with a spring-roller curtain, in shade to blend with the interior finish, and every feature is of the best.

The dining cars in service on the trains of the Lake Shore & Michigan Southern Railway are operated by the company. The cars are neat and tasty in all their appointments. Great care is exercised to provide the patrons of the Lake Shore Route with a service which shall prove satisfactory. As a result, dining on the trains of the road is accomplished in a very satisfactory and comfortable way.

The sleeping cars in service on the Lake Shore Route are of Wagner build. Ordinarily, they contain twelve sections, a state-room, a smoking apartment, and toilets for ladies and gentlemen. In some instances, however, there are cars containing sixteen sections, the state-room being omitted. Every valuable device is embodied in their construction.

The Lake Shore operates a most perfect sleeping car service between the cities of Chicago, Cleveland Buffalo, New York and Boston, in connection with the New York Central and Boston & Albany Railways. This is not only the direct, best and only double track route between the cities mentioned, but the Lake Shore is the only line from Chicago conveying passengers into New York City without a ferry transfer.***

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., May 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	113½	115
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	101½	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	101½	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102½	.....
" " " Debenture	1891	200,000	M. & N.	6	1901	111	.....
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	111	112
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	110	113

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., May 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	1,000,000	Quart.	3	.....	85	95
City & Suburban Ry. Co	50	3,000,000	.....	1	.....	30	33
Central Pass. Ry. Co	50	300,000	.....	...	.....	60	65
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	15½	16

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort	1892	500,000	.....	5	.....	107½	108
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	106½	107
Balto. Traction Co. (Cable)	1899	1,500,000	M. & N.	5	1929	106	106⅜
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D.	5	1942	101⅜	102
" " "	1891	1,250,000	M. & S.	6	1901	101½	102½
City Pass. R. R. Co	1891	2,000,000	"	5	1911	111½	112

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange, May 19. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,400,000	J. & J.	4	1887	75	77
West End Com'n	50	9,085,000	J. & J.	3	1890–1892	48¼	49¼

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, May 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co	10	6,000,000	Q.—J.	2	.....	.....	167
Brooklyn Traction Co., pref	100	3,000,000	.....	...	1893	67	.....
" " common	100	6,000,000	.....	...	1893	15	.....
Coney Island & Brooklyn R. R. Co	100	500,000	Oct. 1.	4	.....	.....	144
Long Island Traction Co	100	30,000,000			1893	16	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	102	.....
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	.....	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	104	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st	.....	3,000,000	J. & J.	5	July, 1916	.....	110

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., May 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	0	.....	.....	65
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 167 Dearborn Street, Chicago, Ill., May 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	300	.....
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	100	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	241¾	242
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	141	141½

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	100½	101¼
Chicago Passenger	1883	400,000	F. & A.	6	1903	105	110
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	106	.....
" "	.....	1,850,000	M. & N.	4½	1927	....	100
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	.....	103½
West Chicago Street	.....	4,100,000	M. & N.	5	.....	103	103½
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	.....	98
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	103½	103½

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, May 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$7,500,000	Q.—J.	5	.....	105½	105¾
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	106	106½
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	59½	60½
" " " Pref.	100	100,000	.....	6	.....	96¾	98
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	.	.....	19	19½

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1894	100	.....
" "	.....	50,000	J. & J.	7	July, 1895	101½	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	98	99½
	.....	150,000	J. & J.	5	.....	100½	101½
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	110⅜	111½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104¾	105½
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	107	108
" " "	.....	300,000	J. & J.	6	Jan. 1914	103½	104½
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	.....
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	113	115
S. Cov. & Cin. 2d Mort. gold 6's	.....	250,000	J. & J	...	1932	113	115

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., May 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co.	100	12,000,000	.....	....	1893	48⅝	49⅛
The Cleveland City Ry. Co	100	8,000,000	.....	....	1893	57	60

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	101	102⅜
" " City " "	1893	2,349,000	.....			95	96

DETROIT STOCKS.—Corrected by Cameron Currie & Co., Bankers and Brokers, 82 Griswold Street, Detroit, May 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. Mackintosh & Co., Bankers, Holyoke, Mass. May 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.	100	1,000,000	J. & J.	4	.....	200	225
Holyoke Street R. R.	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.	100	50,000	.....	...	.....	125	150

LOUISVILLE STOCKS AND BONDS.—Corrected by Almstedt Bros. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., May 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref.	100	$1,000,000	A. & O.	5	Jan. 1891	84	85
Louisville St. Ry. Co., com.	100	5,000,000	.....	...	Jan. 1891	36	38

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	99½	100
Louisville City Ry. Co. Cons.	1884	1,000,000	J. & J.	6	1909	114	115
Central Passenger Ry. Co.	1888	400,000	M. & N.	6	1908	114	115
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. Warren & Co., Bankers and Brokers, New Haven, Conn. May 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$400,000	J. & J.	4	.....	55	57½
State Street Horse R. R. Co.	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	.....	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.	100	140,000	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.	100	200,000	J. & J.	3	.....	125	.....

Bonds.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co.	1874	20,000	J. & J.	7	Aug. 1, 1894	104	.....
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Horse R. R. Co.	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B.	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by George Le Sassier, 188 Common Street, New Orleans, La., May 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.	100	1,200,000	Quart.	1½	1867	127	130
Crescent City R. Co.	100	1,150,000	"	3	1866	81	90
Canal & Claiborne R. R. Co.	40	240,000	Semi.	2½	1888	38	42
New Orleans City & Lake Co.	100	1,500,000	Quart.	2½	1860	111	115
Orleans R. R. Co.	50	185,000	"	2	1868	43	50
St. Charles Street R. R. Co.	50	600,000	"	2½	1865	57	60

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	.....	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	100	.....
do do new	1886	40,000	M & N	6	1896	100	.....
N. O. City R. R. Co.	1879	416,500	J & D	6	1903	114	120
N. O. & Carrollton R. R. Co.	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.	1893	1,725,000	J & J	5	1943	95	100
St. Charles Street R. R. Co.	1881	120,000	J & D	6	'93-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by Gordon Strathy & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, May 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (old stock)	50	$2,000,000	M. & N.	4	May, '91.	140	141
" " (new stock)	50	2,000,000	.....	...	May, '94.	132¾	133¼

Bonds.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by James McGovern & Co., 6 Wall St., New York, May 20.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry	100	900,000	J. & J.	¾	.....	25	30
Broadway & Seventh Avenue	100	2,100,000	Q.—J.	2½	.....	184	187
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	148	152
Central Crosstown	100	600,000	Q.—F.	1¾	.....	140	.....
Dry Dock, E. B'way & Battery	100	1,200,000	Q.—F.	2	.....	120	124
42d & Grand St. Ferry	100	748,000	Q.—F.	4	.....	285	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	50	55
Eighth Avenue	100	1,600,000	Q.—J.	3	.....	240	260
Houston, W. St. & Pav. Ferry	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue	100	1,862,000	Q.—J.	1	.....	132	135
Sixth Avenue	100	1,500,000	Q.—J.	1¾	.....	190	200
Third Avenue	100	5,000,000	Q.—M.	4	.....	181	183
23d St.	100	600,000	Q.—F.	2½	.....	290	.....
Ninth Avenue	100	800,000	Q.—J.	1½	.....	132	.....
Union Railway Co.	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry	.....	700,000	J. & J.	7	July, 1900	108	111
B'way & 7th Ave., 1st mort.	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.	.....	500,000	J. & J.	5	July, 1914	105	.....
Broadway Guaranteed 1sts	.....	1,125,000	J. & J.	5	July 1924	105	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	105	.....
Broadway Consolidated	.....	7,650,000	J. & J.	5	 1943	108	109
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort.	.....	250,000	M. & N.	6	Nov., 1922	115	120
Dry Dock, E. B'way & Battery, 1st mort.	.....	.....	J. & D.	5	 1932	105	.....
Scrip (can be called at par)	.....	1,200,000	F. & A.	6	Aug. 1914	99	100
42d St. Manhat. & St. Nich. Av 1st mort.	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. Income bonds	.....	1,200,000	J. & J.	6	1915	55	.....
Eighth Ave., Scrip	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue	.....	5,000,000	J. & J.	5	Jan., 1937	117½	.....
Union Railway Co.	.....	2,000,000	F. & A.	5	Feb., 1942	.....	.....

PHILADELPHIA SECURITIES.—Corrected by Huhn & Glendinning, 143 South Fourth st. (Bullitt Building), Philadelphia, May 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'	50	$500,000	Q.—J.	4	1858	270	275
Continental	50	1,000,000	J.—J.	6	1873	127	130
Frankford & Southwark	50	1,250,000	Q.—J.	5	1854	305	310
Germantown	50	1,500,000	Q.—J.	2¼	1858	110	112
Green & Coates	50	500,000	Q.—J.	3	1858	123	125
Hestonville	50	2,050,000	.....	...	1859	37	.....
Lombard & South	25	500,000	A.—O.	8	1861	90	90
People's Traction Co.	50	10,000,000	.....	...	.....	28½	29
Philadelphia City	50	1,000,000	J.—J.	7½	1859	155	160
Philadelphia & Gray's Ferry	50	617,500	J.—J.	3½	1858	80	85
Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	105	106
Ridge Avenue	50	750,000	Q.—J.	5	1872	230	235
Second & Third	50	1,060,200	Q.—J.	5	1853	207	210
Thirteenth & Fifteenth	50	1,000,000	J.—J.	9	1858	232	240
Union	50	1,250,000	J.—J.	9½	1864	199	200
West Philadelphia	50	750,000	J.—J.	10	1857	200	210
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	114	114½
Baltimore Traction	25	5,000,000	.....	1	1889	16	16¼
Buffalo (N. Y.) Railway	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	12⅛	12¾

Bonds.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	107¾	108¾
" " Imp.	1892	1,250,000	M.—S.	6	1901	101	102
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100¾	102
Germantown, 1st mort.	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.	.....	300,000	M.—N.	6	1895	103½	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort.	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., May 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 306 Times Bldg., Pittsburgh, Pa., May 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co	50	1,500,000	.....	..	.....	20	20¼
Citizens' Traction R. R. Co	50	3,000,000	J. & J.	3	.....	60	60¼
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	12½	12⅞
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	...	65
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	19⅞	20
Pittsburgh, Allegheny & Man	50	3,000,000	....	1½	.....	41	41½
West End R. R. Co	50	200,000	J. & J.	...	.....	.....	.....
Second Avenue R. R. Co	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	...	.....
Fort Pitt Incline Plane Co	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co	50	3,000,000	.....	...	.....	26	27
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co	1887	1,250,000	A. & O	5	1927	107	110
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	105⅛	.....
Pitts. & Birmingham Traction Co	1892	.....	.....	5	.....	93	94½
Pleasant Valley Ry	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co	1891	1,500,000	J. & J.	5	1931	102¾	103¼
Duquesne Traction Co	1890	1,500,000	J. & J.	5	1930	101¾	102
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	101	103
Central Traction Co	1889	375,000	J. & J.	5	1919	102	103
Union R. R. Co	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co	1887	75,000	J. & J.	5	1922	.....	.....
Birmingham, Knoxville & Allentown Tract. Co	.....	.....	.....	6	.....	.....	.....
Suburban Rapid Transit	.....	.....	.....	6	.....	.....	.....
Fort Pitt Incline Plane Co	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	...	.....
Penn Incl'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co	1889	250,000	J. & J.	6	1919	.....	.....
Manchester	.....	.....	.....	...	.....	103	103½

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS Bankers, Providence, May 19.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	..	.....
BONDS.	Date of Issue	Amo'nt Out-stand'g	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	97⅜	100
Newport St. Ry. Co	.....	50,000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, May 19.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry	100	5,000,000	.....	...	1890	30	35
Buffalo (N.Y.) Ry	100	6,000,000	.....	...	1891	59	61
Paterson (N. J.) Ry	100	1,250,000	.....	...	1891	13	20
Columbus (O.) St. Ry	100	3,000,000	Q.—F.	1	1892	39	40
North Shore Traction Co. (Boston) Pref	100	2,000,000	A.—O.	6	1892	60	80
do do Common	100	4,000,000	.....	...	1892	15	18
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	68	80
do do Common	100	3,000,000	.....	...	1892	15	20
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	35	36
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry	1890	3,000,000	A & O	5	1930	93	95
Buffalo (N.Y.) Ry	1891	5,000,000	F & A	5	1931	99	99½
Paterson (N. J.) Ry	1891	850,000	J & D	6	1931	85	95
Newark (N. J.) Pass. Ry	1890	6,000,000	J & J	5	1930	94	96
Columbus (O.) St. Ry	1892	2,600,000	J & J	5	1932	90	95
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	87	90

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., May 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co	100	1,000,000	Monthly	5	.....	98	.....
Geary St., Park & Ocean R.R.Co	100	1,000,000	.....	1	.....	.....	105
Market Street Cable Co	.....	17,892,000	.....	...	.....	39	39½
Metropolitan Electric	.....	.....	.....	...	.....	.....	30
Presidio & Ferries R. R. Co	100	1,000,000	.....	...	.....	13½	14
Sutter St. R. R. Co	.....	.....	.....	...	.....	90	.....
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	.....	5	.....	104	.....
Ferries & Cliff House	.....	650,000	M. & S.	6	1914	106½	107¾
Geary St., Park & Ocean	.....	.....	.....	...	.....	102	.....
Market Street Cable Co	.....	3,000,000	J. & J.	6	1913	121	124
Omnibus Cable Co	.....	2,000,000	A. & O.	6	1918	.....	115
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	113¾	116½
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	103½	.....
Powell Street R. R.	.....	700,000	M. & S.	6	1912	107½	111
Sutter St. Cable Co	.....	90,000	M. & N.	5	.....	102	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., May 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds	100	2,500,000	.....	...	1876	50	65
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue	100	112,000	Dec. '88	2	1885	125	150
Lindell	100	2,500,000	.....	...	1890	85	86
Missouri	100	2,000,000	Q.—J.	2	1891	190	210
People's	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis	100	2,000,000	J. & J.	3½	1890	145	150
Fourth Street & Arsenal	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban	100	2,500,000	.....	...	1891	10	20
Southern, Pfd	.....	800,000	Jan. '94	3	.....	80	85
" Com	.....	700,000	.....	...	.....	15	25
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground	1892	1,800,000	J. & J.	5	1912	98½	100
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	104	106
Fourth St. & Arsenal	1888	50,000	J. & J	6	1898-1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895-1910	102	103
Missouri Cable	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort	1882	125,000	J. & D.	6	1902	99	100
" 2d mort	1886	75,000	M. & N.	7	1902	100	102
People's Cable	1889	800,000	J. & J.	6	1889-1914	90	95
St. Louis Cable	1890	1,500,000	M. & N.	5	1900-1910	100	102
Union Depot	1890	4,000,000	A. & O.	6	1900-1910	104	105
Southern	1884	200,000	M. & N.	6	1904	103	105
Southern	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban	1891	1,400,000	F. & A.	5	1921	84	86
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	70	80

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D C., May 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	290	320
Metropolitan R. R.	50	750,000	Q. J.	2	1864	90	91
Columbia R. R.	50	400,000	Q. M.	1	1870	67	72
Belt R.R.	50	500,000	Q. J.	...	1875	28	.....
Eckington & Soldiers' Home	50	352,000	.....	...	.....	28	.....
Georgetown & Tenallytown	50	200,000	.....	...	.....	.....	.....
Rock Creek R. R.	100	401,700	.....	...	.....	.....	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'tn & Geo'tn conv't. 1st.	'83-'99	3,000,000	J. & J.	6	1899-1929	130	134
" " " 2d	.....	500,000	J. & J.	6	1903-1943	130	134
Eckington & Soldiers' Home	.....	150,000	J. & D.	6	1896-1911	95	.....
Belt	1921	240,000	J. & J.	6	1921	85	100
Metropolitan R. R. convert	1901	200,000	J. & J.	5	1901	103	108
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

New York Street Railway Stock Market.

May 28, 1894.

With railroad mortgages and municipal bonds ruling at figures that allow of but poor returns on the money invested, with many of the prominent steam railways in receivers' hands, with interest and dividend defaults threatened by the score, it is no wonder that investors have within the last few months been forced to turn their attention to new fields of investment, and it is due to this desire of people to put the present large amounts of capital now lying idle at this and other centers of finance, into profitable opportunities that the stocks and bonds

of street railway companies have occupied of late such prominence in the financial world.

Leaving aside the operations in the Philadelphia market in the stock of the big $30,000,000 Metropolitan Traction Company, most of the dealings are on the orders of New York trades. A good deal of the local specialist's attention has been given to Third Avenue Railroad stock. Ever since the introduction of the cable system Wall Street has been filled with story after story as to the road's big earning capacity now that the cable has superseded the horses as a motive power, and, while figures of quarterly earnings recently put forth give but slight indications as to how much earnings have improved as a result of the change of motive power, it is claimed that they do not fairly represent the road's present money making abilities in that the cable machinery was not yet in perfect working order, and operating expenses consumed a larger proportion of gross receipts than they are likely to now that everything is running smoothly. It is undoubtedly true that the earnings of the Third Avenue line of the Manhattan Elevated Railroad Company have been seriously encroached upon by the competition of the Third Avenue cable road, which, with its transfers from 125th Street at Grand and Canal Streets, offers special inducements to the laboring man to patronize this system. Of recent days there has been some little slackening in the quotation for the stock (it is now around 181) on the report that the company is soon to issue $1,000,000 debenture bonds, in addition to the present indebtedness, the proceeds of which are to be used in purchasing new equipment and in other newly contemplated improvements.

Other locally active Traction stocks are the shares of the Second Avenue Railroad Company, concerning which some mysterious rumors regarding a change in control continue in circulation, and Dry Dock, East Broadway & Battery stock which recently had a sudden rise of ten points to 131. There is no real reason known for this big jump, but it is probably an appreciation, on the part of investors, of the work that the new management is doing.

Naturally, for the reasons adduced in the opening paragraph, Traction bonds are most in demand. The New York City street railway bonds of the roads embodied in the Metropolitan Traction Company's local system, like Broadway first 5s and Broadway & Seventh Avenue new consolidated 5s, are in especial favor, the prices bid for them fully demonstrating the eagerness of investors to put their money in what is well considered a "gilt edged" security. For instance, the new Broadway 5s were put out at 98½; now they sell at 107 and are hard to get at that, investors still seeking them with alacrity. Were it not for the sight setback given to the market by the default on the bond issue of the Syracuse Street Railway Company, quotations would still be on the upward tack.

Stocks of the street railway companies in Long Island have not participated in the strength characterizing New York issues. Long Island Traction, which is one of the few Traction stocks listed on the New York Stock Exchange, has been particularly weak on sales for the account of inside interests. There is seemingly a determination on the part of some prominent stockholder to get rid of his holdings regardless of price, and, do what the bull operators can to stem the tide, the quotation has been steadily declining. Brooklyn City Railroad stock, which is controlled by the Long Island Traction Company, and on which 10 per cent. dividends are guaranteed, has reacted sympathetically and has slumped several points to 162. Brooklyn Traction stock is held rather steady; the company suffered no material loss from the recent strike of its motormen and conductors, but there is no demand for the stuff, and it is rather inclined to go down than up. It is quoted at 14.

The New Orleans Traction Company, the shares of which are mostly dealt in in New York, has successfully carried through its financial undertakings involving a change in control and the acquisition of new capital. The New York syndicate, headed by H. B. Hollins & Company, that is now interested in the property, has agreed to loan the New Orleans Traction Company $3,500,000 in cash for two years, in consideration of which the syndicate is to have an option on the road's first mortgage bonds. The money is also subscribed. It will be used in pushing the work of converting all the roads in the combination into electric trolley lines. The common stock is now offered at sixteen; it has sold at eighteen. The preferred is 58 bid, and is offered at 60.

Financial.

THE Dallas (Tex.) Rapid Transit Railroad, it is reported, has been sold to Henry C. Scott, of St. Louis, for $90,000.

$ $ $

THE Port Richmond & Prohibition Park Electric Railroad, of Staten Island, N. Y., has been purchased by the New Haven Traction Company, of which Ex-Governor Waller is president.

$ $ $

THE Cincinnati (O.) Street Railway Company on May 17 issued to stockholders of record of May 14, $500,000 stock at par. The company has now outstanding about $7,500,000, and authorized $10,000,000.

$ $ $

CLAY, MOORE & COMPANY, of Philadelphia, have secured control of the Centerville Horse Railway Company, of New Haven, Conn., for which they have been negotiating for many months. The purchase price is said to have been $225,000. The deed was recorded May 10.

$ $ $

THE Bridgeport Traction Company, of Bridgeport, Conn., which operates the entire street railway system of that city has sold to Redmond, Kerr & Company, bankers, of New York, its whole issue of $1,300,000 first mortgage bonds. The contracts have all been let and work will be immediately begun.

$ $ $

COL. WM. N. SINCLAIR, president of the Galveston City Railway Company, of Galveston, Tex., during his recent visit North, was successful in placing the issue of $1,000,000 consolidated bonds of the street railway company, intended to pay off the company's outstanding bonds and all of the floating debt.

$ $ $

The following is a comparative statement of the operations of the Scranton (Pa.) Traction Company, for the month of April: Gross earnings, 1894, $18,813.69; 1893, $15,316.91; increase, $3,496.78. Operating expenses, 1894, $11,442.16; 1893, $9,784.76; increase, $1,657.40. Net earnings, 1894, $7,371.53; 1893, $5,532.15; increase, $1,839.38.

$ $ $

THE Raleigh Street Railway Company, of Raleigh, N. C., has been sold under foreclosure proceedings for $4,000, to John H. McAdam, of Charlotte, N. C., R. S. Tucker, A. B. Andrews, Julius S. Carr, the General Electric Company and others, who will re-equip the road and operate it in connection with incandescent electric lighting.

$ $ $

THE following is a comparative statement of the operations of the Columbus (O.) Street Railway Company for the month of April: Gross earnings, 1894, $43,216.55; 1893, $44,720.03; decrease, $1,503.48. Operating expenses, 1894, $20,087.47; 1893, $26,960.96; decrease, $6,873.49. Net earnings, 1894, $23,129.08; 1893, $17,759.07; increase, $5,370.01.

$ $ $

THE Brooklyn (N. Y.) Traction Company submits the following comparative statement of its operations for April: Gross earnings, 1894, $75,095.64; 1893, $64,032.56; increase, $11,063.08, or 17 per cent. Operating expenses, 1894, $50,431.46. From operation, 1894, $24,664.18. Miscellaneous earnings, $3,375. Net earnings, $28,039.18. We have no data showing the operating expenses and net earnings for the corresponding month of 1893.

$ $ $

THE following is a comparative statement of the operations of the Buffalo RailwayCompany for the month of April:

	1894.	1893.	Inc. or Dec.
Gross earnings	$120,592.13	$117,082.49	Inc. $3,509.64
Operating expenses	67,175.53	73,220.44	Dec. 6,044.91
Net earnings	$53,416.60	$43,862.05	Inc. $9,554.55

$ $ $

EARNINGS of the West End Street Railway Company, of Boston, for the first six months of the present fiscal year, October, 1893, to March 31, 1894, are given as follows:

	1894.	1893.	Increase.
Gross	$3,126,899	3,124,543	2,356
Operating expenses	2,166,716	2,325,055	*158,339
Net	960,183	799,488	160,695

*Decrease.

$ $ $

THE North Shore Traction Company, of Lynn and Boston, Mass., submits the following comparative statements of its operations for March: Gross earnings, 1894, $84,956.99; 1893, $79,459.11; increase, $5,497.88. Operating expenses, 1894, $62,767.26; 1893, $74,144.58; decrease, $11,377.32. Net earnings, 1894, $22,189.73; 1893, $5,314.53; increase, $16,875.20. For the six months ending March 31, the following showing is made: Gross earnings, 1894, $480,891; 1893, $462,118; increase, $18,773. Operating expenses, 1894, $361,182; 1893, $423,233; decrease, $62,051. Net earnings, 1894, $119,709; 1893, $38,885; increase, $80,824.

$ $ $

THE Buffalo (N. Y.) Ry. Co. and the Crosstown Ry. Co., of Buffalo, present the following consolidated report of operations for the year ending Mar. 31,

	1893.	1894.
Receipts from passengers	$1,280,361	$1,480,661
" other sources	25,292	25,833
" total	1,305,653	1,506,494
Operating expenses	825,294	886,261
Earnings from operation	480,359	620,233
Deductions from earnings.		
Interest	320,598	356,460
Taxes	60,444	87,377
Surplus	99,317	176,396
Total surplus account	242,112	418,507
Per cent. O. E. to total receipts	64.46	59.85

Balance Sheet of the Buffalo Railway Company, Mar. 31, 1894.

Assets.		Liabilities.	
Cost of road	$8,607,354	Capital stock	$5,370,500
" equipment	2,533,669	Funded debt	5,020,257
Current assets	52,399	Bills payable	524,492
Other assets	355,000	Other liabilities	274,129
		Profit and loss (surplus)	359,044
Total	$11,548,422	Total	$11,548 422

$ $ $

AT the regular monthly meeting of the directors of the Baltimore Traction Company held on Wednesday, May 9, T. Edward Hambleton presented his resignation as president of the company, and Governor Frank Brown was elected to the position. The new president is a man of great executive ability and energy, and his other duties

will not interfere with the devotion of the greater part of his time to the interests of the company. Mr. Hambleton, the retiring president, was elected to the position upon the organization of the company, and the credit of inaugurating rapid transit in Baltimore is largely due to him. Mr. Hambleton found that his duties as president of the Traction Company consumed the greater portion of his time, to the detriment of his own business; hence his determination to ask the directors of the Traction Company to accept his resignation.

$ $ $

THE Louisville (Ky.) Railway Company has submitted the following statement of its operations for the year ending December 31, 1893.

Receipts from passengers	$1,265,201.80
" other sources	16,791.08
" total	1,281,992.88
Operating expenses (including taxes and rentals)	807.055.54
Earnings from operation	474.937.34
Deductions from earnings.	
Interest on bonds	314,000.00
Net income	160,937.34
Dividends paid	87,500.00
To surplus account	73,437.34

The balance sheet is as follows:

Assets.		Liabilities.	
Cost of road	$11,559,177	Capital stock	$6,000,000
" equipment	1,376,175	Funded debt	6,000,000
Cash assets	163.106	Bills payable	10,000
Other assets	220,124	Other liabilities	333,347
		Profit and loss	975,235
Total	$13,318,582	Total	$13,318,582

$ $ $

THE gross earnings of the Baltimore (Md.) Traction Company for the last eight months and corresponding months in the previous year are shown below:

	1892.	1893.	Dec.
September	$107,301	$80,642	$26,659
October	103,163	81,442	21,721
November	91,735	77,345	14.390
December	95,814	79.472	16,342
	1893.	1894.	
January	$ 80,646	$72,376	$ 8,270
February	74 339	64,955	9,384
March	88,858	77,647	11,211
April	94,307	79.351	14,956

Hambleton & Co., of Baltimore, express themselves as follows in regard to this report:

"While the gross earnings of the Traction Company do not at present compare favorably with the same dates last year, it must be remembered that then there was practically no competition. The gross receipts now are not only not decreasing, but have, since full competition was met with, largely increased. Further, we are informed that the expenses of the company have so greatly decreased that the net earnings are, since the first of the year, larger than they were for the same months last year. The red, white and blue lines of the City Passenger Company were all in active operation for the first time in September, 1893, and, naturally, the Traction Company's earnings fell off largely. The Traction Company has in process of construction, and now nearing completion, several electric lines which cover most valuable territory, and must add largely to the earning capacity of the company. The comparatively small difference in January and February is explained by the fact that there were frequent delays caused by the severe winter of 1893, and the comparatively greater decrease in April by the unusual weather, a heavy snowstorm and winter weather during the greater part of the month, against spring weather and bright skies in April last year."

$ $ $

THE Binghamton (N. Y.) Railroad Co. has submitted the following statement for the years ending Mar. 31, 1893 and 1894.

	1893.	1894.
Receipts from passengers	$76,402.11	$106,138.54
Operating expenses	45,069.26	59,198.95
Earnings from operation	31,332.85	46,939.95
Deductions from earnings.		
Interest on bonds, paid and accrued	12,000	17,577.43
Taxes	3,072.20	3,088.64
Net income	16,260.65	26,273.88
Per cent. O. E. to total receipts	59	56

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LINE CONSTRUCTION MATERIAL.

The balance sheet shows:

Assets.	
Cost of road and equipment	$917,529.48
Payment on purchase of East and West Side Railroads	58,700.00
Due by open accounts and East End & West Side Railroad Companies	37,305.05
Cash assets	19,243.86
Supplies on hand	3,235.87
Total	$1,036,014.26

Liabilities.	
Capital stock	$324,290.00
Funded debt	545,000.00
Bills payable	127,150.48
Loans and accrued interest	4,312.50
Due on open accounts	25,155.23
Profit and loss	10,106.05
Total	$1,036,014.26

Map of the United States.

A large handsome Map of the United States, mounted and suitable for office or home use, is issued by the Burlington Route. Copies will be mailed to any address on receipt of fifteen cents in postage by P. S. Eustis, General Passenger Agent, C., B. & Q. R. R., Chicago, Ill. ***

Of Interest to Travelers.

The Baltimore & Ohio Railroad announces that it has placed on sale round trip tickets at reduced rates to the winter resorts in Florida and the South, and also to such points of interest as Luray, Natural Bridge and Gettysburg. This company has also arranged to place on sale excursion tickets to San Francisco and other points in California, on account of the Mid-Winter Fair, at unusually low rates. Excursion tickets are now on sale to Baltimore and Washington via the famous Royal Blue line.

With its vestibuled train service, via Washington, to Cincinnati, St. Louis and Chicago, the Baltimore & Ohio is in the best of condition to handle Western and Southern travel. That the line is a popular one, is attested by the immense World's Fair business handled this summer.

Those contemplating a trip West or South this winter should write to C. P. Craig, general Eastern passenger agent, 415 Broadway, New York, for rates and other information. ***

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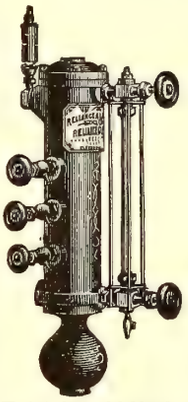
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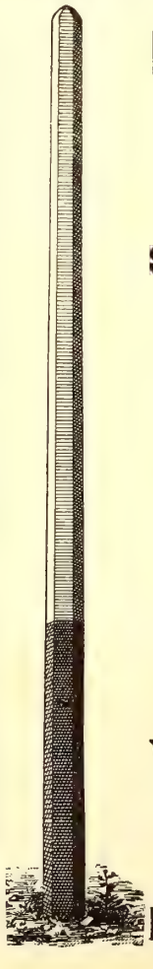
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THE STREET RAILWAY JOURNAL

Vol. X. *NEW YORK & CHICAGO, JULY.* *No. 7.*

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CINCINNATI AND ITS STREET RAILWAYS.

Cincinnati is the city of the double trolley, full grooved girder rail, and of vestibuled cars. There are also other characteristic features pertaining to the street railway systems of the city, which will have attention later on.

Although the employment of the girder rail, and the use of the vestibules were compulsory, and in the face of earnest protest by the managers of the Cincinnati Street Railway Company and the Mount Adams & Eden Park Inclined Railway, their employment has been attended with less difficulties than was originally supposed, while they have developed a number of commendable features, so that the management has now come to regard them favorably, and has ceased all opposition to their introduction. In fact, the double trolley, having been adopted with misgivings, has so worked its way into the favor of the management that, in answer to a direct question on the subject, John Kilgour, general manager of the two systems, informed us that had he the introduction of electric traction in a city like Cincinnati, or, in fact, any of the large cities of the country, he would in all cases employ the double trolley.

The advantages are that both arms of the circuit are more equally balanced than where a track return is employed, and that it avoids the necessity of the tearing up of the streets, and for making repairs to bonds and return connections. Most of the difficulties experienced with the double trolley in the early history of these lines have been overcome, and, with the exception of the fact that the overhead construction is a little more complicated and unsightly, and that it requires a little more attention on the part of the conductor to handle the trolley poles at switches and crossings, there are no serious difficulties that have not been overcome.

The principal difficulties which were first encountered were those of providing overhead crossings and switches, to prevent short circuits at the crossing of positive and negative wires. These have been overcome in an ingenious manner, as will be seen from the accompanying illustrations of switches and crossings (Figs. 2 and 3). In case of double turnouts, it has been found better to provide a second set of trolley wires for one track, rather than to attempt the insulation of the crossings, in which case it is necessary for the conductors, on entering some of the curves, to transfer the trolley poles to a different set of wires. This is readily done, however, as the poles have a considerable reach to the right or left, and on some streets the cars of the different systems pass over the same tracks, with a different set of overhead conductors for each system, in which case four wires are required. At one or two of the points in the system, notably on Walnut Street, cars equipped for both the double and single



FIG. 1.—EDEN PARK VIADUCT—MOUNT ADAMS & EDEN PARK INCLINED RAILWAY, CINCINNATI.

trolley pass along the same tracks without any difficulty, the wires of the single trolley system being mounted to the left of those for the double system. It will be noted from the illustrations that there are certain dead parts at the switches, over which the cars pass by momentum, and then, again, that the current is carried past these dead points by insulated cables above the switches.

The ordinary sized span wires are employed for supporting the two trolley wires, but the side poles are placed a little nearer together than usual, being spaced 100 ft. apart. Owing to the presence of soot in the atmosphere, from the employment of soft coal in the manufacturing establishments, the employment of galvanized iron for span wires is not permissible, as the soot causes it to rust

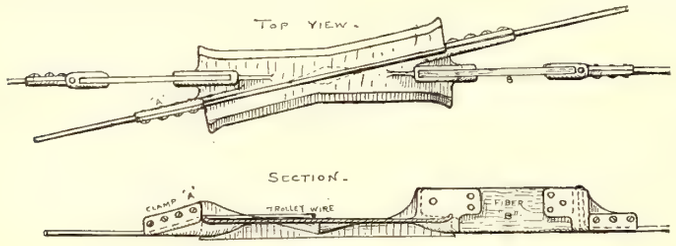


FIG. 2.—SLIGHT ANGLE INSULATED CROSSING.

out in the course of six months, so that it is necessary to employ silicon bronze for span wires.

The causes that originally led up to the adoption of the double trolley in Cincinnati, were that after thoroughly investigating the subject, the management was convinced of its superiority; and second, the fact that most of the business streets of the city had recently been paved with granite blocks and asphalt, and a city ordinance prevented the tearing up of the streets for the repairing of tracks, or renewing of water pipes for five years, so that in a measure it became an agreeable necessity for the Cincinnati Street Railway Company to employ the double trolley. The company is now congratulating itself on the fact that it is able to operate so successfully with the two wires, and is not uneasy over the question of the destruction of water and gas pipes by electrolytic action, which is now disturbing some of the street railway companies of the country.

The cost of the installation for double overhead construction is somewhat more than that for the ground re

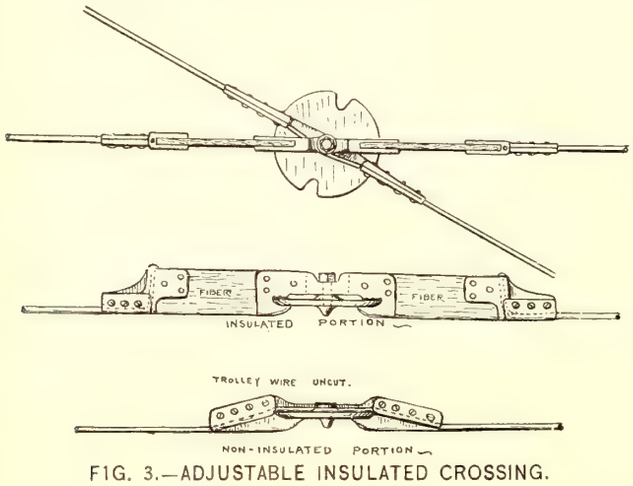


FIG. 3.—ADJUSTABLE INSULATED CROSSING.

turn, where the rails alone are depended upon, but not more than where a good return ground wire is provided. It is necessary, of course, to provide that the feed wires on both arms of the circuit balance.

The trolley poles or masts, as will be noted from the accompanying engravings, are attached to a single stand on the roof of the cars. With a single base the wheels do not adjust themselves as readily to spreading wires as they do where a double base is provided, as was described in our last issue in connection with the cars of the Covington system, which operate on a double trolley on the Cincinnati side of the river, but there is less danger from short circuiting in the case at the single base, as the poles cannot come in contact with each other.

The introduction of the grooved girder rail first came about through the demands of the citizens of Avondale two years since, when it was proposed to extend one of the lines through this suburb, and although the company protested it at length yielded to the wishes of the citizens, and demands of the local engineer, and a full grooved girder rail was provided. This differs somewhat from the English type of the grooved rail, and is locally known as the Stanley rail, having been designed by H. J. Stanley, the city engineer of Cincinnati. Where the streets are paved, and kept in clean condition, the grooved rail has proved very acceptable both to the public and the street railway company. Where the rail is laid carefully to gauge, and the wheels properly mounted, it is not observed that it requires very much more power to operate the cars than over a side bearing rail, but it is not adapted to macadamized streets, nor streets that are left habitually dirty. With these conditions the experience that has been had with the grooved rail in New York, and other cities, is being repeated, that where dirt accumulates in the groove, traction is from 30 to 40 per cent. greater than with a side bearing, or T rail. The experiment in Avondale led to the adoption of the same type of rail in all the new construction throughout Cincinnati. With this rail the pavement, whether it be of brick, asphalt or granite, is laid flush with both sides of the rail, so that vehicles do not follow the tracks, as is the case with other types of rail. This avoids blockading the cars, and there is very little tendency for wagon tires to cut into

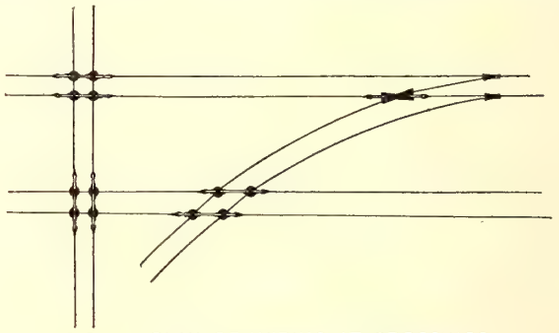


FIG 4.—PLAN OF WIRING AT CROSSINGS.

the pavement along the edge of the rails, and the rail is not distorted by heavy loads, resulting in a great saving in track repairs.

To comply with the requirements of an Ohio state law, for the employment of vestibules on all electrically propelled cars for winter service, the Cincinnati Street Railway Company last winter provided most of its closed cars with vestibules. The ordinary construction of these additions is shown in the accompanying illustrations. Generally only one end of the cars is vestibuled, and an opening is left on one side. As a general thing the motormen take kindly to the vestibules, as they provide protection to a considerable degree in cold and stormy weather. In case, however, the cars are to be run backwards, the conductors find it very difficult to handle the trolley poles through the vestibule window.

All of the tracks of the Cincinnati Street Railway Company's system make a loop at the city terminal, and all touch or encircle Fountain Square. Turntables or loops are also provided at the suburban ends of the lines, so that the cars are turned and always run in the same direction.

Cincinnati is now a city of 340,000 population, and there are numerous suburban cities, or villages, to which the street cars cater, and which are shown on page 417.

Cincinnati Street Railway Company and Mt. Adams & Eden Park Inclined Railway Company.

The majority of the mileage in Cincinnati is controlled by the Cincinnati Street Railway Company, and the Mt. Adams & Eden Park Inclined Railway, which are both virtually under the same management, and are locally known as the consolidated system. Of these systems John Kilgour is president and general manager, James A. Collins secretary, and John Harris and John C. Weaver superintendents. Mr. Harris has been engaged

in the street railway business in Cincinnati for twenty-eight years, having entered the service of the Cincinnati Street Railway Company in 1866 as stable boss, in the stables which were originally located where the Government building now stands, and in all these years he has not loss a day on account of ill health.

During the last year, as has already been stated in these columns, all the franchises of these companies were renewed, and grants for a number of extensions secured. In granting the new franchises and extensions, the conditions imposed were perhaps more burdensome than those required by any other city of the country. Under the old franchises the companies were required to pay two and a half per cent. of the gross receipts into the city treasury, and to pay an annual car license of $56 per car. By the new conditions, which are to go into effect as soon as the remaining horse car lines are all electrically equipped, and which it is expected will be accomplished before the end of the present year, the company is required to pay 5½ per cent. on gross receipts, and to pay an annual car license of $4 per foot, inside measurement, for each car, so that it is estimated the entire payments to be made by the consolidated system into the treasury will amount to at least $110,000 per annum. This payment, however, is in lieu of all expenses for street paving, except repairs which the company is required to make whenever it tears up a pavement for any cause, but it is not required to furnish new material for paving. The entire amount received from the street railway companies is set apart in a fund "to be applied to the cleaning and repairing of the streets wherein the tracks of such company exist."

It is also required in the new conditions that a general system of transfers be provided, so that when the extensions are completed transfers without extra charge will be issued at 125 points, including trips in both directions.

The extensions which are now in process of construction will aggregate about sixty miles. The company is also engaged in reconstructing most of the lines in the business portion of the city, embracing about fifteen to twenty miles. This re-construction includes the horse car



FIG 5.—CLOSED CAR—CINCINNATI STREET RAILWAY.

tracks, and a considerable portion of the electrical construction on which a fifty-two pound girder was originally employed. Some of this construction has been in service only about six years, but has failed to such an extent that it was necessary to renew it. Other portions have been in service for only a year or two, but with the requirements for new paving new rails are included, and the whole system is being rebuilt.

In the process of construction the pavement is removed, and the surface excavated to a depth of twenty inches. The foundation is then rolled with a steam roller having a weight of 250 lbs. per lineal inch of surface measure. The oak ties, 6×7 ins., × 8 ft., with joint ties 6×12, are then placed with two foot six inch centers. The rails are then spiked direct to the ties and the tracks surfaced up and supported on wooden blocks. A foundation of concrete six inches in depth is then placed under the ties, and the space between the ties filled with concrete and tamped. In case asphalt or brick is employed, the concrete is also placed above the ties, so that they are entirely enclosed in a pocket of concrete. Where granite paving is to be employed the concrete is brought to a level with the ties, above which is two inches of sand to receive the



FIG. 6.—OPEN CAR—CINCINNATI STREET RAILWAY.

blocks. On all paved streets the full grooved girder rail, weighing ninety-five pounds per yard, is employed which with granite paving is required to be eight inches in depth. With asphalt and brick the same pattern of rail is employed, but the depth is only six inches and the weight eighty-six pounds per yard. The rails were manufactured by the Johnson Company and are known respectively as Nos. 216 and 200. The special work employed is of the Johnson Company and Weir Frog Company's manufacture. The joints are supported on the twelve inch ties, and are united by means of heavy (twelve inch bolt) fishplates. The base of the eight inch rail is five and a half inches wide, but that of the six inch rail is six inches.

In the process of construction the concrete is mixed on platforms resting upon the rails, and so provided with guides that they can be slid along on the track as the construction proceeds. The proportions of the concrete mixture are as follows: One sack of cement, one barrel of sand to three barrels of broken stone. A portion of stone employed between the ties consists of the old concrete foundation broken up, but fresh stone is employed under the ties. With the old concrete the proportion of cement is also slightly increased. Both asphalt and brick paving are employed to a considerable extent on the Cincinnati streets. In the opinion of the City engineer asphalt is somewhat the best, although vitrified brick is giving very excellent service. Some of the streets of Cincinnati are subject to an unusually heavy and peculiar traffic. For hauling coal to the higher portions of the city very large heavy horses are employed, and these are usually driven in teams of four, and when newly shod, the toe calks are nearly an inch in depth, so that if the animal brings his shoe down near the edge of a paving brick, the excessive weight is apt to chip off a small portion. Except for this traffic the brick paving is quite satisfactory.

The cost of the new track construction, as described above, including the repaving, and renewing of the blocks that are worn out is about $38,000 per mile of single track, or $76,000 for a double track. Where it is possible to construct both tracks at the same time the cost is a little less than the latter figure. This is claimed to be the most expensive street railway track that has ever been

built for electric service in this country on so large a mileage.

ROLLING STOCK.

The Cincinnati Street Railway Company operates on an average seventy horse cars, thirty cable trains, including a trailer in busy hours, and 150 electric cars. The Mt. Adams & Eden Park line employs forty electric cars, and thirty cable trains. In the fire which destroyed the Avondale car barn last winter the Cincinnati Street Railway Company lost eighty-four cars and thirty motor equipments. One car equipment with the Genett air brake was also destroyed. These have been replaced with a new equipment including forty closed cars built by the

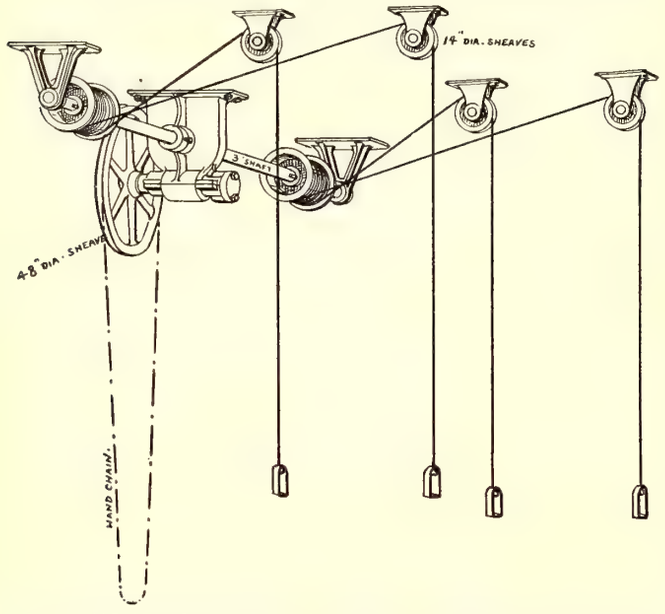


FIG. 7.—HOISTING APPARATUS FOR CAR BODIES—CIN. ST. RY.

Barney & Smith Company, of Dayton, O. These cars are eighteen feet inside measurement, and twenty-six feet over all, not including the bumpers. They are provided with a vestibule at one end, which is open on the left side. The window sashes are usually large and are stationary, there being only four lights on a side. These consist of French plate, 32 × 48 ins., and three-sixteenths of an inch in thickness. The cars are finished in cherry, natural wood, with a birds-eye maple ceiling. The ceiling, in some of the cars, however, is of prima vera, or white mahogany. The mirrors are of chipped French plate, and the decklights are also of chipped glass. The seats and backs are upholstered in dark scarlet.

The cars are provided with electric heaters of different types. Most of them, however, are of a type devised by the electrician of the company, and built in the company's shops. Electric and oil headlights are provided. The front dash of all the cars is provided with a tapering mitered board or strip, for the purpose of supporting the headlight. These are placed over the narrow portion of board, and slid down so that they are held firmly in position.

There are also ten cars which were built by the Laclede Car Company, of St. Louis, after the same specifications. The vestibules were adopted in order to comply with the requirements of a state law, which has now been pronounced unconstitutional, because it specified that electric cars only should be thus equipped. Most of the closed cars, however, were provided with vestibules last winter, at a cost averaging about $35 per car, and as noted above, not as much objection is found to the use of the vestibules as was anticipated. The motormen being required to pay for broken glass, or damage to the car from collisions, whenever it is the result of their own carelessness, have learned to be more careful, and the loss in this direction has been very light.

Among the new open cars there are sixty built by the American Car Company, and twenty by the Laclede Company, of St. Louis. These cars are twenty-nine feet six inches over all, and are provided with cross seats, having spindle backs, with bronze seat arms, and provided with rigged hand rails on the posts. The deck lights are of French chipped plate, and the cars have a seating capacity for forty-five persons. All the cars of the two systems are painted yellow, two shades only being employed, lemon yellow and cadmeum. In order to designate the different routes, four sided roller signs are employed. These are placed on the hoods, and also on the sides of the roof, and are painted red or yellow, and lettered with black or red-brown. Specifications were sent out recently, and bids asked for 110 new closed cars. Fifty-six of these will be built by the Barney & Smith Car Company, of Dayton, O., and the rest by the Laclede Car Company.

The advertising privileges are let to Carleton & Kissam, and the cars are all provided with the well known advertising racks controlled by this firm. The electric cars are built to run in one direction only.

A variety of trucks are employed. There are about eighty of the Bemis type, eighteen of the Brill manufacture, including Nos. 31 and 13; seventy-five of Peckham's manufacture, latest type; thirteen of the McGuire Columbian trucks, and one of the Barney & Smith. Double motor equipments are employed, and these embrace seventy-four of the G. E. 800, thirty-three F 40 Thomson Houston type (double reduction); fifty equipments of the W. P. 50 type; twenty-five equipments of the S. R. G. motors, and fourteen of the Westinghouse. The G. E. 800 are among the latest types purchased, and twenty-five equipments have also been recently ordered from the Card Electric Motor & Dynamo Company, of Cincinnati, and twenty of the Sperry motors have been ordered. The motor equipment of the Mt. Adams & Eden Park system embraces W. P. 50's type, the G. E. 800, and the G. E., F 30 of the Thomson-Houston style of motors. A 300 lb., thirty-three inch wheel is generally employed on electric cars, and the more recent purchases have been from the Mowry Car Wheel Works, of Cincinnati. On the cable cars, the Wharton double tread wheels are employed, which are designed to be operated with the elevated switches.



FIG. 8.—EIGHTH STREET VIADUCT—CINCINNATI STREET RAILWAY.

FARES.

The fare is five cents, with a three cent fare for children under ten years of age, or two children's fares for five cents. On all of the horse car lines six tickets are sold for twenty-four cents, or twenty-five tickets for $1. A lump sum is received from the Post Office department for the fare of mail carriers and messengers who ride on their uniform. The employes' tickets are issued to the heads of the departments who issue to such employes as require them, the tickets being punched by the issuing officer. Before the practice of issuing tickets to the heads of departments was adopted, a very large number of employes' tickets were required, but after the introduction of the above arrangement, their use fell off about half.

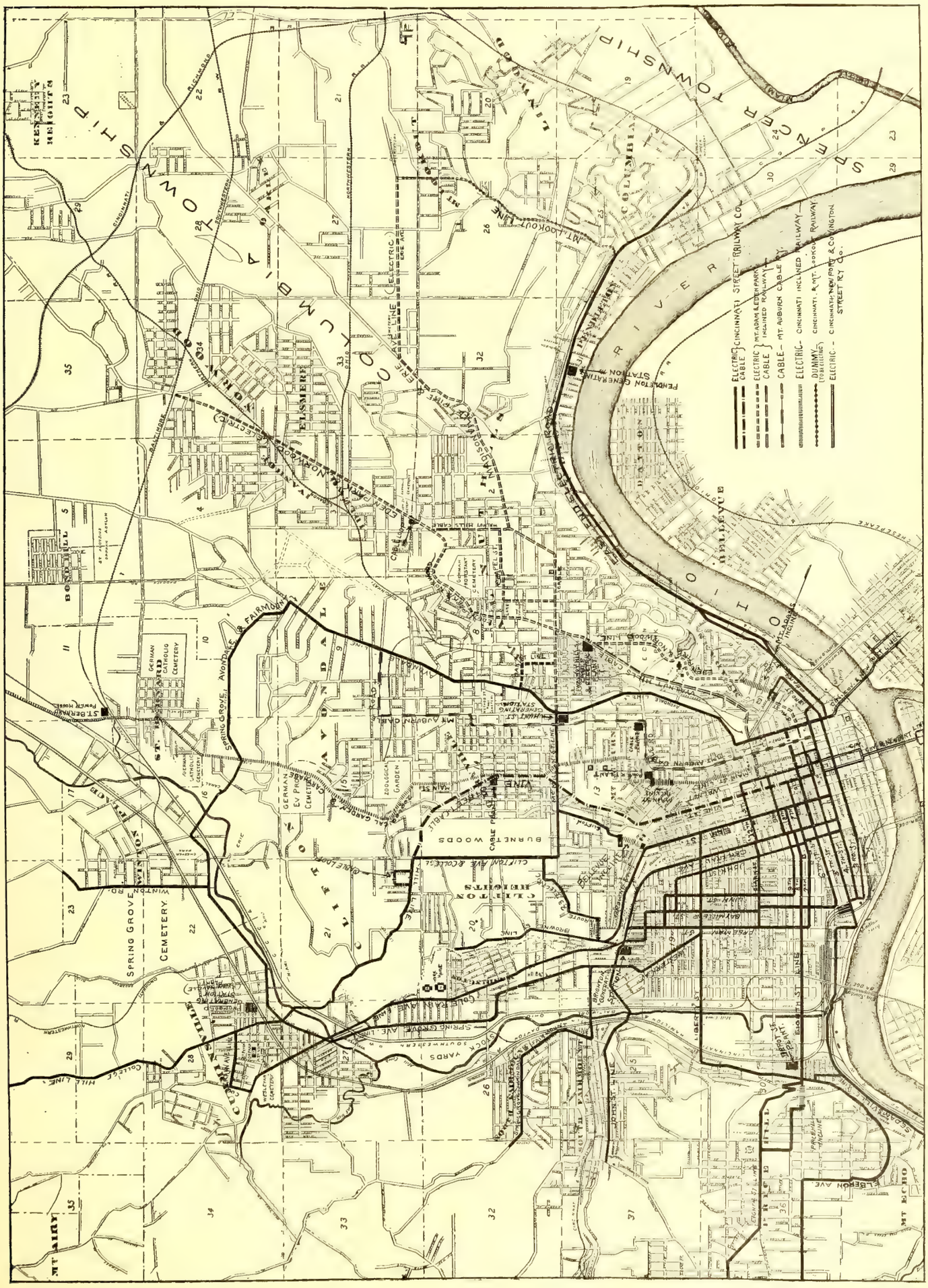


FIG. 9.—MAP OF CINCINNATI, SHOWING THE STREET RAILWAY SYSTEMS.

By the new ordinance the company is required to issue transfers as noted above, over all connecting lines and extensions, Walnut Street being the dividing line for the city. Coupon tickets are employed, which are numbered, and the day, hour and minute indicated in the ordinary manner. Transfers are issued only to passengers paying five cents cash fare, and must be called for at the time the fare is proffered. In issuing the transfers the conductors retain the coupon, which they return to the receiver, and for which they receive new tickets, being required to purchase their original supply of transfer tickets from the receivers. The present system of transfers is not wholly satisfactory to the management, and a new system will probably be adopted as soon as one is devised. Considerable loss is experienced from the abuse of the transfer privilege by passengers, and some by conductors. The conductors are provided with the bell punch and the new model registers, and punch their trip slip to indicate the fare, whether full or reduced rates.

The pay of the conductors, motormen and gripmen is $2 per day of twelve hours. Extra men are paid at the same rate. A deposit of $50 is required from conductors, and $25 from motormen.

POWER STATIONS.

The evolution of mechanical traction in Cincinnati is more strikingly indicated by a study of the power equipment than by almost any other feature, experiments having been made in the electric stations with a number of different types of boilers, engines and generators. There are now three electric power stations, with two additional in process of construction; two cable power stations, and two for operating the inclined railways, and a new one building, so that when the new ones are completed the entire engine equipment of the consolidated system as now planned will aggregate 17,300 H. P.

The first electrical station to be equipped was that at Brighton, in 1889, and the power plant was located in the basement of one of the principal car barns. The first engine installed was a Corliss, having cylinders 22×42 ins., of the Hooven, Owens & Rentschler Company's manufacture, from which power was transmitted to a line shaft, and two Ball high speed engines, with cylinders 16 × 16 ins. were installed, and were belted direct to four D 62 General Electric generators. These were so arranged that the generators could be run from either the line shaft or from the high speed engines. As the traffic increased two more Corliss engines were added, one having cylinders 24×48 ins., and the other 24×54 ins., with a new line shaft, and an additional equipment of generators of the same type until the number reached seventeen. There being no more room in the old station, a new brick building or extension has been added (80×120 ft.) with the roof supported by timber trusses and tie rods, this building being used for an engine and generator room only. The power equipment of this new station consists of two Buckeye engines of 750 H. P., each one of which is a tandem compound, run non-condensing, the cylinders being 20—32½×36 ins., and is run at 114 revolutions. These are coupled direct to a Siemens & Halske generator of 480 K. W. capacity. The flywheel is placed between the crank and generator, and is fourteen feet in diameter and weighs sixteen tons. The generator is ten feet six inches outside diameter, the fields being inside of the armature, and the commutator on the periphery of the machine, as previously described in these columns. The machine has eight poles, and consequently eight sets of brushes, with four brushes to each set. These are held in position by an adjusting mechanism.

The second engine is a single cylinder, 28½×36 ins., and is run at 110 revolutions. The flywheel is belted direct to an M. P. General Electric generator of 500 K. W. capacity. The belt is fifty inches wide, and the shaft centers are about forty-five feet apart. Both generators are connected with the same circuit, and the rated capacity of each machine is about 900 amperes, but both at times have made an output of 1,200 amperes at 550 volts, for a period of five minutes or more without apparent injury.

The switchboard of the Siemens & Halske machine is provided with Westinghouse instruments, and with a Siemens & Halske rheostat and field switch. The board for the General Electric generator is equipped with standard slate panel switchboard and the feeder with switches and instruments manufactured by the Card Electric Motor & Dynamo Company of Cincinnati. An overhead, hand power traveling crane of ten tons capacity, is provided to facilitate the handling of the heavy parts.

The power station has capacity for two additional units of power, one of which is now being installed. This consists of one McIntosh & Seymour tandem compound, non-condensing engine with cylinders 20 and 32×36, ins. with rated capacity of 1,100 H. P. This is belted direct to a pair of M. P. General Electric generators of 300 K. W. capacity each. The receiving pulley is placed between the two armatures,and friction couplings being provided, either one or both of the generators may be operated. The shipping weight of the new engine and attachments was 190,000 lbs., 65,000 lbs of which is in the flywheel pulley (fourteen feet in diameter and sixty-five inches face). The additional equipment being in place, the station will then have three varieties of equipment, and will furnish a very excellent opportunity for studying the relative merits of different types of engines, and methods of coupling. The first, as noted above, is a tandem compound, non-condensing, direct coupled engine; the second, a single cylinder, high pressure engine, belted direct; and third, a tandem compound, non-condensing, belted direct to two generators; the steam supply for each engine being from the same source. The second of the new equipments is to be a McIntosh & Seymour tandem with generators, the same as those described.

The boiler equipment for the Brighton station is located in another building, formerly occupied as a stable, and consists of four Babcock & Wilcox boilers, of 400 H. P. each, but often run to 500 H. P., set in two batteries. Both boilers are fired by the Roney mechanical stokers. The station has room for twelve boilers, and two additional are now being installed. The smokestack is 175 ft. in height, with a flue eleven feet six inches in diameter. The boilers are distant from the engine room about 160 ft., and the steam is delivered to a receiver, four feet in diameter and twelve feet high, in the engine room, through a riveted steel main twenty inches in diameter, properly protected and running through a tunnel under ground. The steam is led from the top of the receiver to the different engines, the water of condensation being drawn off at the bottom of the receiver.

We have not space to describe in detail the other stations, but the original equipment of the principal station consisted of Corliss engines with countershafts and D 62 type of generators. The equipments of two of the principal stations, that of Hunt Street, and the Pendleton station on Eastern Avenue, were increased about a year and a half since by the addition of a Corliss engine belted direct to an M. P., 300 K. W. generator in the first case, and to a 500 K. W. in the second, and the former station has recently been increased by a Frick-Corliss engine taken from the Brighton station, which is also belted direct to a generator of the above type. Both these stations have Babcock & Wilcox boilers, and Murphy furnaces. During the hours of heavy traffic all the engines in all the stations are in operation.

At different points in the station, dependent cords or ropes are provided, which operate over small sheaves along the ceiling or roof trusses, which connect with the cut-off valves of the engines, and by means of which, should an accident of any kind occur, the engineer or attendant can immediately shut down any one of the engines wherever he may be about the station, without the necessity of going to the throttle valve.

A new station is now being erected on Depot Street, near the Price Hill incline, adjoining one of the company's car barns. The building is to be of brick, and the dimensions of the engine room are 80 × 200 ft., and the boiler room, 54 × 200 ft. The first equipment will consist of four McIntosh & Seymour engines, of the tandem compound type, the same as described for the Brighton

station, and these will each be belted direct to a pair of M. P., 300 K. W. Thomson-Houston generators, as in the other station. The steam equipment will consist of seven boilers of the Abendroth & Root type, of 400 H. P. capacity each, and these will be fired by the Roney stokers. Economizers and mechanical draft will be employed, as the formation of the locality is quicksand, and it is not deemed expedient to erect a brick stack. It is expected this station will be in operation by September 1. The installation of the draft apparatus is being made by Westinghouse, Church, Kerr & Company.

Another plant is also to be built this season at Cumminsville, and an addition is being made to the Walmut Hills cable plant, for additional electric power, consisting of two Hamilton-Corliss engines, size 32 × 54 ins., and four belted M. P. 300 generators.

A new car barn is being constructed near the Hunt Street power station, and is designed to have a capacity for storing 100 cars. The ground plan is 200 × 180 ft., and it is covered by a double roof, each of 100 ft. span. The framework and roof trestle are of steel, and are enclosed with a brick wall laid up between the columns. The covering for the roof consists of three inch, yellow pine planking covered with tin. Each division of the barn is provided with ten tracks, and one side will be utilized for storing cars that are not in service, and the other will be employed for housing the operating cars at night. All the power stations and the new car barns have been designed and equipped under the direction of Bert L. Baldwin, mechanical engineer of the company.



H. P. BRADFORD,
GENERAL MANAGER CINCINNATI INCLINED PLANE RAILWAY CO.



JOHN HARRIS,
GENERAL SUPERINTENDENT CINCINNATI STREET RAILWAY CO.



JOHN C. WEAVER,
SUPERINTENDENT EDEN PARK INCLINED RAILWAY CO.



JAS A COLLINS,
SECRETARY CINCINNATI STREET RAILWAY CO.

THE CITY.

Cincinnati is located on the north bank of the Ohio River, in the southern part of the state, and borders the river for a distance of about ten miles. The topography of the location is very irregular and broken. The business portion of the city occupies a plateau, three miles in width, which rises abruptly from the river to an average elevation of about eighty feet, and which is backed by an irregular line of bluffs having an average altitude of over 300 ft. above the river, over and beyond which the city has already spread. The principal hills are named, respectively, Mt. Auburn, Price Hill, Clifton, Mt. Adams, Avondale and Walnut Hills. Walnut Hills is on the northeast, and extends almost to the bank of the river. The heights are all reached by inclined planes, cable roads and, in some instances, by the electric lines, so that the rapid transit facilities of the city embrace almost every known method of traction, including horse car lines, cable and electric roads, inclined planes, and one dummy line. There are six inclined planes, on four of which the electric cars are transferred from one level to the other, and continue their course. The planes are provided with triangular shaped trucks, with platforms on a level, so that the electric cars are readily run on or off at the terminals. All the inclines are provided with the latest types of safety devices, and are operated in a very safe and satisfactory manner.

An effort was made by the Cincinnati Street Railway Company some time since, to get control of the Price Hill incline, and equip it for transferring the electric cars, the same as on the Bellevue line, but failing in this it has graded, and is building a zigzag line up the heights in the neighborhood, over which the electric cars will be operated. The grade in some sections will be as high as 11 per cent.

REPAIR SHOPS.

The present repair shops of the Cincinnati Street Railway Company are located near the Pendleton power station, on Eastern Avenue. The car barns have a capacity for eighty cars, and the wood working department occu-

pies a separate building on the opposite side of the street. The iron working tools are located in the basement of the car barn. These are operated by power from a Card motor of twenty-five horse power, which also operates an elevator between the two floors. The tool equipment is very complete, including planers, lathes, automatic gear cutters, wheel borers, etc. In the blacksmith shop are seven forges. The tin or sheet iron shop adjoins the machine shop, and there is also a very large storage room for extra wheels, axles, etc.

In the manufacture of thimbles for the motor fields, the flanges or collars are made by bending the metal into shape, which avoids the use of solder, as has been the practice heretofore, and which sometimes was melted by the heat, necessitating frequent repairs.

For the purpose of removing car bodies from trucks, a hand hoist (Fig. 7) is provided in the car barn, which is operated by a chain running over a sheave near the ceiling, and through worm gearing the power is communicated to two grooved rope drums, from which four half inch wire ropes are led over guide sheaves, in a position to bring two of the ropes on each side of the car, and near the ends. To the ends of the ropes iron stirrups are attached, of sufficient size to receive bars, by means of which, when placed across under the floor, the body is readily lifted or lowered, as the case may be. The shops are operated under the management of Patrick Leen, master mechanic.

A new incline has recently been built by the Cincinnati Company, which operates up the bluff near the Brighton station, and which is designed to transfer the electric cars over the route known as No. 23. The incline is 700 ft. in length, and on a 35 per cent. grade. The track is laid for the most part on the solid rock, which was graded out for the purpose, and there is 150 ft. of trestle work. The line is double track, and the rails are laid as in steam practice. A new brick station with brick smokestack stands at the head of the incline, and the power is to be supplied by a pair of Lane & Bodley Company's coupled link motion engines.

The Vine Street cable line, which is included in the Cincinnati Street Railway Company's system, has been in operation since 1887, and is still running in a very satisfactory manner. The tracks, except the curves and on sections where the electric cars pass, is still in good condition. The curve construction in some places has been removed, and the joints are being strengthened on those sections occupied by the electric cars. Originally the rails were laid with suspended joints, but heavier connections are being employed, and a block support is being placed under. The original grip, which is of the Lane type, is still employed.

The ropes are purchased for the most part from the Hazard Manufacturing Company, and generally last for a service of from 30,000 to 35,000 miles. Very little change has been made in the power station since it was first built, except that one set of winding drums has been renewed to provide for the wear in the grooves. The engines, which are of the Lane & Bodley manufacture, have been in steady service since installation, and are still in good condition, having had very little repair.

In the opinion of the general manager, the cable traction is cheaper and more satisfactory to operate than electric lines, where the traffic will warrant the building of a cable line. He is also of the opinion that there is not much difference in the original cost of an electric or cable line where the construction in each case is done in an equally thorough manner. Of course this is on the supposition that there are not many substructures to interfere with the excavation for the cable construction. This line was built from designs furnished by H. M. Lane, of Cincinnati, who was general engineer of construction.

The cable line of the Mt. Adams & Eden Park Incline Railway Company, which embraces eight miles of track, is also still working in a satisfactory manner.

MEDICAL DEPARTMENT.

The medical department of the system is in charge of Dr. C. S. Muscroft, who was formerly assistant to his father when he held the same position, and to which the son succeeded on the death of the latter in May, 1888.

The methods employed in this department are along the same lines as those recommended in the articles which have appeared in these columns during the last year, on "The Medical side of Street Railway Practice." The conductors on each of the lines are provided with cards, which are issued by the superintendent, and which read as follows: "Notice to conductors:

"In case of personal injury occurring either to passenger, public or employe, in connection with your car, at once notify the company's surgeon, and state from what point the telephone message is being sent; also, if possible, the disposition of the injured person, whether going to the hospital or home.

"Dr. C. S. Muscroft, Telephone, Office and Residence 1410. John Harris, Supt.

"(Keep this card about you.)"

On the back of the card are the telephone numbers of each of the officers and of the power stations, and also the names of the officers of the company, together with the names of the heads of the departments. Arrangements are also made with the police department, so that in case of accident the police exchange notifies the surgeon, and states to what hospital the injured person has been sent, or what disposition has been made of him.

As soon as notice of injury of any kind is received, the surgeon at once responds, and in case another surgeon has been employed the company's surgeon co-operates with him and makes thorough notes of the case. In case it appears that the company is in any way responsible for the accident, the patients are treated in a private ward of the hospital, or at their homes, as the case may be, at the company's expense, which includes the drug bills as well as the surgeon's services. All employes who are injured while on duty also receive medical attention free of expense. They are not, however, treated for sickness.

The surgeon, in responding to a call, carries with him a case of instruments, sufficient to perform an amputation, if necessary. In case a call is received while the surgeon is absent from his office, he telephones for a messenger to meet him with a case of instruments. Every power station is provided with a case of medicines and appliances such as can be handled by a person of ordinary intelligence, and in each case the surgeon gives the engineers, and others in charge of these stations, instructions in the use of appliances where the injury requires prompt action, such as washing injured parts and applying bandages or tourniquets to prevent bleeding.

In case an accident occurs where the company is evidently not at fault, the surgeon does not take charge of the case, but in all cases reports to the company on blanks provided for the purpose. These reports are filed with those made by the conductor, and any reports that may come from other employes. The surgeon also co-operates with the claim department, and advises regarding the settlement of accident claims.

The surgeon examines all car employes before they are assigned to duty, but as to their eyesight only. Cross eyed men, or men with only one eye, are not engaged. In the re-examination of all the employes in the system, only two men were found who could not tell the name of the letters presented, or, in other words, who could not read. The practice of examining employes to test their eyesight grew out of an accident which occurred, where the conductor started the car before a passenger had alighted, when it was discovered he was blind in one eye, and hence did not see that the person had not left the car.

Cincinnati Inclined Plane Street Railway Company.

This company, of which H. H. Littell is president, and H. P. Bradford is general manager, has been prominent in street railway legal literature for a number of years. The contest with the telephone company, when it was first proposed to adopt electric traction, and the signal triumph of the street railway company against the opposition to electric traction, or rather the single trolley system, is the most prominent suit in which the company has

been engaged. Recently, however, it has again gained prominence from the efforts of the city solicitor to annul the company's charter, and deprive it of its corporate rights. In the preliminary suit the city was victorious, and an order was issued, restraining the company from operating its line in the principal streets after a certain period. Afterwards, however, this decision was reversed by the higher court, and it was held that inasmuch as the company was operating virtually under a steam railway franchise, the concession granted by the city and state, the company was entitled to use the streets on which its tracks were laid. Under the franchise, the company is not required to pay any car license, or any per cent. on the gross receipts into the city treasury. This suit has been appealed to a higher court, and is still pending.

Notwithstanding the difficulties under which the company has labored, and the prejudices engendered by the suits, the line is doing a better traffic to-day than ever, and a gradual increase is noted from month to month, and especially over the corresponding months of last year, so that it is one of the few lines in the country on which the traffic has steadily increased, notwithstanding the financial depression that has prevailed. This increase of traffic has been induced, doubtless, by careful management, and by attention to all the little details of service which make a line popular with its patrons.

The city terminal of the line, makes a loop about the government building, touching a corner of Fountain Square as do all the other lines in the city, with one exception. The first division is divided by an incline plane which starts at the head of Main Street, on which the cars are transferred to the upper plane, when they continue their course over a thickly settled route to the original terminal of the line at the entrance to the Zoological Gardens about four miles from the Post Office. More recently, the tracks have been extended to Carthage, O., a further distance of four miles, to which the passengers are transferred, and over which a second fare is required, so that the entire distance is about eight miles from the Post Office, embracing a single track mileage of sixteen miles.

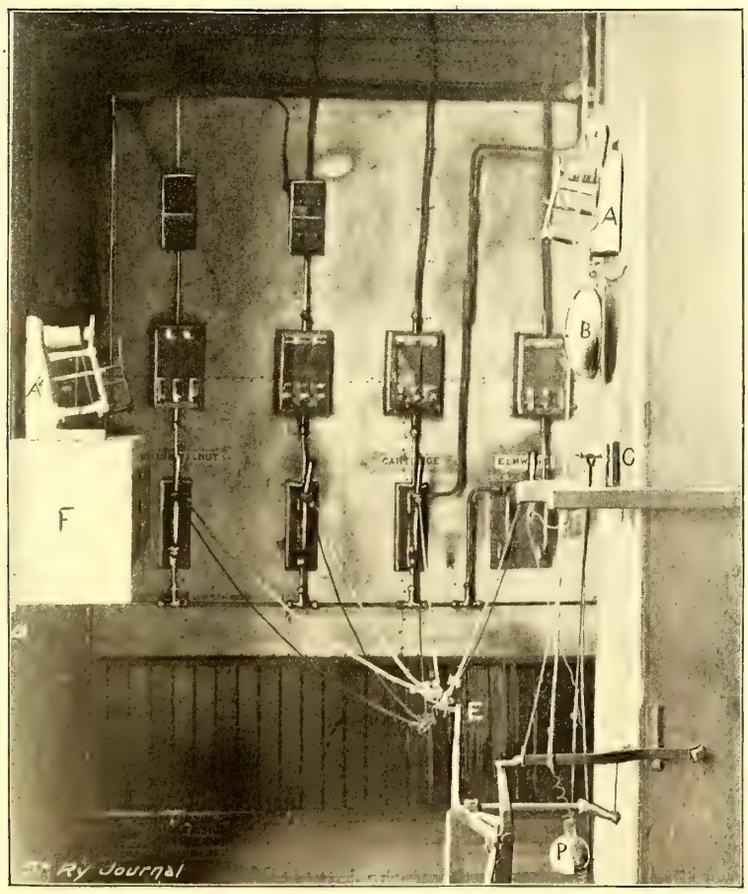


FIG. 10.—LIGHTNING ARRESTER AND CIRCUIT BREAKERS—CINCINNATI INCLINED PLANE RAILWAY.

The number of grades is very considerable, especially on the approach to the foot of the incline, where for several blocks there is a 13 per cent. grade, and the cars are run upon the incline trucks over a sharp curve on the grade. The grades and radius of curve at this point have been somewhat diminished, so that the approach is much easier than it formerly was. The incline is a double track road 960 ft. in length, and has a varying grade from 35 to 25 per cent., the total rise being 312 ft.

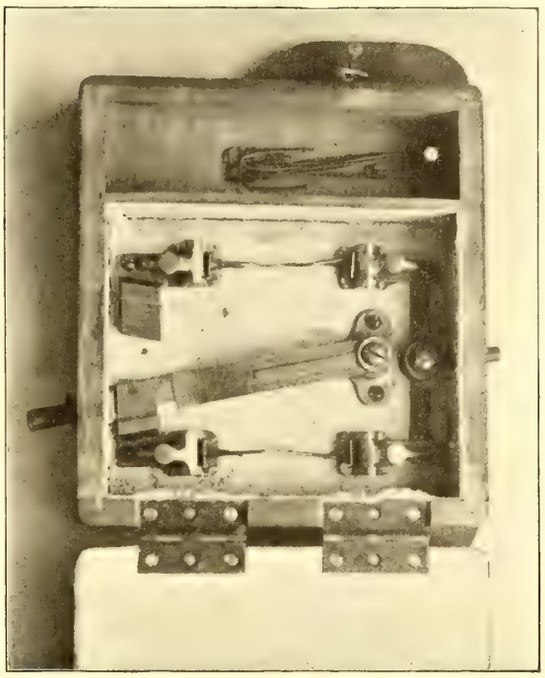


FIG 11.—DOUBLE FUSE BOX AND MAGAZINE—CINCINNATI INCLINED PLANE RAILWAY.

Before leaving the city, the line crosses the canal, makes the ascent of the inclined plane, and continues on over the brow of the hill to New Mt. Auburn, Clifton and Avondale, and descends the northern slope, where, just before reaching the power station at St. Bernard, it recrosses the canal at the same level.

The line is operated from two power stations; one is located at the head of the incline, and forms a part of the power plant which hauls the cars up the incline. The buildings and repair shops at this point are plain wooden structures, but the equipment, although not in all respects up to that employed in recently constructed power stations, is standing up well under the traffic, and has made a very excellent record.

The station equipment consists of two Lane & Bodley Corliss engines of 250 H. P. each, and one "Brown" engine of 150 H. P. These are belted to a countershaft, from which two No. 32 and four No. 20 Edison generators are operated. One Ball engine, 150 H. P., formerly employed in this station, has been transferred to the new station near the terminal.

The boiler equipment consists of four 150 H. P., tubular boilers which also supply steam for the engines of the incline. At night one engine operates the entire system, and frequently furnishes power for all the cars, the average number operated being twenty-six.

Included in the electric equipment of the station is a lighting arrester and attachments which have been devised by the electrician of the company, and since the placing of these arresters in the circuit, no burnouts have occurred from the atmospheric discharges, and the lines are never shut down during the most severe electric storms. Although there are a number of arresters of other types in the cir-

cuit, this is always the first to operate. The arrester shown at A (Fig. 20), consists of two carbon brushes attached to a lever and which at normal position are held about one-sixteenth of an inch apart. The opposite end of the lever is supported above a magnet which serves to tip the lever and break the arc as soon as it is formed.

Supplementary to the arresters is a tripping mechanism which serves to throw out all the circuit breakers whenever the arrester operates. This mechanism consists of a lever and two weights, one, D, shown in the engraving, and the other beneath the floor, and cords which connect the principal lever with the handles of the circuit breakers. The tripping weight is supported by a cord and hook which are held in position by a small copper fuse, C, placed in a horizontal position, and which forms part of the ground circuit from the arrester. In case an arc is formed through the arrester, the fuse blows, which allows the trip weight to drop. This unlatches the heavy weight which operates to open the circuit breakers, E, and sounds the gong, B. Extra fuses are kept in position beside the arrester, and as fast as one blows a new one is inserted, and the circuit breakers are immediately returned to position by the attendants. A duplicate arrester is shown at A 2, and they are also placed at intervals along the line.

The coal for this station is hauled by wagons about a mile, from the barges on the river to the foot of the incline, where it is dumped into coal cars which are attached to the incline truck, and by it hauled to the top where the coal is dumped through the trestle, and delivered at the door of the boiler room.

The second, or new power station, as before noted, is located at Ludlow Grove, on a siding of the Baltimore & Ohio Railroad, from which coal is delivered direct from the cars to the boiler room. The manager has laid in a supply of coal sufficient for operating both stations until Christmas, the object being to prevent any possible delay on account of a coal famine that might be the result of the miners' strike.

This new station is a frame building with a corrugated iron sheeting, the engine and boiler rooms being separated by a considerable space. The equipment consists of a 250 H. P., "Brown" engine manufactured by I. & E. Greenwauld of Cincinnati. This is belted to a countershaft, from which two No. 32 Edison generators are operated. There is also the Ball engine which has been transferred from the other station as above noted. Three tubular boilers of 150 H. P., each supply the steam which is led from the boilers to the engines in an underground main.

When the station was first constructed, the supply pipe led from the top of the boiler across to the engine room, and was depressed to connect with the cylinders, in which position the pipe vibrated considerably from the reaction of the exhaust, so much so that it was impossible to keep the joints tight, and the leakage of steam kept the engine and boiler room in a damp condition. Since the supply pipe was placed under the ground, no leakage has occurred. The feedwater is drawn from artesian wells and leads through a feedwater heater.

The station is kept in an exceptionally neat and tidy condition, and the engineer has given it an air of comfort and produced a pleasing effect by painting the engine and generator parts in brilliant colors. The same practice of painting the flywheels and generator fields in bright colors, is also practised in the old station, the edge of the flywheel rims being a bright yellow, and the generator fields a scarlet.

ROLLING STOCK.

The company owns forty-two cars, but the average number operated is twenty-six. The closed cars have cross seats, and the end doors are placed to one side, the end seat in each case being longer than the other, and is backed against the end of the car.

The trucks are one of the early types of Brill manufacture, and the Sprague No. 6 double reduction motors are employed, and although they have been long in service, are still working well. This is a single trolley road, and is the only single trolley operated in the city.

Formerly the car fuse box was placed under the seats, and sometimes, especially when approaching the the incline over the steep grade noted above, the fuse would blow, which tended to frighten the passengers. More recently a double fuse box has been provided, and this is attached in the usual manner under the side of the car. The fuse box being double, as noted in the engraving (Fig. 11), in case one fuse blows the motorman has only to throw the switch handle, which brings the second fuse into service. The box is also provided with a magazine or separate apartment, in which extra fuses are kept, so that the fuse box is readily re-equipped in case the fuse burns out. It is the duty of the inspector to notice that extra fuses are always provided in the magazines. The rolling stock also includes six open cars which were built by the American Car Company.

There has been no change in the return circuit since the line was constructed, except the keeping up of repairs, by renewing bond wires, etc. The track being constructed with No. 58 Johnson girder rails supported on chairs, requires considerable repairing.

The city authorities will require the company to re-equip the lines with a full grooved girder rail, just like that employed by the Cincinnati Street Railway Company.

EMPLOYES.

Motormen and conductors are paid $2 per day after the first six months' service, but begin at $1.75. Before being assigned to duty, they are required to serve as students under three different motormen, and also to work in the machine shops until they become familiar with the electric equipment. They are then examined by the electrician of the company, and go on as extras. The hiring and discharge of the car men is entirely in the hands of the manager. The fare is five cents over each division. Round trip tickets are sold to residents over the two divisions for fifteen cents. The cars carry the United States mail and deliver pouches to five different offices. The motormen who carry the mail receive a special appointment or a detail from the post office authorities.

The employes are required to wear uniforms, and to carry watches, which are to be kept with the clock at the company's headquarters. A deposit of $25 is required from the motormen and conductors as a guarantee of faithful service.

H. P. Bradford, the general manager, was formerly the superintendent of the lines in Little Rock, Ark., and at the time of H. M. Littell's transfer to New Orleans, a year and a half ago, Mr. Bradford assumed control of the system.

ZOOLOGICAL GARDENS.

As noted above, the first division of this system terminates at the entrance to the Zoological Gardens. These gardens have a world-wide reputation, and are claimed to have a finer collection of animals and birds than are to be found in any similar institution in the country, and it is the only institution of the kind that has been built and managed entirely by private enterprise without municipal aid. The grounds embrace a tract of forty-five acres, broken up in plateaus, ravines and ridges, and thoroughly improved and shaded with a selection of choice trees and shrubbery, so that the natural features are not among the least of the gardens' attractions.

The cages, houses and apartments for the accommodation of the animals are of stone and iron, and constructed in a very tasty and thorough manner, being located in different parts of the grounds, so that every turn in the driveways brings one to some new station with new attractions. The collection embraces about 1,500 specimens, gathered from all parts of the world, and all are kept in an exceptionally fine condition, and have become so thoroughly acclimated, that they seem to enjoy life in captivity equally as well as on their native heaths. Additional attractions in the way of music, athletic feats, fireworks are provided during the summer season, all of which tend to induce a large pleasure traffic over the lines of the Inclined Plane Street Railway Company. A charge of twenty-five cents is made for admission to the grounds.

The Pendleton, Mt. Lookout & East Walnut Hill Railway.

This is a suburban steam dummy line, and connects with the electric cars of the Cincinnati Street Railway Company's system at Eastern Avenue. The line is about two miles in length, and is operated by self-contained, six wheel motor cars, the engine being mounted in the cab, supported by one pair of wheels, the other end of the car resting on a four wheel truck. Trail cars are employed as occasion requires.

The line is being equipped for electric traction, and General Electric motors are being employed. It is expected the change will be effected during the present season. The line is operated under the management of C. H. Kilgour.

Mt. Auburn Cable Railway.

This line, which is four miles in length, was built in 1888–89 for the purpose of conveying passengers to the heights known as Mt. Auburn, to reach which, over the then existing lines, a fifteen cent fare was required. The moving spirit in the enterprise was Henry Martin, who owned considerable property in the neighborhood, and was himself a resident of Mt. Auburn, and who became president of the company.

The line starts on Sycamore Street, at its junction with 4th, crosses the canal and ascends the heights, terminating at the Avondale Town Hall. The ascent of the bluff is over a 9½ to 13 per cent. grade, 2,200 ft. in length, terminating near the summit on a reverse curve, which is shown in the accompanying illustration. Just before reaching the reverse curve the line makes a right angle turn into Auburn Street.

The line has had a checkered history. In the first few years of its existence it enjoyed a liberal traffic, which was afterwards decreased by having been paralleled by an electric line of the Cincinnati Street Railway Company's system, and in March, 1892, fire destroyed the power station, so that traffic was interrupted for a period of 103 days, until a new station could be built and equipped. During this interval traffic sought other lines, and has not since wholly returned to the cable.

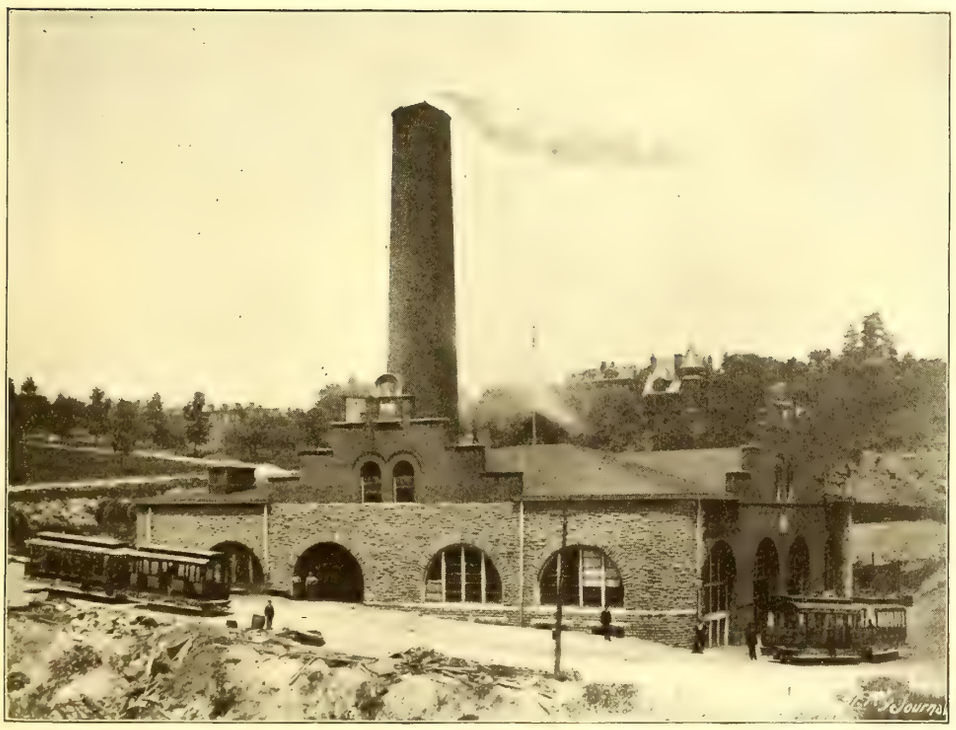


FIG. 12.—POWER STATION—MT. AUBURN CABLE RAILWAY CO., CINCINNATI.

About eight months ago the property was placed in the hands of Alfred Hill, receiver. Traffic has steadily gained during each month of the present year, and the line is now carrying about 5,000 passengers per day. Effort is being made to reorganize the company and secure sufficient capital to place the road on a solid basis. The roadbed has been considerably improved, and the whole line seems to be in a better condition than it was three years ago, when we made our first visit to the plant.

The streets along the route are being rapidly built up with a fine class of houses, and when a city terminal, as is now contemplated, is obtained near the Post Office and Fountain Square, it will doubtless become a good paying property.



FIG. 13.—COMPOUND CURVE ON 13 PER CENT GRADE—MT. AUBURN CABLE RAILWAY CO., CINCINNATI.

The new power station, illustrated in Fig. 12 was built on the site of the one destroyed by fire, at the corner of Highland and Saunders Streets, and is a one story building with basement.

The power equipment occupies the basement, and there are offices on the first floor, while the greater portion of the first floor is occupied by the car repair shops. The fire destroyed twenty-four cars, and a new equipment was purchased, for the most part from the St. Louis Car Company. Some new cars are being built in the company's shops.

The cars are operated in trains consisting of a grip and trailer, open cars in summer and closed cars in winter. The grip cars are of the combination type and provided with seats as well as the trailers, and the trailers are provided with an emergency slot brake, which is operated by a hand wheel from the center of the car. It is considered safer to operate over the steep grade with two cars than with one, as in case the brake mechanism of one car should fail, the other may be employed. A wheel screw grip, which has already been described in these columns, is employed. The grip jaws are now made of cast iron. Formerly phosphor bronze was employed, which sometimes failed to haul the loaded cars over the steepest points in the grade. The life of the cast iron jaw is from ten to twelve days, while that of the phosphor bronze was only about seven. The iron jaw never fails to hold the rope.

During the history of the road a runaway has never occurred, and a gripman has never lost control of a car, although, in a few instances, it has been necessary to back down the grade. It is necessary for the gripman to re-

lease the rope seven times on a trip, but the rope has not been cut, but once, in three years' service. The cars have also been recently equipped with track brakes, devised by the superentendent of the company, G. Levins. The number of trains now operated is from eleven to thirteen, depending upon the amount of traffic.

The power equipment consists of two Lane & Bodley engines, Corliss type, of 350 H. P. each, which were rebuilt after the fire. The same shafting was also employed, but new gear wheels and winding drums were substituted for the old equipment. The latter are provided with the Walker differential rings, and both are driven by intermediate gears The plant is working in a highly satisfactory manner. The ropes are operated in two sections, one being about three miles in length, the other five miles, are run at a speed of eight and ten miles per hour respectively.

The four boilers are of the tubular type, of 350 H. P. each. Pittsburgh coal is employed, which costs, delivered, $1.75 per ton, being hauled about two and a half miles in wagons, and it requires about six tons per day to operate the plant.

A new carrying pulley has been substituted for the old pulleys which were of the combination type, and weighed about fifty pounds each. The new pulleys are solid, and weigh twenty-five pounds each. These last much longer than the old ones, and with them it requires much less power to operate the ropes. The track was constructed with yokes four feet apart, and the rails, which are of the girder type, weigh fifty-six pounds per yard, and were laid with suspended joints. As noted above, the joints have been recently raised and supported on blocks, and since these repairs have been made, including the renewal of the carrying sheaves, a saving of three tons per day is made in the coal consumption. This saving strikingly illustrates the importance of a smooth track in street railway traffic. The extra amount of power required to operate over a track with low joints is not generally realized by either cable or electric railway managers.

Crossover switches are employed at the terminals, the trailer being shifted by hand. The grip car runs either end first.

The fare is five cents. A special fare of six tickets for twenty-five cents is given from the city terminal to the foot of the hill, and children's tickets are sold for three cents. After seven o'clock in the evening, and also on Sundays and holidays, during the summer season, passengers are carried the round trip for one fare, in case they do not leave the car.

Conductors and gripmen are paid $2 per day, or twenty cents a trip. A deposit of $50 is required from conductors, and $25 from gripmen.

The regular fares are recorded on a Meaker register, and special fares on a trip slip with a punch. C. B. F.

The Jersey City, Hoboken & Rutherford Electric Railway.

The line of the Jersey City, Hoboken & Rutherford Electric Railway Company is approaching completion, and operations will commence, it is thought, during July. The eastern terminus of this line will be at the Barclay Street Ferry, Hoboken, and its Western terminus at Rutherford, where it will connect with the Paterson, Passaic & Rutherford road which extends to Carlstadt. Connection will also be made at this point with the New York & Greenwood Lake branch of the Erie Railroad, and arrangements have been made for handling the excursion traffic in connection with this road.

The power house will be built on the Hackensack River, and is being constructed by Westinghouse, Church, Kerr & Company. It will employ the kodak equipments throughout. At the Hoboken end of the line a number of interesting engineering problems will be cared for, including a trestle on 2nd Street about 300 ft. long, at the point of crossing the steam railroad tracks.

The president of the company is Charles L. Johnson, who is also president of the Paterson, Passaic & Rutherford Railway Company.

Michigan Street Railway Association.

The advantages shown to be afforded by membership in a state street railway association has led to the formation of a new society of this kind, that of the street railway companies in Michigan. A meeting of the companies of this state was held at Grand Rapids, June 5, and an organization perfected to be known as the "Michigan Street Railway Association." The following officers were elected to serve until the regular meeting to be held in the same city September 19, 1894: President, W. L. Jenks, City Electric Railway Company, Port Huron, Mich; vice-president, W. Worth Bean, St. Joseph & Benton Harbor Railway & Light Company, St. Joseph, Mich.; secretary and treasurer, B S. Hanchett, Jr., Consolidated Street Railway Company, Grand Rapids, Mich.

The Executive Committee consists of the officers of the Association and David H. Jerome, City of Saginaw Street Railroad Company, Saginaw, Mich. and Strathearn Hendrie, Wyandotte & Detroit River Company, Detroit, Mich.

Electric Freight Cars in Spokane.

An important and somewhat novel application of electricity has in the last three months been made by the Spokane Street Railway Company in the City of Spokane, Wash., in the propulsion of freight cars loaded with wheat and flour over certain streets of the city between the steam railroad depots and the mills.

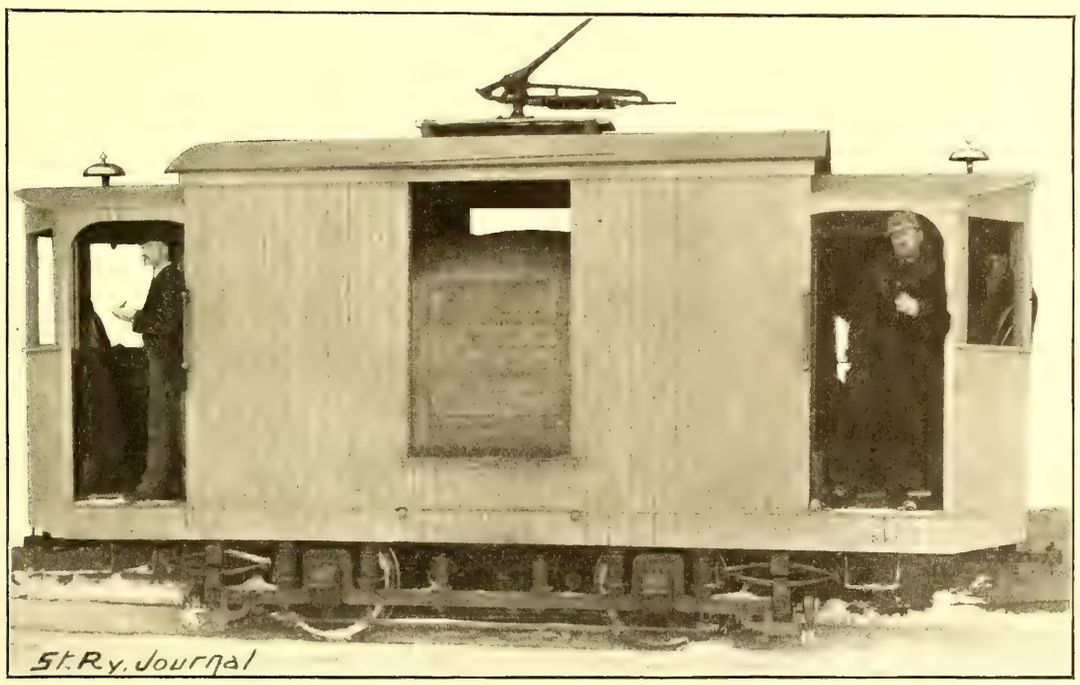
For the past three years the question of trackage facilities from the steam railroads to the water power and the mills has been one which has been under serious consideration in Spokane, and though many plans have been proposed to settle it, so far it has not received a satisfactory solution, the mills being to-day without permanent steam trackage facilities to and from the railroads centering in the city. So far the output of these flour mills has been handled by means of teams, and it was with the object of temporarily relieving the needs of the flour mills in this respect that the Spokane Street Railway Company in March last applied to the City Council for, and obtained, an ordinance giving the company "the right to haul cereals and the products of cereals on, along and over certain streets and street railway lines in the city of Spokane."

Connection now exists between the Northern Pacific Railroad transfer tracks and two of the mills, the C & C Mill and the Echo Mill; but the ordinance provides for service if necessary from any and all of the flour mills to any and all of the steam railroad depots, as well as the Northern Pacific, and it specifies that the company shall lay such track and make such connections whenever called upon to do so by the City Council or by any of the other mills. The ordinance provides that "the company shall haul all cereals and the products of cereals from any railroad affected to any mill on such roads at a charge not greater than twenty cents per ton, and if the cars are loaded both ways the charge shall not exceed fifteen cents per ton each way. This sum shall be inclusive of the cost of handling from steam cars to the electric cars, and five tons shall constitute a minimum carload." The ordinance also provides that in the case of any mill owning its own car, the company will supply current and right of way over its tracks to any depot reached at a charge for the service of a sum not to exceed $2 per car per day. With one car such as that now in use the wheat in and flour out of a 1,000 bbl. mill can be handled in fifteen round trips, or in one day's work. The capacity of the car is 12,000 lbs. or 200 bhls. of wheat. In the month of February the car handled in 230 hours, rnnning between the dry kilns and the mill, some 64,000 bhls. of wheat.

As the ordinary tracks of the electric railways are used for this freight car, and as the curvature of the company's lines had to be considered, necessity compelled the

design of electric freight cars specially arranged for this work. As a result, a very ingenious car was designed by the manager of the company and was built in the company's car shop. The car is twenty feet long over all, and twelve feet long inside; outside width six feet; five feet six inches high inside from the floor level to the roof. In external appearance it is like an ordinary box car, but beneath the inside floor of the car is a hopper, and the floor opens up in two halves from the center of the car, each half of the bottom falling over to the end of the car. When the floor is level over the hopper it is the same height from the rails as the floor of an ordinary steam freight car, which is about four feet.

The maximum speed of the car is six miles an hour; it is mounted on a Brill No. 21 truck, six feet six inch wheel base, with thirty inch wheels. The electrical equipment consists of two Edison No. 8, double reduction street car motors. The speed of these motors was reduced by special rewinding from their normal rate of 1,000 revolutions to 500 or 600 revolutions per minute. These motors are controlled by an ordinary rheostat and ordinary reverse switches, cutouts, etc., and, instead of a crank, a lever brake is used for braking purposes, which works more quickly.



ELECTRIC FREIGHT CAR—SPOKANE.

When the car is loaded it is run to the front of the mill, where it comes to a stop over the mill sink. The hopper is furnished at its lowest point with a sliding steel gate. This steel gate is then drawn and in less than a minute the contents of the car fall into the mill sink, and from thence it is conducted by elevators up into the mill for grinding. The hopper is then closed over by throwing down the hinged floors of the car, and the car is then loaded with flour for transfer to the steam railroads. A larger car of the same design is now being built by the company to handle increased business.

The car has now been on the road for three months, and has never been to the shops for repairs. There are one or two pieces of line over which the car travels having 5 per cent. and 4½ per cent. grades and a 55 deg. curve, and the car travels over them as smoothly and as rapidly as on the straight and level track. The car has been found exceedingly convenient on several occasions for the handling of macadam on the road between the rails. Macadam is loaded into the hopper portion of the car, and when its distribution is required the steel gate is drawn, the current is thrown on, and the car delivers its macadam evenly on the track proposed to be surfaced.

Up to the present all grain has been transferred from the steam cars to the electric car by hand, but the superintendent of the company, Mr. Knowles, is now perfecting an electric power shovel and elevator arrangement, whereby all grain will be moved out of the steam cars by the shovel and dumped into the boot of the elevator, which, running also by electricity, will lift the grain to a bin, from which it will flow by gravity into the electric freight car.

When the ordinance was first introduced into the Council considerable opposition was manifested on the part of some of the property owners on the streets covered by the ordinance, who supposed that this work was going to depreciate the value of their street frontage. Since then, however, they are unanimous in its favor, and as the route selected is on a street, the property on which is most suitable for wholesaling purposes, some of the property owners are already agitating the question of putting spur tracks into their property, so that freight in general can be handled in and out in less than carload lots, thus doing away with the cost of drayage between the wholesale establishments and the depots. The last two months of operation has demonstrated that even with the convenience now perfected the mill product can be handled at a less charge per steam freight car than the switching charges prevailing in the city, viz., $2.50 per car. The development of the plan started in Spokane will no doubt be watched with interest by the electrical fraternity, and the use of the street car tracks in cities for freight purposes may prove to be a considerable source of revenue to the street railway companies.

The accompanying cut shows an exterior view of the car, and is from a photograph taken last spring.

A Sprinkling Car at Toronto.

The Toronto Railway Company has recently installed upon its line a sprinkling car which has been in operation for a short time and is proving very satisfactory. The tank was built by a local firm and holds 2,800 gallons of water. It was mounted in the company's own shops on a Taylor improved truck. It takes about five minutes to fill the tank, and from one filling the car will sprinkle about ten miles of single track.

The railroad company has entered into a contract with the city to sprinkle the railway portions of the streets at sixty-five cents per mile for four sprinklings per day.

The company has something over forty miles of street, and estimates that the car will bring in gross at least $25 a day for the service above mentioned.

THE Bremen Bergbahn or hill railway near Bremen, Germany, was opened to public traffic April 16, 1894. This is the first rack railway in Germany operated by electricity, and was constructed by Siemens & Halske, of Berlin.

THE gripmen and conductors of the Third Avenue Street Railway Company, of New York, had their wages raised May 28. Hereafter the gripmen will receive $2.50, and the conductors $2.25 per day.

The Electric Railway of Genoa, Italy.

According to M. Edouard Hospitalier, the eminent French electrician, the few electric tramways now operated in Europe are a disgrace to the civilization of that respectable quarter of the world, but happily they are also an excellent sign of an awakening to benefits of which the new world has known how to take a large share. The house of Siemens & Halske whose Berlin road was one of the first ever laid down in Europe, and whose Buda-Pesth line is said to be the only successful conduit electric road in the world, has done perhaps more than any other company or individual to bring home to the European mind the many advantages of the electric street car system.

An interesting road has just been installed by this house in the famous city of Genoa, which has ever been a city of innovations, and which gave to the world the greatest of modern innovators—the discoverer of America; and the streets along which marched the captives from the Algerine coasts now ring to the sound of the electrical car gong and the hum of the trolley contact.

The line in question runs at present from the Piazza Corvetto through the Via Assarotti to the Piazza Manin where it terminates near the generating station. Another is in course of construction to run from the Piazza Corvetto along the Via San Filippo, Via Giacomo and the Via Serra to the Piazza Brignole, while another will run from the Via Circonvallazione to St. Ugo.

The system used is the overhead trolley line system, and in the careful method of insulation of the supply wires, their height above the roadway, the method of suspension, and the extreme care with which all the details of construction are carried out, the road may be considered as perfect as any yet installed in Europe. Strange to say, the project met with no great opposition on the part of ignorant editors, nor have any objections yet been raised to the appearance of the overhead conductors.

The power house and its equipment have been laid out with a view, not only of supplying the needs of the present line, but also of the extensions either under construction or in contemplation. The completed house will have three sets of boilers, three engines and three generators, besides one set of boilers, one engine and one generator as a reserve unit. At present, only one set of two boilers, one engine and one generator are in operation, the current generated by this combination being sufficient for present needs.

The power house is located about three-quarters of a mile from the present terminus at the Piazza Manin, on the road from the Porta Pila to Stagliano. The engine is of the vertical, compound, condensing type, with cylinders superposed in tandem, and was constructed in the shops of F. Tosi, of Legnano. The governor system is American, the governor weights being mounted on the shaft like a second flywheel. The bearings are all of the best anti-friction metal. The diameter of the low pressure cylinder is 18.7 ins., that of the high pressure cylinder, 12.08 ins., and the piston stroke is 14 ins. The engine operates at 260 revolutions per minute, giving 150 H. P. normal, and 200 H. P. maximum. The condenser is operated by a slow speed, horizontal engine which also operates a pump sunk in a well for keeping the water for the condenser up to level, even in the dry weather. One condenser serves for two engines. The boilers are of the Cornish type, with double grates and soft steel bodies. They are 5.1 ft. in diameter and 24½ ft. long, with a heating surface of about 67 sq. yds. The normal pressure is about 10.5 atmospheres. Water is supplied by two duplex steam pumps, one being held in reserve.

The electric generators are of the compound wound, interior pole Siemens & Halske railway type, generating 200 amperes at 525 volts when making 420 revolutions per minute. Each is fitted with four brushes, which can all be operated as a single unit, resting on a commutator with 260 sections. The resistance of the armature is .003 of an ohm, that of the fields 3.6 ohms, while the efficiency is about 94 per cent. The generators are insulated by running the base frame bolts into a mixture of sulphur, glass and pitch set in porcelain insulators filled with oil, and cemented into the foundations. The bolts themselves are insulated by wooden blocks and leather washers.

The switchboard shown in the background of the illustration of the engine and dynamo room carries three rheostats, three 200 ampere ammeters, one 550 volt voltmeter, three main switches, six 200 ampere cut-outs, four lightning arresters with magnetic blowout, a differential voltmeter for parallel working, and three magnetic circuit breakers. The line is divided up into sections so that each part may be cut out as desired for test or repairs.

The feeders and return run from the station to the Piazza Manin, a distance of 1,367 yds., in two cables containing four 7.5 M. M. wires each, on poles erected forty-four yards apart. Of the eight wires, four are return wires and are soldered to the rails, while four are carried to the trolley wires.

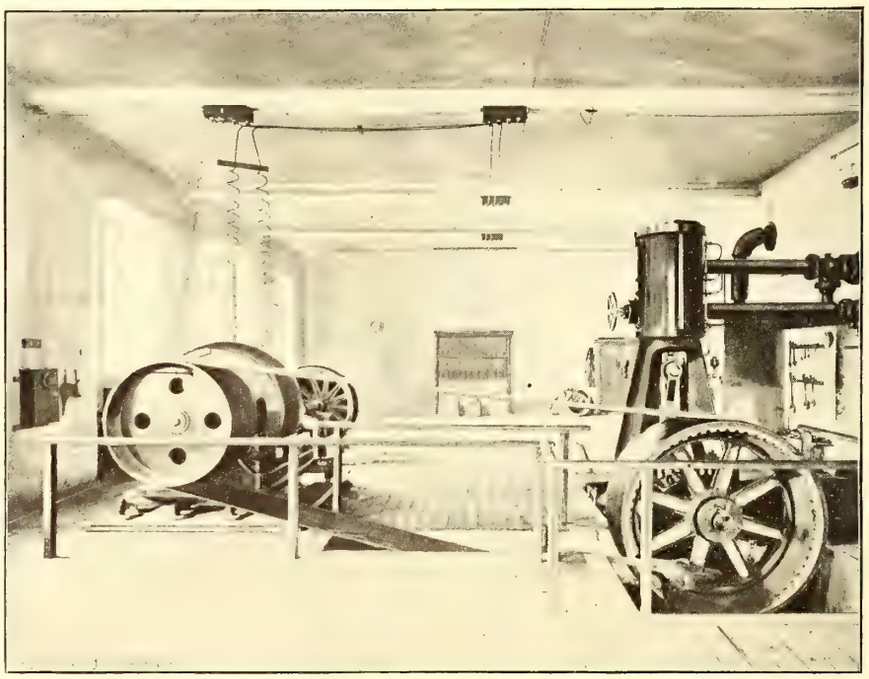


FIG. 1.—INTERIOR OF STATION—ELECTRIC RAILWAY AT GENOA, ITALY.

The rails are of the Phoenix channeled girder type set on ties in a massive granite pavement. The line in the Via Assarotti is single track throughout with the exception of one turnout. The return is provided for by a careful bonding of each rail with a copper band securely riveted. So perfect is the return that no trouble has been experienced with the telephone or telegraph service, although their earth plates are occasionally very near the street railway wires.

The span wire supports in the city are of ornamental cast iron, and are fixed to the walls of the houses by a circular iron plate and four bolts, the insulation between the support proper and the house being obtained by two creosoted cones of wood. Each support carries also a porcelain skirted insulator, to which is attached the span wire. In places where poles are used instead of these wall supports, a pole line insulator of similar form is used. The span wires of galvanized wire are one-fifth of an inch in diameter and the trolley wire of phosphor copper .28 in. in diameter. This is carried at a height of twenty-two and a half feet above the roadway. The trolley wire is not suspended in a right line directly above the center of the track, but is strung in a sinusoidal curve over the central line. This allows of a constant change of contact

point on the contact bars which replace the trolley wheel in American practice. At curves the usual number of pull-offs and wires is done away with, the conductor being doubled and held in a special suspension of the span wire.

The trolley or traveling contact is the upper side of a rectangular frame carried on a tubular support. It is of simple iron wire one third of an inch in diameter,and presses, like the trolley wheel, on the under side of the overhead conductor, a strong spiral spring keeping it in contact. Two of the frames and supports are fitted to each car, and as mentioned above, the contact point travels from side to side along the entire breadth of the contact bar.

mounted on each truck so that the fields on the one side and the armatures on the other are in parallel. The brushes are of carbon. The armature shaft is coupled by a leather friction clutch to a three-threaded worm which engages in a toothed wheel bolted to the axle. The reduction is as 10.33 to 1. Each worm and gear runs in a cast iron case filled with oil, and works absolutely noiselessly. The motors are insulated from the frame by means of rubber washers, a sheet zinc case protects the motors from dust,water and mud. One end of each motor is hung from the axle while the other is carried on the frame and supported on rubber springs to prevent shock. The resistances are placed beneath the cars and are four



FIG. 2.—VIEWS ON THE LINE OF THE GENOA ELECTRIC RAILWAY.

The advantages claimed for this form of contact are, a greater degree of reliability in maintaining contact, as one bar is always in contact when passing the insulators, and the elimination of the danger of the trolley jumping when the car oscillates. The pull-off wires at curves are unnecessary since the line need not follow the curve of the rails, but can form a chord across, the width of the bar being sufficient to allow of contact being preserved. The system also does away with the overhead frogs and switches at points of bifurcation, as well as the constant jumping at such points. The contact supports are so arranged on the car as to permit of their reversal automatically as soon as pressure in the reverse direction is applied.

The Siemens & Halske motors are of eighteen horse power and have a speed of 800 to 900 revolutions, two being

in number, of 4, 12, 18 and 30 ohms resistance, corresponding to the switch contacts. The maximum speed attained with a car fully loaded with 36 persons, on the steepest grade in the Via Assarotti is seven and a half miles per hour, and it was found that by a suitable arrangement of the resistances and reversing the current after removing the brakes, the car running at this speed was stopped in its own length. Each platform is furnished with a switch and set of resistances. The energy required by the motors, the car being loaded with two and a half tons of sand and running at a speed of seven and a half miles an hour on the 8 per cent grade of the Via Assarotti, is 26.4 K. W.

Each car is provided with two mechanical brakes, the first being the ordinary chain brake with shoes applied to each of the four wheels of the car, while the

second is an emergency brake by means of which the driver, by a single motion of a lever, can drop in front of the forward wheels two conical iron shoes. This brake is only used in case of grave danger, the stoppage of the car being very violent, but it provides ample security against such an occurrence as a runaway on the steep grades along which the car may be running.

An electric brake is also provided. This consists of a simple switch on the platform, which allows the driver to cut the connection between the supply wire and the motors, closing the motor circuits on a suitable resistance. The motors then operate as generators, and the wheels turn in the opposite direction. Another method is simply to reverse the current on the motors.

The cars were turned out from the Savigliano shops, and do not sin on the side of artistic effect. They are very narrow, and have a passage from end to end, the seats being arranged for two persons on one side, and one on the other. They are divided into two classes, the interior being first class, and the platform second class. So peculiar is the arrangement of the cars that there is a difference of load on the axles of about 1,600 lbs. The rolling stock of the line consists at present of four cars, three in constant service, and one in reserve. Twenty-six additional cars are now being constructed for the new lines. The company which operates this road is the Electric & Cable Tramways Company, of Kerns, Switzerland.

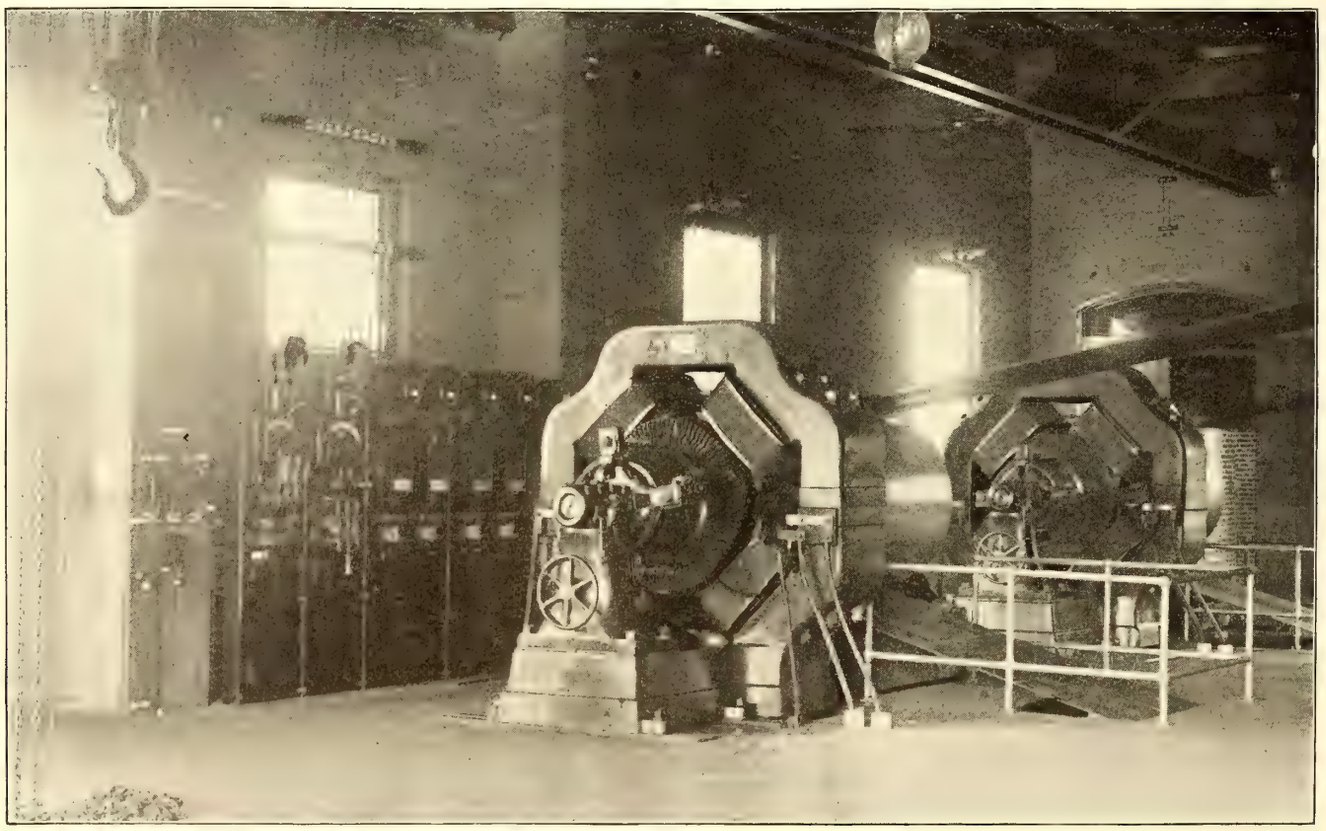


FIG. 1.—INTERIOR OF STATION—ALLENTOWN & LEHIGH VALLEY TRACTION CO.

In the Lehigh Valley.

The present line and equipment of the Allentown & Lehigh Valley Traction Company, of Allentown, Pa., merit a special mention at this time as being one of the few successful enterprises of equal magnitude projected at a time of financial panic, and carried through to completion during the most stringent four months of a trying fiscal year. Ground was only broken for the primary grants of this company on May 15, 1893, and the work of grading and track laying began at the same time. Despite the fact that the engineering obstacles presented were many, ten miles of double track were constructed and cars operated by October 1. In addition, a viaduct of nearly 1,000 ft. was built and two girder bridges were constructed. The prompt completion of these bridges was necessary to the success of the enterprise. The contract for all three was let to the Variety Iron Works Company, of Cleveland, O., and they were erected in place ready for travel within ninety days from the day of the receipt of the order.

One principal reason for the necessity of pushing the work was that the city of Allentown had demanded a forfeit deposit of $50,000, as a guarantee that the road would be built, fully equipped and in operation on or before November 1, of the year in which it was begun. This sum was furnished by A. L. Johnson, president of company, and the rapidity with which the work was done is obvious, when it is stated that cars were running nearly or quite a month before the time limit.

About March 1 last, the entire plant belonging to an earlier company, the Allentown & Bethlehem Rapid Transit Company, was purchased outright by the Traction Company, and this property is now, together with the Allentown Electric Light & Power Company, controlled and operated exclusively by the Traction Company. This gives to the latter corporation a monopoly not only of the electric railway traffic, but also of the electric lighting and power supply of the city. In conformity of the policy adopted elsewhere by the syndicate controlling this company, there has been a marked increase both in quantity and quality to the service. At the same time the fares have been reduced nearly one-half; thus the spectacle is presented here, as in other places, of a monopoly proving a public benefactor.

When the traction line has completed all its projected arms and feeders, it will have one of the most attractive and complete systems of rapid transit in the United States. At present the city is in close connection by this company's lines with the three boroughs of West Bethlehem, South Bethlehem and Bethlehem, as well as Fountain Hill, Freemansburg and Hellertown on the South, and with Fullerton, West Catasauqua, Catasauqua, Hokendauqua, Coplay, Stempton, Siegfrieds, and White Hall on the North—a total population of 120,000. All of these lines center at Rittersville, midway on the historic pike between Allentown and Bethlehem, where the railway

company has provided what is said to be the finest base-ball grounds in the State, and has engaged Mike Kelley, the well known ball player, as manager of the local team. Here also has been located a public park appropriately called Central Park, with zoological and other attractions, which has proved an added stimulant to travel.

We present on this page a group of engravings showing views along the line of route of the company. The bridges span the Little Lehigh and Jordan Rivers, the length of each span being 125 ft. They are of the Warren girder type, and are used exclusively by the cars of the Traction Company. The Aineyville Viaduct is 864 ft. in length and forty feet in height. Both bridges and viaduct were constructed under the supervision of H. F. Coleman, of the Variety Iron Works, Cleveland.

The power station measures 80×180 ft., and contains two 750 H. P. Cooper-Corliss engines, one 300 H P. engine of the same type, and one 300 H. P. Hamilton-Corliss engine. The boiler equipment consists of five 150 H. P., return tubular Cooper boilers, eight 150 H. P., return tubular Phœnix boilers and three 300 H. P. Stirling boilers. Berryman heaters and Worthington pumps are used. Fig. 1 gives a view of the General Electric generators employed.



FIG. 2.—VIEWS ON THE LINE OF THE ALLENTOWN & LEHIGH VALLEY TRACTION CO.

The rails were furnished by the Johnson Company, of Johnstown, Pa., and the Bethlehem Iron Works, of Bethlehem, Pa., all special work being supplied by the Johnson Company. In the city the rails are of the 78 lb. girder type, and in the suburbs a 70 lb. T rail is used. The rail is laid on ties 5×8 ins. × 7 ft. of white oak, placed every two feet. On the bridges and viaduct each T rail is provided with a double line of guard rails. The poles are of white cedar tastefully finished in green and white. The ballast is of stone and blast furnace cinder to a depth of twelve inches. The grades range in height up to 12½ per cent.

All of the hangers, pull-offs, insulators and other overhead appliances were supplied by the H. W. Johns Manufacturing Company, of New York, and the Steel Motor Company, of Cleveland. The trolley wire was supplied by Benedict & Burnham, of Waterbury, Conn., and the insulated feed wires by John A. Roebling's Sons Company, of Trenton, N. J.

The cars are of a special type especially adapted for suburban traffic and are sixty in number. They are of the Brill, Briggs, Lewis & Fowler, Newburyport and Stephenson makes. The car bodies are mounted on a number of trucks, including those of the Brill, McGuire, Bemis, Harris and American Car Company types. The Harris trolley is used with the Steel Motor Company's equipments and Lewis & Fowler registers, Missouri Car & Foundry Company's wheels, Star headlights and De Witt sandboxes form part of the car equipments.

The officers of the company are: President, A. L. Johnson; secretary, J. K. Page; general manager, J. J. Coleman. Both the president and general manager, though young men, are well known for the active part which they have taken in the development of street railways. Mr. Johnson, though scarcely thirty-two years of age, is interested in a number of similar enterprises in the West, on Long Island and elsewhere; but despite the demands upon his time gives the closest personal attention to his large interests in Lehigh Valley. Mr. Coleman had direct supervision of the construction of the enterprise, and has distinguished himself as an executive officer in the street railway business in more than one city of the West. The company has already expended $3,000,000 on the line and its allied features, and the contemplated extensions will necessitate an investment of a still larger amount.

The Electrical Equipment of the Brussels Tramways Company.

The power station of the Brussels Tramways Company, of Brussels, Belgium, which was put in operation a short time ago on the trolley system, contains five generators, three of which have capacity sufficient for the operation of the line. Two are kept for emergencies. These generators are driven by three engines, each of 225 H. P. Worthington pumps are used. The electrical equipment was supplied and installed by the Union Electricitäts, of Berlin.

The Street Railway Concession in Cairo.

The invitation for bids for an electric railway in Cairo, Egypt, which was published with comments in an article in our February issue, not having given any results, the Minister of Public Works of that city has published a notice that he would receive further bids up to the 1st of July, 1894. The onerous conditions have been somewhat changed, so that now bidders can suggest certain modifications under which they would be willing to take the contract. Each bid is to be accompanied, however, with the amount of 1,000 livres, which is to be retained in the treasury of the Egyptian Government until a decision shall have been taken on the propositions, when deposits will be returned with all rejected bids. The Minister of Public Works reserves the right to reject any and all bids.

The Rapid Transit Question in Newcastle-Upon-Tyne, England.

The city of Newcastle-Upon-Tyne, England, has at present an antiquated horse car system operating thirty-four cars. The city had a population in 1891 of 187,000, but the total length of the street railway system (single track) is only fourteen miles. The passengers carried last year were 3,890, receipts per car mile 12.65 pence, and expenses 11.25 pence. The average speed of the cars, exclusive of waits at termini, is five miles per hour.

The city corporation, deciding to learn what could be substituted to advantage, some time ago requested the city engineer, W. George Laws, to report on the relative advantages of the conduit electric and cable systems. The corporation advisedly excluded the overhead electric system, while the accumulator method has hitherto given such lamentable results that it was thought not worthy of consideration.

In this report, which was presented May 28, 1894, some interesting particulars are given of the Buda-Pesth conduit system, including some observations made by W. N. Colam, the eminent engineer who was recently in that city. Of this system Mr. Laws says: The chief streets of Pesth are extremely wide, sometimes 150 and 200 ft., and this allows of the tram lines being run outside of and parallel with the ordinary traffic, while leaving ample room for carriages and carts alongside the foot walks. In consequence of this peculiarity, the speed of running is much greater than could safely be allowed in our narrow and crowded streets. Labor in Pesth is one-third less than in England, while fuel is one-fifth more.

The chief facts in Buda-Pesth are:

Mileage open (single line)	14 miles
Length of route	7½ "
Miles run, per annum	1,437,000
Passengers carried	11,000,000
Receipts per car mile	11.86d.
Expenses per car mile	6.32d.
The cost per single mile of construction	£12,000
" " " " equipment	£2,750
	£14,750

The service on the electric route is at intervals of one and a fourth minutes, and the average speed is twelve miles per hour, viz.:

9.3 miles in the heart of the city.
11.16 in the residential parts.
15.5 in the suburbs.

The cars are small, to seat twenty passengers only, but with wide platforms, on which many stand. They have no seats on top.

The population of Buda-Pesth is 520,000, but as the tramways are laid only in Pesth, probably 300,000 is a fair estimate of the population served. Buda, on the other side of the Danube, is hilly, while Pesth is perfectly flat. The difficulty of working electric lines on any but very flat gradients has prevented the extension of the system into Buda, and the authorities are now inquiring into the possibility of introducing the cable system there. Commercially, the result in Pesth is that the shareholders have received dividends of 7 per cent. in 1892, and 8 per cent. in 1893; while a tax of 2 per cent. is paid to the authorities for the concession.

On a total capital of £284,000 (which includes, however, some miles of steam lines), the earnings were, in 1892, £63,893, of which, after payment of expenses, about £24,100 was available as profit, and £17,500 was divided among the shareholders.

For 1893 the figures were:

Capital expended	£284,000
Total earnings	81,330
Net earnings	32,452
Divided as profits	26,666

There are some specialities of construction which must be noted as bearing upon the applicability of such a system to English towns, and especially to Newcastle. For these particulars the committee was indebted to W. N. Colam, who visited Buda-Pesth in the course of business, with a view to see the details of the system.

Mr. Colam refers to the similarity of construction between the electric and cable conduit, but with this difference, that while in the cable system the conduit for the rope lies in the center of the way between the rails, in the electric system it is placed under one rail. Mr. Laws says, "At first sight it would appear as if this was a distinct saving in first cost by avoiding the central slot-rail; but the saving is more apparent than real, as the actual cost of the way is about £1,000 per mile more than in the cen- tral slot system. Besides this, however, there are disadvantages as compared with the central slot which are very serious, and more than counterbalance the saving of the central rail.

"The central slot is not subject to the wear and tear from the flanges of the wheels since they do not run in it, and consequently there is no tendency to wear it down or widen it, and it remains permanently at its original width of five-eighths of an inch, and the edges remain unworn. With the conduit under one rail, on the other hand, the slot takes the flanges off the wheel, and the edges are rapidly rounded off and the slot widened.

"The width required to allow the electric "collector" to pass is larger than is needed for the cable "grip." As a matter of fact, in Pesth the slot in no case is less than one and a half inches in width, and this in many cases, especially at curves, has been enlarged by the wear of the wheel flanges to two inches."

Mr. Laws then gave a description of the cable system with cost of installation and probable earnings, and in his comparison of the two systems expressed himself in favor of the cable. He recommended that the city undertake the cost of construction and that the operation be undertaken by lessees.

The Wheel and the Rail.

BY FRED. H. FITCH, C. E., CHICAGO CITY RAILWAY COMPANY.

Questions of great import present themselves in a thorough discussion of the wheel and the rail, and their relation one to the other. For in the almost endless mileage contact of the wheel and the rail, a minute difference per mile in friction, in power used in propelling cars, or in wear of rail and wheel, will materially add to or subtract from the net earnings of the road.

In this discussion we will consider thirty inch wheels and on street railways only, fixed or pressed on an axle, rotating with the axle, the wheels provided, as usual, with a five-eighths inch flange which serves to compel the tread of the wheel to run along the head or ball of the rail. The common form of this wheel is cone shaped, or, in other words, the tread of the wheel which bears upon the rail is beveled usually from one-eighth to three-sixteenths of an inch in its width of about two inches; its diameter next to the flange being one-quarter or three-eighths of an inch greater than the diameter measured on the outer edge of the tread. The common form of the rail head is flat on top, slightly crowning. It follows then that between the new wheel and the new rail there is only a very small contact, as is shown in Fig. 1.

The questions which now arise and which should be solved by every street railway manager are:

What are the salient points of the wheel and the rail to-day?

To what may these faults be assigned?

Can they be remedied?

Why is a wheel made cone shaped?

Why not flat?

Why beveled only about one-eighth of an inch?

Why is the head of the rail flat or nearly so on top?

These questions have long been the study and thought of the steam railway engineers and mechanics, but it is only recently that the importance of investigating and answering these questions has made itself apparent to the street railway manager. Heretofore, the motive power of street railways has been largely confined to animal and cable power, in neither of which the problem of traction appears. The experience of the steam railway engineers, while it will aid our investigation, cannot be taken as a criterion for all conditions affecting street railways. Their curves are gradual, their wheel treads broad, speed greater, and so many other points of difference that it will be better if we strike off alone, as in an unexplored region. Our study, thus freed from any danger of following in old ruts, will be more beneficial, and I trust more fruitful; at least, it will be original.

First, let us consider why the wheel is made cone shaped. Is it thus that it may be drawn from the chills? There is no denying the fact that a cone shape greatly facilitates this operation. Yet if we needed flat car wheels, and no other reason for their cone shape existed, flat wheels could be moulded.

Is it for the purpose of rounding curves? This may have been and probably was a consideration in fixing the shape of wheel treads primarily in steam railroad practice. For where a maximum of 10 deg. curves were in use, and where the centrifugal force of the moving car would cause the wheel on the outside rail to roll on its greatest circumference next to the flange and the inside wheel on its least circumference, it caused the outside wheel, during each revolution of the axle to travel nearly one inch farther than the inside wheel, thereby keeping the car axle radial to the curve at all times, without the slipping or sliding of either wheel. But in street railway practice, where the average curve is of fifty feet radius, it is absurd to assume that the bevel of one-eighth of an inch on a wheel, will accomplish this result; for the outside wheel in rounding an ordinary street corner must travel seven and a half feet farther than the inside wheel, and it would require the impossible amount in practice of one and a half inch bevel in a two inch tread. Without this great and impossible amount of bevel, one wheel or the other, or both, must slip or slide along the rail every time a car rounds a curve. That the wheels do this, we have evidence in the brightness of curve rails.

The bevel of the tread of car wheels does, however, subserve one of the most important requirements in railway practice. Like the crown pulley which centers the belt upon its face and corrects any side movement, or a disposition on the part of the belt to leave the pulley, the bevel of the car wheel centers the car upon the track. This on a loosely gauged track may be noted by an observer standing in the center of the track, and watching the continual movement from side to side of a receding car, the function performed by the bevel on the tread of the wheel being as follows: When one wheel is traveling over a joint, dirt or other obstruction, or when one wheel is minutely smaller in diameter than the other, and lags behind, its direction of travel is changed from a straight line to an outward direction or path until its own largest circumference next to the flange of the wheel is in contact with the ball of the rail, the other wheel meanwhile being directed in a course which brings its smallest circumference into rolling contact with the rail, which serves to accelerate the movement of the adjustment of car on track, wheels on rails, and axle of the wheels at right angles with direction of correct travel. Or the action may be described by saying, the lagging wheel "catches up." This action transmits to a car on loosely gauged track a movement from side to side, which is easily noted. When a wheel becomes flat and loses its ability to perform this important function, it is said to "run sharp." In steam road practice, wheels are declared useless or worn out upon this basis, rather than upon the depth of chill wear. This should also be the basis upon which street car wheels are condemned. As one rides in a car whose wheels are no longer mates, the grinding, grating and sideway jerks can furnish food for the imagination, concerning the great friction and excess in power required to drive such a car over the road, compared to the perfectly self-adjusting car.

Yes, the cone shape of the car wheel has a most important function, and we would at once pronounce it an indispensable adjunct. But are car wheels beveled? When they are new, yes! When the chill is far from being worn out, decidedly no!

Referring again to Fig. 1, and observing that the wear of the wheel will be only at the point of contact, it is plain why the wheels lose their bevel before the chill is worn out, and to corroborate this fact one need only to examine worn out wheels or even wheels that are a long way from being relegated to the scrap pile. But to present

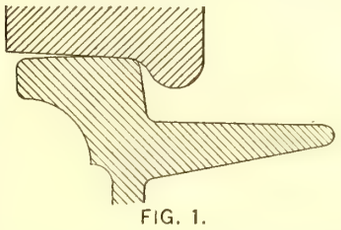


FIG. 1.

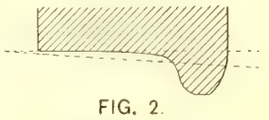


FIG. 2.

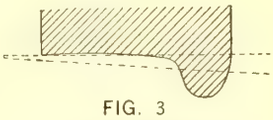


FIG. 3

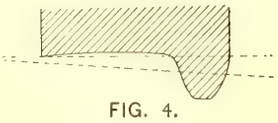


FIG. 4.

the matter in full in this paper, I have taken numerous plaster of Paris casts of old wheels, and several specimens are shown in the accompanying Figs. 2, 3 and 4.

Fig. 5 presents an engraving of two old wheels which were mates, rigidly fixed to the same axle, one having the fillet between the flange and tread almost worn to an angle, the fillet of the other being even gentler than on a new wheel. There is only one explanation which can be offered for this phenomenon, and that is that the first mentioned wheel dragged behind continually, its flange fillet constantly wearing against the corresponding fillet of the rail, which was a sharper one than that of the wheel. Needless tons of coal are thus annually consumed in the additional power required to drag flat or bevelless wheels over a roadway as against perfectly adjusting beveled wheels.

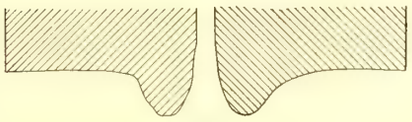


FIG. 5.

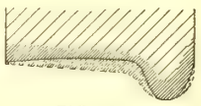


FIG 6.

But this is not the only loss from unequal wear of the wheel tread. Fig. 6 represents a section of the rim of an old car wheel, showing by dotted lines the original line of the tread surface, and also the line of efficient chill. The wheel is thrown into the scrap pile because at one point the chill is worn through, although half of the entire chill still remains. If the tread of this wheel had worn evenly, it would have run twice as many miles before the chill of the entire face would have worn away.

Summing up the foregoing remarks about the wheel, I have endeavored to show that the car wheel is made cone shaped for adjusting the speed differences between two wheels on the same axle; that for this purpose it is absolutely indispensable if the highest efficiency in traction is to be attained; that the wheels lose their cone shape long before being discarded, and that when they are discarded as worn out scarcely one half of their chill is worn away.

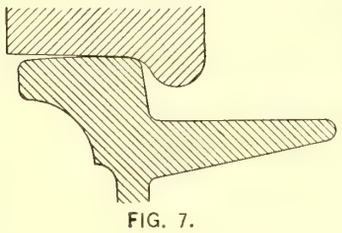


FIG. 7.

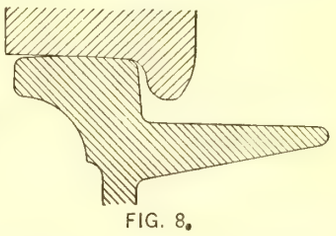


FIG. 8.

Now let us consider the rail; and referring again to Fig. 1, it is evident that as the wheel wears only across a portion of its face, the rail head will wear correspondingly on only a portion of its surface, the tendency of the wheel being to conform itself to the flat surface of the rail, and the tendency of the rail to become beveled as the wheel. Now, if the life of each was the same, the final form would be a bevel on wheel and rail about half the original bevel of the wheel. But the facts are, wheels must be renewed about once a year, while rails, at present, last six or seven years. The result is, there is always a variety of wheels running on the same track, in all stages of wear, some new and beveled, some with a slight bevel, some perfectly flat, and some even hollowed out until the outer circumference of the wheel is greater than the circumference next the flange.

Figs. 7, 8 and 9 represent a new rail and a new, one-half worn and old wheel, respectively. Figs. 10, 11 and 12 represent an old rail, and a new, one-half worn and old wheel, respectively. Here we see three distinct lines of contact for every stage of rail wear. The variety which could be derived from this basis would be endless.

Again, as the wear of the rail is mostly confined to the inner edge, it will be scarcely half worn out when the flange of the wheel will be rolling upon and digging into the flange of the rail, as is illustrated in

Fig. 12. The dire result of this cannot be better conceived than by reference to some dynamometer tests in which I found that 52 per cent. more power was required to draw a car over worn out rails, where, over long stretches, the wheel flange rolled along the rail flange, than to draw the same car over new rails, all other affecting conditions being equal. It cannot be said that flat car wheels were a factor in this case, since the same car wheels were used on both old and new rails. What would have been the result had new beveled wheels been matched against old flat wheels on old rails I cannot say, but leave to the conjecture of the interested reader.

The solution of the problem now presented is as simple as it is effective. *Make the ball of the rail beveled to conform to the bevel on the car wheel.*

This style of a rail is illustrated in Fig. 13. Besides dissolving to a most satisfactory degree every objection to the present form, it has other numerous and valuable recommendations of which I will speak later.

First of all, will a beveled wheel and a beveled rail perform the same important function of adjustment as the beveled wheel on a flat

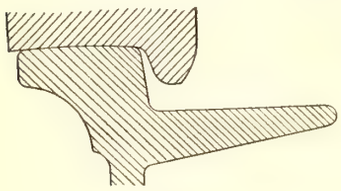


FIG. 9.

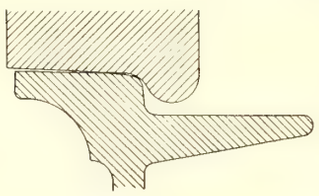


FIG. 10

rail? Referring to Fig. 14, the full line represents the position of the wheel on the rail at the time of its extreme motion to the left; the dotted lines at the time of its extreme motion to the right. It is plain that without a small difference in the gauge of track and wheels, no adjustment could take place on any rail. We will assume that this difference, or play, is one-fourth of an inch. Now the bevel of the rail in Fig. 14 should be as little as may be necessary to adjust the car on the track, because if too great the axle of the two wheels constantly rising and falling at the alternate ends as the points a and b move back and forth from and to the points a^1 and b^1, will cause the wheel to bear alternately at the points a^1 and b. If $a^1b = 2$ ins. $aa^1 = \frac{1}{4}$ in., and the bevel of $a^1b = \frac{1}{8}$ in., when the wheel is theoretically bearing only at the point a^1, the point of the wheel at b will be lifted $\frac{1}{2000}$ in. above the ball of the rail, which in practice is absurd to con-

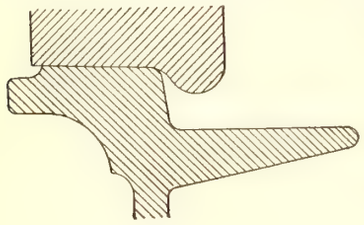


FIG. 13.

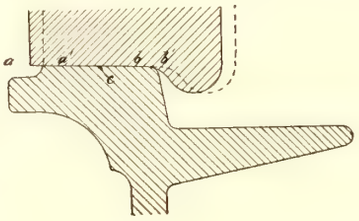


FIG. 14.

template. Therefore we may say the wheel tread has a perfect contact on the rail head at all times. Then the distance traveled by the car, or axle center, in one revolution of the wheel, equals the circumference of the wheel which is at the point, c, the center point of the rail head, which point is also the point of no friction between wheel tread and rail. As the wheel moves from a to a^1, the diameter of the wheel at the point c becomes less by $\frac{1}{32}$ in., which is twice the amount of bevel in $\frac{1}{4}$ in. The difference in circumference caused by an increase of $\frac{1}{32}$ in. in diameter is then the maximum difference in travel of the two wheels on the same axle in adjusting themselves..

The next point to consider is that of the grinding on either side of the point, c; on the right, or inside, an accelerating and on the left a retarding motion. It is admitted that additional power will be required to overcome this friction. Let us ascertain, as well as theory can, how much additional power will be required. We can afford to pay something for the numerous advantages to be derived from a beveled rail, which I will sum up hereafter.

Referring to Figs. 14 and 15, the diameter of the wheel at the point, c, will represent the diameter of travel of the wheel. That is, the forward movement of the car in one revolution of the axle, will be equal to the circumference of the wheel at the point, c. Now, if the point, b, was free to move separately from the point, c, at the end of one revolution it would come to the rail at the point, f, the distance, fg, ahead of the point, c. Likewise the point, a, would come to the rail at the point, e, the distance, de, behind the point, c. But being rigid they remain in the line, dcg, and, therefore, in each revolution of the axle there is a grinding or sliding about the point, c, which is represented by the triangles, dec and fgc. The forward motion of the car may be disregarded in this calculation, and the problem solved as if the wheel and axle were still but a force applied at the center of the axle, where the power is applied, to overcome a continual tendency to pull the center of the axle backward. The forces thus working are a series of parallel forces represented by the parallel lines in the triangles, fgc and dec. The comparative magnitudes of these forces are as the lengths of these parallel lines. The resultant of all of them will be a force at the center of gravity of the triangles, which is two-thirds of the altitude of the triangle measured from the apex, c, and equal to the sum of all of them. This sum of all the forces is the force necessary to overcome the friction between the wheel and the rail, which is the weight on the wheel multiplied by the co-efficient of friction, which we will take as .2. That is, to slide a wheel over a rail requires a force equal to .2 of the total weight upon the wheel. If the car weighs 8,000 lbs., the weight on one wheel is 2,000 lbs., .2 of which are 400 lbs., the constant direct force necessary to slide the wheel over the rail.

It is not essential to take into consideration the area of friction, for when the area of contact is greater, the weight per square inch of contact is less. Within reasonable limits friction is independent of the area and the velocity. Therefore, it matters not whether the line, fg, is three-eighths of an inch or three-quarters of an inch long, or in other words whether the bevel of the rail is one-eighth of an inch or a quarter of an inch, for it is just a question of velocity. The points along the outer and inner circumferences of the wheel have a little farther to slide in the same time, if the bevel is greater; so they slide faster, but the force required is the same whether they slide fast or slowly. We have now found that the force of friction is equal to a direct force of 400 lbs. But the force to overcome this force of friction acts at the center of the car axle and about the fulcrum at the point, c, the power arm being half the track gauge, 2 ft. 4¼ ins. + 1 ins., the distance from, c,

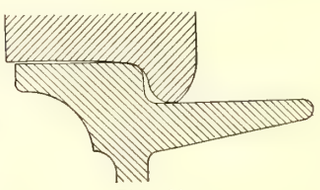


FIG. 11.

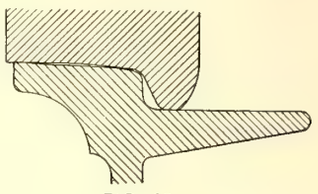


FIG. 12.

the fulcrum, to the gauge line. We have already seen that the force or weight arm was two-thirds of the altitude of the triangle which is one inch. Hence we have the proportion:

W : P :: P. arm : W. arm.
400 : x :: 29¼ : ⅔ "
x = 9.11 lbs.

This constant force multiplied by the distance through which it works in one minute, which is 880 ft., for a speed of ten miles an hour, divided by 33,000 equals the horse power caused by the grinding friction.

The result is .25 H. P. This is for each wheel. For four wheels there will be required 1 H. P. A morning car now requires about 12 H. P., so that we pay for any advantages derived from the beveled rail, 8 per cent in power.

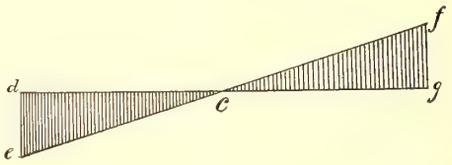


FIG. 15.

What are these advantages?

Can we afford to pay for them the price required?

First, and above all, if wheels are very carefully mated, and such unequal wear factors as sand boxes on one side only, and side pulling valve beams, are eliminated, there will never be any such thing as wheels running sharp. A wheel will have the same bevel the day it is thrown into the scrap pile as the day it was pressed upon the axle. It will be worn out solely because the efficient chill is worn through, rendering the wheel liable to break, and the tread liable to wear flat in skidding. The maximum efficiency can be gotten from the wheels. Thus, a great saving is to be had in wheels. But the greatest saving will be in the fact that the wheel will be perfectly self-adjusting until the day it is discarded. How can we compute the great saving hereby effected? But we know it must be enormous. An illustration of a wheel running sharp, which will be an aid for conception, is given by a vehicle in the track trying to turn out, one wheel behind the other, and the tire grinding against the ball of the rail. A wheel running sharp is constantly tending to turn the car from the track, and the wheel flange is ever grinding against the ball of the rail.

Another advantage is to be found in the wear of the rail. The wheel having at first only a small contact with the rail, wears it more rapidly. I will speak of the rail as wearing, although, in fact, it is mostly a process of cold rolling which it undergoes. Two days' time is sufficient to note a change in the rail section. Each succeeding day the rail wears less, as the contact becomes greater. But before the contact becomes full, and the wear at a minimum, the wheel flange touches and rolls along on the rail flange, and the dynamometer tests before mentioned have told the story of such a condition.

The city ordinances generally limit the height of the ball above the flange of the rail. In the beveled rail more metal can be put into the wearing surface of the rail, and the city ordinances still be complied with. The minimum rail wear, the result of full contact, will commence in the beginning with the beveled rail. I venture to say that the life of rails would be doubled if made with the ball of the rail beveled.

Again all wheels, whether new or old, will have the same line contact with the rail whether it be new or in its tenth year. There will be no variety, as shown in Figs. 7, 8, 9, 10, 11 and 12.

The most sensible argument, and most convincing, still remains: If a river will flow through a certain channel in spite of everything,

why expend energy in trying to divert it? Adopt the natural channel, and expend your energy in perfecting that one. A successful undertaking in the realm of the material or immaterial must not combat nature. So in mechanical details, we must, to form a perfect device, adopt in the beginning the form to which nature will eventually lead us. The final form of rails is a bevel. Why not adopt it to begin with?

Numerous incidental advantages appear of which I will speak very briefly, the chief of which, to my mind, is the rail joint. All street railways hope and look for the day when electrical welding will have reached its perfect stage and solved completely the joint problem. It has been found that no matter how firm the under bearing of the rails, that nevertheless at the joint there will be a pounding, small at first, but increasing much more rapidly as the hole formed in the rail head becomes deeper, A small cut one-eighth of an inch deep made in the center of a rail by a hack saw will make a pounding place in the rail.

What then is the remedy? Rails have been laid with mitre joints, as shown in Fig. 16, and have failed because the rail was flat. The wheel, having a bearing on only a portion of the rail next the inner edge, made it practically no better than a right angle cut. Now if the wheel had a full contact on the rail it is evident that no pounding could occur where this mitre joint was in use.

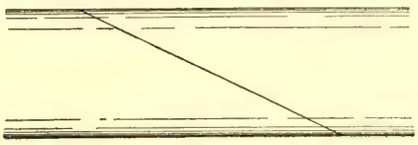


FIG. 16.

Fig. 17 shows a portion of a tongue switch. An examination of any such switch, where there is an offset in the rail for the switch tongue, will show that there is a little pocket between the points, *a* and *b*, caused by the wheel falling from a greater to a less diameter of its cone. If the rail which was cut out for the tongue had been beveled, no pocket would have formed.

Other recommending features for electric railroads are:

A path offering less resistance for the return circuit is presented in the increased contact.

Greater contact between wheels and rails will allow greater grades to be climbed, and on many roads allow of single motor equipment.

The rails will keep clean on account of their bevel.

New brake shoes will have a better bearing on old wheels.

Cars may be stopped quicker on account of more frictional area between track and wheels, and some accidents may thus be avoided.

I offer these gleanings of my study of the rail and the wheel, which I have found a most interesting study, more with a view to place the subject, as far as I have gone, before those who will take an interest in it, rather than as conclusive facts. Perhaps there are unforeseen difficulties and factors which I have entirely neglected. I believe in a beveled rail, but am not so far wrapped up in it that I am blind to

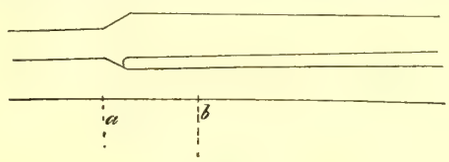


FIG. 17.

reason, and even though my ideas and hopes for a better rail were shattered by one lurking and neglected factor, I would feel that my study had not been in vain.

Annual Meeting of the American Society of Mechanical Engineers.

The annual summer convention of the American Society of Mechanical Engineers was held at Montreal, June 4-8. The professional sessions were held in the Engineering Building of the McGill University, while the headquarters of the society were at the Windsor Hotel. The meeting was in every way successful, and the excursions included a visit to the power station of the Montreal Street Railway Company, a trip to Ottawa, where the plant of the Ottawa Electric Street Railway Company was inspected, etc.

We print below abstracts of several of the papers presented:

Mechanical Draft.

By William R. Roney, Boston, Mass.

The importance of good draft, natural or artificial, for supplying sufficient oxygen for the economical combustion of fuel, has long been recognized by intelligent engineers. The gain, both in efficiency and capacity, obtained by the rapid and energetic combustion of the various kinds of coal, and the resulting high furnace temperatures, is well established. Its importance has, however, been generally conceded only within a few years. The wonderful stimulus which the development of electrical industries has given to the building of compound engines has necessitated higher boiler pressures, and this in turn has greatly increased the use of boilers of the water tube type. While high initial temperature in the furnace is essential to the best economy with all types of boilers, it is especially so with water tube boilers, with their large amount of heat absorbing surface in close contact with the products of combustion; as otherwise, the temperature of the gases will be lowered below the point of ignition and will pass to the chimney only partially consumed. To obtain this high furnace temperature requires draft sufficiently strong to deliver an abundant supply of oxygen to the furnace.

There are two well known means used for accomplishing this result, viz., natural draft, produced by a column of heated gases in a chimney of suitable proportions; and forced draft, obtained by mechanically creating a pressure under the grates with a blower or fan.

A third means, less widely known, is mechanical exhaust or induced draft, produced by a suction fan so arranged as to draw the waste gases from the furnace and discharge them into a short stack sufficiently high to clear the surrounding buildings.

The largest and most successful applications of mechanically induced draft have been made in connection with feedwater heaters designed to utilize the waste heat of the flue gases, and known as fuel economizers. This form of feedwater heaters has been manufactured in England for over fifty years, and in this country for three or four years. They have, however, been imported for many years, as their value as a fuel saving device is well established. Their successful operation is, however, so dependent upon a good draft, that no well informed engineer would think of installing an economizer without making provision for much better draft than the boilers would require without it.

On account of the reducing effect on the draft caused by lowering the temperature of the gases and retarding their flow by the mechanical interference of the pipes, it cannot be considered good engineering to attach an economizer to a chimney less than 200 ft. in height. In fact, the best working economizers in connection with chimneys are those where the chimney is considerably over 200 ft. high.

The objections to be urged against high chimneys, as compared with mechanical exhaust draft when used with economizers, are: First, excessive cost, both on account of the height required and on account of foundations, which must of necessity be very substantial, and which may involve expensive piling and filling. Second, the space required for foundations, which may be very valuable, especially in large cities, or may be required for other purposes, and which can with difficulty be spared. A chimney 250 ft. high will require foundations not less than thirty feet square, and in some cases much more. Third, a certain minimum temperature of flue gases is required to produce an effective draft and to operate the boilers economically, and this fact limits the amount of economizer heating surface which can be used, and consequently the fuel saving obtained by use of the economizer. The same fact operates unfavorably at small capacities, which are often unavoidable, when the chimney must be built large enough for future increase of the boiler plant. Fourth, a chimney once built limits the maximum capacity of the boiler plant, and also is liable to be affected by atmospheric changes which may seriously impair its efficiency.

These objections to the tall chimneys which are so essential to the use of economizers, do not hold with mechanical draft.

The first cost of a properly designed mechanical draft plant is very much less than that of a suitable chimney of equal capacity, often averaging 75 to 80 per cent. less, according to the size of chimney and character of foundations required. The fans and short stack require very little foundations, even less than that of an ordinary boiler setting. The space usually required for extensive chimney foundations can be utilized for economizers, and by elevating the economizers and fans upon beams and columns, the space underneath them can be used for pumps, condensers, etc.

Natural draft requires that the gases in the chimney be above a certain minimum temperature in order to secure a proper supply of oxygen in the furnace and a good combustion of the fuel, whereas with mechanical exhaust draft the amount of draft obtainable is entirely independent of the temperature of the flue gases, and when used in combination with a properly proportioned economizer, it is possible to lower their temperature to a point where the draft of even a very tall chimney would be practically destroyed.

Mechanical draft possesses great advantages over natural draft in its flexibility and adaptability to both large and small capacities, and in its ability to meet sudden and excessive demands for steam, either by an extra turn of the throttle valve, or by an automatic regulator controlling the steam supply to the fan engine according to the boiler pressure. It is unaffected by atmospheric changes, furnishing the desired amount of draft irrespective of conditions of wind or weather. Operating independently of the amount of heat in the stack, it is possible to obtain a higher temperature of feedwater in the economizer, and a lower temperature of escaping gases than could possibly be obtained with a chimney, and at the same time provide sufficient draft to maintain rapid and economical combustion of the fuel. There are undoubtedly many boiler plants equipped with economizers and chimneys, where the draft is so greatly reduced by the economizer, that it is an open question whether the saving in fuel by thus heating the feedwater is not more than balanced by the loss due to imperfect combustion in the furnace, and whether it would not result in a greater saving in coal to cut out the economizer and get better combustion, and a higher initial temperature due to better draft.

A mechanical draft plant properly designed, with duplicate fans and engines of suitable construction, so arranged that one is always in relay, can be made so reliable that the boilers cannot be shut down by any ordinary accident. With the fans properly designed and proportioned to the work, the power required to operate them is so small as to practically have no effect on the economy obtained. The mistaken idea that prevails somewhat, even among intelligent engineers, regarding the amount of power required for mechanical exhaust draft, is probably caused by the well known large amount of power required to drive the high speed pressure blowers and fans used for forced draft. Mechanical draft handles a large amount of heated gases with slow speed exhaust fans at a low pressure, and with a small expenditure of

power. To illustrate: The writer recently designed a mechanical draft and economizer plant for 6,000 H. P. of water tube boilers, providing duplicate, large, slow running fans of special design, each driven by an independent engine, and each having a capacity, estimated in pounds of coal burned per hour, sufficient to develop 25 per cent. in excess of rating, or 7,500 H. P. The power required to drive one fan to do this work was .6 of 1 per cent. of the boiler horse power developed. Or, estimated in coal per horse power per hour, and at $3 per ton, the fuel cost of operating the plant one year was 2 per cent. of the estimated cost of the chimney originally planned for the plant. In other words, it would not pay to build the chimney so long as money was worth more than 2 per cent. per annum.

In a typical boiler house, the economizer is elevated upon columns and beams to provide for utilizing the space under the economizer for feed pumps, condenser, etc. The exhaust fans, of which there are two placed side by side, are equipped with direct connected engines, only one engine showing in the illustration, the other being on the farther side. These fans and engines are of special design, with protected bearings, self-oiling and water jacketed, to withstand the heat when the economizer is cut out for cleaning or for repairs, and the hot gases pass directly to the fans. They are so proportioned to their work as to handle a maximum amount of gases with a minimum expenditure of power.

The arrangement of the economizer pipes and blow-off connections are worth noticing, in that they provide a means of blowing out the sediment which may accumulate in the pipes, and at the same time a complete circulation is maintained in the economizer. Many extensive plants are now in operation, or in process of construction in various parts of the country, equipped with economizers and mechanical draft similarly arranged.

Probably the largest plant of the kind yet built is that of the Philadelphia Traction Company, Philadelphia, Pa. Two large power houses are in process of erection and partly in operation for this company, one of 7,500 H. P. and one of 6,000 H. P. At the 13th and Mt. Vernon Streets Power House,* there are twenty Babcock & Wilcox boilers of 375 H. P. each, arranged in two parallel rows of ten boilers on opposite sides of the boiler room. The other station of 6,000 H. P. is arranged similarly, except as to the number of boilers. The gases from each row of boilers are conveyed by flues at the back to the center of the boiler house, drawn through the economizers and discharged into stacks by four large, slow running exhaust fans of special design. These fans are arranged in pairs, and are of such a capacity that two of them will handle the gases for the entire plant, thus leaving two in reserve. The fans are driven by duplicate engines and countershafts, so arranged that either engine will drive any one or more fans, as desired. The stacks extend but a few feet above the roof, and are lined with brick to preserve them from the corroding action of the gases. The feedwater is pumped through exhaust steam heaters to the economizers, and thence to the boilers. At the 33d and Market Streets station of the same company, the fans are driven by engines belted directly, one small engine to each fan. The economizers occupy the space originally planned for two tall chimneys, one for each side of the boiler house. These chimneys were to have been 200 ft. high, with a flue eleven feet in diameter. Two of the fans are capable of producing a draft equal to that of the two brick chimneys originally planned. The power required to drive one of these fans, as the plant is now being operated, is exceedingly small, being less than ten horse power for each 2,000 H. P. produced, or less than one-half of 1 per cent. of the power developed by the boilers.

The following data will be of interest, as showing in tabulated form the results obtained by economizers and mechanical draft in a number of plants in regular service. In every case the feedwater was partially heated by exhaust steam heaters, or in hot wells by condensed steam from various sources.

TESTS OF ECONOMIZER AND MECHANICAL DRAFT PLANTS, SHOWING INITIAL AND FINAL TEMPERATURES OF FLUE GASES AND FEED WATER IN DEGREES FAHRENHEIT.

Plants tested.	Gases entering economizer.	Gases leaving economizer.	Water entering economizer.	Water leaving economizer.	Gain in temp. of water.	Fuel saving, per cent.
1	610	340	110	287	177	16.7
2	505	212	84	276	192	17.1
3	550	205	185	305	120	11.7
4	522	320	155	300	145	13.8
5	505	320	190	300	110	10.7
6	465	250	180	295	115	11.2
7	490	290	165	280	115	11.0
8	495	190	155	320	165	15.5
9	595	299	130	311	181	16.8

Tests of Small Electric Railway Plant.—

By Jesse M. Smith, Detroit, Mich.

This paper gives the results of a test made in October, 1893, on the power plant of the Wyandotte & Detroit River Railroad, which is a suburban road running from Detroit to Trenton, Mich., 10.5 miles long.

The plant contains two tandem compound, condensing engines rated at 150 H. P. each, and guaranteed for a maximum load of 225 H. P., made by the Phoenix Iron Works Company, Meadville, Pa. Each engine is belted direct to a Westinghouse railway generator of 150 E. H. P. The vacuum is obtained by a Conover air pump and condenser belted directly to the engine shaft. The boiler feed pump is driven from the air pump shaft. Steam is supplied by two Manning vertical boilers. One engine and dynamo only were used during the test. It will be noted at the outset that each engine and dynamo is designed to deliver on average of 150 H. P., but that during the test the average load on the engine was only 70 I. H. P., and the maximum 141 I. H. P. The best conditions of economy were therefore not realized. The test was made under commercial conditions for the owners of the plant. All the machinery had been run about three months and no adjustments by the makers had been made since it was first put in. No special care had been taken to get very close regulation either of the engine or generator. One boiler was fired with coal, and used exclusively to supply steam for the fuel atomizer of the other boiler, "straight crude oil" was used exclusively as fuel for the boiler, which supplied steam to the engine, and no steam was used from that boiler for other purposes. Indicator cards were taken at intervals of five minutes during the seventeen and one-third hours of the test. A Tabor indicator was applied directly to each end of each cylinder, and all operated by the same mechanism. Indicator cards were taken simultaneously from the four indicators by two persons on a signal given at the proper time, without regard to the load on the engine. The speed of the engine was determined by a continuous revolution counter which was directly connected to the shaft of the engine. The variation of speed was shown by a tachometer belted directly to the engine shaft, and constantly in service. It was carefully compared with the revolution counter when on constant speed, and was made to agree with the counter. The speed of the dynamo was taken at four different times by a revolution counter held in the end of the shaft for five consecutive minutes each time. Three readings gave 604 revolutions, and one reading gave 603 revolutions per minute. The speed of the air pump was taken in the same way.

The steam gauges on the boilers were connected to the boiler near the bottom, so that they show the pressure due to a head of water of about ten feet in addition to the steam pressure. The boiler gauges therefore show about five pounds more pressure than the pressure of the steam in the boiler. The standard gauge, when placed on the steam pipe of the engine just above the throttle valve, showed about five pounds less pressure than the boiler gauge, so that there was practically no loss of steam pressure between the boiler and engine.

The amperes were measured by a Weston standard ammeter connected in series with the station ammeter. The volts were measured by a Weston standard voltmeter connected to the bus bars of the switchboard. Volt and ampere readings were taken every ten seconds by a different person at each instrument, the time being given by a third person.

The water used by the boilers was taken from the overflow of the air pump, and weighed in two barrels on two scales, and was pumped from the barrels by the regular feed pump worked from the shaft of the air pump. The feedwater passed through a closed heater with brass tubes, the heater being connected with the exhaust pipe between the engine and condenser. The fuel oil was stored and fed by the Snell water pressure system. The amount of fuel oil fed to the atomizer was measured by measuring the number of gallons of water which flowed into the storage tank.

The dimensions of the plant and data, and the results are given in the following tables:

DESCRIPTION OF PLANT.

Boilers.—Kind, Manning vertical tubular; number, 2; size, known as 61 in.; rated capacity, 150 H. P.; inside diameter of firebox, 6 ft.; height above grate, 3 ft. 6 ins.; number of tubes, 184; outside diameter of tubes, 2½ ins.; total length of tubes, 14 ft. 10 ins.; length of tubes below water line, 10 ft. 7 ins.; heating surface in firebox, 89.2 sq. ft.; heating surface in tubes below water line, 1,272.7 sq. ft.; heating surface in tubes above water line, 511.1 sq. ft.

Engine.—Kind, Phœnix Iron Works Company tandem compound, condensing; diameter of high pressure cylinder, $11\frac{1}{16}$ ins.; diameter of low pressure cylinder, $20\frac{1}{2}$ ins.; stroke of piston, 15 ins.; piston valves on both cylinders, both controlled by shaft governors; number of flywheels, 2; diameter of flywheels, $78\frac{3}{8}$ ins.; face of flywheels, $16\frac{5}{8}$ ins.; weight of rim of each flywheel, 2,445 lbs.

Air Pump.—Kind, Conover, belted to engine; size, No. 7; diameter of piston, 15 ins.; stroke of piston, 7 ins.; revolutions per minute, 67.

Boiler Feed Pump.—Kind, single acting plunger driven from shaft of air pump; diameter of plunger, 3 ins.; stroke, 6 ins.

Dynamo.—Kind, Westinghouse four pole railway generator; rated capacity, 150 E. H. P.; standard speed, 625 revolutions per minute; speed when tested, 604 revolutions per minute.

Cars.—Maker, Jones, length, 16 ft.; weight, 14,500 lbs.; number of seats, 22; kind of motors, Westinghouse; number of motors, 2; rated power of each motor, 30 E. H. P.; number of cars in use, 3.

Road.—Length, 10.5 miles; kind of rail, T; weight of rail per yard, 52 and 56 lbs.; supported on cross ties; ties covered with sand, and resting on sand, except from Wyandotte to Trenton, which is stone ballasted.

SPEED OF ENGINE AS CONTROLLED BY GOVERNOR.

Revolutions per minute by *revolution counter*, average for eight minutes with dynamo belt off.....	238 revolutions.
Average revolutions per minute on regular work during 362 minutes.....	234.3 "
Percentage of variation of revolutions.....	1.58
Minimum revolutions per minute, dynamo producing 180 amperes, engine developing 165 I. H. P.....	227 revolutions.

*Fully described and illustrated in the Street Railway Journal for January, 1894.

DISTRIBUTION OF POWER USED.

Power consumed by friction of engine, air pump, and boiler feed pump, with main belt off	9.22 I. H. P.
Friction of engine, air and feed pumps, and dynamo, with brushes off	11.34 I. H. P.
Friction of dynamo and belt	2.12 I. H. P.
Power consumed by engine, air and feed pumps and dynamo, with brushes on and main circuit open	14.34 I. H. P.
Power required to charge fields of dynamo	3.00 I. H. P.
Percentage of engine capacity required by friction of engine, air, and feed pumps	6.15
Maximum power developed by engine as shown by indicator cards, during economy test	141.4 I. H.P.
Minimum power developed by engine, as shown by indicator cards, during economy test	21.27 I. H. P.
Average power developed by engine, as shown by 208 sets of indicator cards, during economy test	70.1 I. H. P.
Average electrical horse power delivered by dynamo.	45 E. H. P.
Average indicated horse power delivered to pulley of dynamo, estimating friction of armature shaft, to be the same as friction of belt	59.81. H. P.
Average number of cars in use during test	2.89 cars
Number of passengers on cars during 17½ hours	1,014
Average number of passengers on cars per single trip.	15.2
Average number of passengers on cars at any one time (estimated)	8
Weight of ten persons at 140 lbs. each	1,400 lbs.
Weight of cars	14,500 lbs.
Total weight of cars and persons	15,900 lbs.
Average weight in motion	44,950 lbs.
Average electrical horse power per 1,000 lbs. of weight moved	0.98 E. H.P.
Average horse power developed by engine per 1,000 lbs. of weight moved	1.52 I. H. P.
Average electrical horse power per car	15.54 E. H. P.
Average horse power developed in engine per car	24.25 I. H. P.
Average watts delivered by dynamo per horse power developed in engine	478.8 watts.
Average watts delivered by dynamo per horse power delivered to belt of dynamo	557.3 watts.
Average speed of cars per hour, including all stops, twenty-one miles in 1.5 hours	14 miles per hour.
Average speed of cars between stops	15.38 miles per hour.
Total car hours	50.25
Time of test	17.33 hours.

ECONOMY TEST.

Duration of test	17⅓ hours.
Average horse power developed in engine as shown by 208 sets of indicator cards taken at five minute intervals	70.1 I. H. P.
Average horse power delivered by dynamo as shown by 6,209 sets of readings taken at ten second intervals	45. E. H. P.
Net average steam pressure in boiler by half hour readings	111.8 lbs.
Average vacuum by half hour readings	25.2 ins.
Steam used by engine per hour	1,721.1 lbs.
Steam used by engine per horse power per hour	24.55 "
Steam used by fuel oil jet per hour	291.5 "
Steam used by engine and fuel oil jet per hour	2,008.8 "
Percentage of steam used by fuel oil jet	14.5
Fuel oil used per hour for engine 20.25 gals.	133 "
Fuel oil used per horse power per hour for engine, .29 gal.	1.9 "
Additional fuel oil which would be required to maintain oil jet for one hour 3.43 gals.	22.58 "
Average temperature of water flowing from air pump	91.8° Fah.
Average temperature of feedwater entering boiler	126.6° "
Rise of temperature of feedwater due to heater	34.8° "
Percentage of fuel saved by heater	3.06%
Fuel oil required to evaporate 1,000 lbs. of water from 126.6° Fah., into steam at 112 lbs. pressure	11.79 gals.
Water evaporated from 126.6° Fah. into steam at 112 lbs. pressure per gallon of fuel oil	84.81 gals.
Ditto per pound of oil	12.9 lbs.
Area of steam outlet of atomizer. Which is same as a round hole .3 in. diameter.	.07 sq. in.

It will be noted that 14.5 per cent. of the total steam generated was used by the fuel oil atomizer. The atomizer was not properly proportioned for the work, and did not receive enough air. The flame was red and evidently not economical. The atomizer and furnace have since been arranged with much better results.

In this engine the piston valves which distribute the steam to both high and low pressure cylinders are controlled by the governor.

It will be noted that while this is a condensing engine the high pressure cylinder does a good share of the work even on the lightest loads, and the receiver pressure does not vary greatly either during a single revolution, or during a change of load of from 21 to 101.8 H. P. While the load changes 488 per cent., the average receiver pressure only changes 167 per cent., and even when the engine ran with the belt off and developed 9.2 H. P., there was no negative work in either end of either cylinder. These results, which I believe to be highly important, both for economy and close regulation, are due to the valves of both cylinders being controlled by the governor.

The results of a study of the indicator diagrams are given in the following table:

	Set No. 1.	Set No. 2.	Set No. 3.
I. H. P. in H. P. cylinder.			
Crank end	2.4	13.8	25.3
Head end	2.5	14.8	26.1
I. H. P. in L. P. cylinder.			
Crank end	8.3	16.6	25.2
Head end	7.8	17.6	25.2
Total I. H. P.	21.0	62.8	101.8
Maximum pressure in receiver	5.9	9.0	11.0
Minimum " " "	4.0	6.4	7.5
Average " "	4.9	7.2	8.2

The variations in load in a plant of this kind are not only extreme, but rapid, and were from 5 to 134 amperes. In one interval of ten seconds the load increased 115 amperes, which equals 120 I. H. P.

During the regular operation of the plant and with these extreme variations in load, the needle of the tachometer never left the space enclosed by the 230 and 240 revolution marks.

Power Losses in the Transmission Machinery of Central Stations.

By Wm. S. Aldrich.

This paper presents some memoranda on the subject of power losses in the transmission machinery of central stations, which had come within the author's experience, and some of which were incompletely referred to in the discussion of the paper on the "Performance of Street Railway Power Plants," presented at Chicago meeting (July, 1893), by Messrs. Wm. A. Pike and T. W. Hugo.*

DISCUSSION OF PAPER.

Test No. 2 in paper of Messrs. Pike and Hugo showing the combined horse powers from cards taken every ten minutes, cannot possibly show the real variations of power in an electric railway plant. The frictional losses in the transmission machinery are best determined by special tests, before or after the regular run, having this one object in view.

In a joint test of an electric railroad, made in 1891, by Mr. Hermann S Hering and the author, they found that it was impossible to arrive at any satisfactory conclusion as to what became of the motive power generated to drive the dynamos, when throwing the load on and off again as quickly as it is done in an electric railroad. At times there would be as much as 40 H. P. unaccounted for; that is, for a few seconds the dynamo output would fall more than 80 H. P. below the then delivered turbine horse power; while, at other times, the horse power delivered by the turbines and the dynamos would be equal. Under light load conditions, which remained steady for about two minutes at one portion of the run, the actual difference between the turbine horse power and dynamo horse power, delivered, was 43 8. All at once, while the turbines were decreasing their output, there would be 50 or 60 H. P. thrown off or on the dynamos, and the turbine gates would keep on closing. At other times the same thing would happen while the turbines were increasing their output, and the turbine gates would keep on opening, causing the difference of power between that delivered by the turbines and that delivered by the dynamos to the line to run enormously high; the maximum difference so observed was 140 H. P., or almost 100 H. P. in excess of that lost in the transmission machinery and dynamo.

Between these extremes one can readily see that the transmission machinery acts in the way of a flywheel, storing up the excess of energy on the one hand, and giving out part of its stored energy during a deficiency on the other hand. These great differences of power exist only for a few seconds.

In our report on this test, we stated that steam engines would not be at all likely to show the same results of great excesses and deficiencies of output, while the dynamo load continued to vary in its characteristic fashion for street railway purposes. We are greatly surprised therefore, to find that the tests of Messrs. Pike and Hugo, on the Corliss engines of the Minneapolis & St. Paul electric railway plants, do show up much the same as in our turbine tests referred to. They even note that, when lightly loaded, the difference between the engine and dynamo output is *minus*, showing that the dynamos are delivering more power than the engine, similar to the case we have cited for the turbine plant. While they believe this peculiarity to be due to imperfect (better, *tardy* regulation) we think it is due almost entirely to the flywheel action of the transmission machinery.

The high speed, automatic engine, directly connected (or better, directly coupled), is, in my opinion, best adapted to meet the sudden and very great variations in electric power plants, while the well known type of Corliss engine seems best adapted to steady loads.

The following table, No. 1, contains a brief presentation of the principal figures in this connection, from the paper under discussion.

*Published in the August, 1893, issue of the STREET RAILWAY JOURNAL.

TABLE I.

No. of Test.	Kind of Engine.	How connected to Dynamo.	Ind. H. P. delivered by engine.	Elec. H. P. delivered by dynamos.	Eng. Friction H. P. by Friction Run.	Per cent. Eng. Friction.	Total Friction H. P.= I. H. P.—Elec. H. P.	Per cent. Total Friction H. P.
1	Tri-cylinder Cond. Corliss.	By Countershaft	1,237.90	1,088.0			149.90	12.10
2	Tri-cylinder Cond. Corliss.	By Countershaft carrying Friction Clutches.	756.20	624.7			131.50	17.40
2d	Same.	Same.	859.73				164.43	19.12
3b	Westinghouse Compounds.	Belted direct to Dynamo.	522.50	434.2	14.27	3.7	88.30	16.90

THE POWER LOSSES IN A TURBINE PLANT FOR AN ELECTRIC RAILWAY.

The following particulars of the performance of the turbine power plant of the Neversink Mt. Electric Railway, Reading, Pa., have been taken from the author's reprint of the published report of the test, as it appeared in the *Electrical World*, May 28 to July 30, 1892.

Each vertical shaft of the Hercules, of which there are two, transmits its power through a mortise crown and jack gear to the horizontal shaft carrying the main driving pulley. The power is thence transmitted to a countershaft, from which each dynamo is belted by means of a friction clutch pulley.

In the test of the turbine plant under a light load, observations were made to determine the distribution of power, and the several losses from the hydraulic head of the water to the available power at the car axle, during the run of a single car over the road. Table II. contains a summary of the power distribution.

The performance of the turbine plant under a heavy load, is shown in table III., which gives a summary of the power distribution.

TABLE II.

With car, on the two principal grades, 3.61% and 3.91%, no other car being on the road at that time.

Grade on which reading was taken	3.61%.		3.94%.	
Time and time interval on grade	11-37-30	11-31-45 to 11-39-30	12-8-0	12 6-0 to 12-16-0
Conditions.	Steady.	Mean.	Steady.	Mean.
Power Delivered.				
Hydraulic H. P. delivered to turbines	190 0	187.0	188.2	184 2
Turbine H.P. deliv. to transmission machinery	93.2	88.7	91.4	86.0
H. P. delivered to dynamo	56.1	53.15	55.1	51.9
E. H. P. delivered to line	48.5	45.9	47.6	44.7
E. H. P. delivered to car motors	46.0	43.1	44.8	42.3
H. P. delivered at car axles	34.50	31.92	33.7	31.78
Power Lost.				
Turbine friction H. P.	96.8	98.3	96.8	98.2
Transmission machinery H. P.	**37.1**	**35.55**	**36.3**	**34.1**
Dynamo losses	7.6	7.25	7.5	7.2
Line losses	2 5	2 8	2 8	2 4
Car motor, gearing and axle losses	11.5	11.18	11.1	10.52
Total losses, Hyd. H. P. to car axle H. P.	155.5	155.08	154 5	152.42
H. P. available at car axle	34.5	31.92	33.7	31.78
Total Hyd. H. P. delivered	190.0	187.4	188.2	184.2

TABLE III.

Section in which reading is taken	I.	II.	Total.
Time base of section, hours and minutes	10.30—11.01	11.01—11.14	10.30—11 14
Time interval of section, in minutes	31	13	44
Power Delivered.			
Hydraulic H. P. delivered to turbines	182.7	234.0	197.8
Turbine H. P. deliv. to transmission machin'y	85.1	134.9	101.0
H. P. delivered to dynamos	50.5	95.8	63.7
E. H. P. delivered to line	38.5	82.0	51.3
E. H. P. " " car motors	36.2	77.1	48.2
H. P. " " car axles	25.4	54.0	33.7
Power Lost.			
Turbine friction H. P.	97.6	95.1	96.8
Transmission machinery friction H. P.	**34.6**	**43.1**	**37.3**
Dynamo losses	12,0	13.8	12.4
Line losses	2.3	4.9	3.1
Car motor and gearing losses	10.8	23.1	14.5
Total losses Hyd. H. P. to car axle H. P.	157.3	180.0	164.1
H. P. available at car axle	25.4	54.0	33.7
Total hydraulic H. P. delivered	182.7	234.0	197.8

POWER LOSSES IN A CABLE PLANT.

This test was made on the Druid Hill Avenue cable plant, Baltimore, Md., jointly by Hermann S. Hering and the author, March 29, 1892, while associated in the department of electrical engineering at the Johns Hopkins University.

A new plan is employed to drive the cable drums by not having them geared together, but using in connection with each driving drum, a compensator. This consists of a simple box train, epicycle gear. The idler drum is double, one-half of which is mounted loose on the shaft, while the other half is keyed to the same. The cable drums are placed, one on each side of the rope drive drum, on the main shaft, and driven through positive clutch couplings. These, as well as similar clutches on the engine shaft, are operated by hand, through compound gear. In the eleven miles of single track, there are fifty-eight single track curves, making 2,900 ft. of curve construction in all. The power house at the other end of the line is a duplicate of the Druid Hill Avenue one. The above particulars are taken from the Street Railway Journal, March, 1891, which contains a full and illustrated description of the "Baltimore Cable Road" and the Druid Hill Avenue power house.

The test was made under the ordinary working conditions of the road, the usual daily traffic and operations not being interfered with in the least during the normal running time of twenty-four hours. The plant consisted of two Wetherill-Corliss type engines, rated at 414 H. P., at sixty revolutions, eighty pounds boiler pressure and one-fifth cut-off. Rope driving is used to transmit the power from the engine shaft to the cable driving shaft. Only one engine was run during the test.

The frictional losses of the engine, drum, and cables were determined by running the engine with only that part of the machinery attached, of which it was desired to obtain the friction horse power. It will be noticed that the sum of the individual friction horse powers of the large and small cables is not equal to that required to drive the two together. This shows an increase in the friction of the transmission machinery and through the rope drive, a result which is to be expected when the transmitted load is increased and the two cable driving shafts are operated as one.

The power necessary to drive the cable, under no load, and at various speeds, was obtained by a special test; from the plotted results of this run it appears that the cable friction horse power varies almost directly with the speed at which the cable is running.

It is the extent of curved track and the steep grades on the road, which no doubt make the efficiency of the cables so low; for, as will be seen by referring to the summary of efficiencies, only 45.9 per cent. of the power delivered to both cables is available for use in propelling the cars.

The data and particulars involving the power losses in the transmission machinery are tabulated below:

TABLE III.

SUMMARY OF POWER DISTRIBUTION AND EFFICIENCY OF CABLE PLANT.

Power developed and delivered.	
Horse power developed, cars on, maximum 6.30 P. M.	342.2 H. P.
" " " minimum 5.04 A. M.	156.0 "
" " " mean (of run)	241.7 "
Horse power developed without cars on, but with both cables, drum and engine friction, mean	152.35 "
Horse power developed without cars on, but with downtown cable, drum and engine friction, mean	124.2 "
Same, but with uptown cable, drum and engine, mean	69 0 "
Same, but with drum and engine only, mean	47.45 "
Same, but with engine only (engine uncoupled), mean	29.15 "
Horse power delivered by engine shaft	212.55 "
Horse power delivered by main driving shaft from clutch couplings	194.25 "
Horse power delivered by both cables to cable car grips	89.35 "
Friction horse power of both cables and additional shafting required by same, mean	104.9 "
Friction horse power of both cables alone, mean	98.3 "
Power Lost.	
Engine friction horse power	29 15 H. P.
Drum friction	18.30 "
Uptown cable friction	21.55 "
Downtown cable friction	76.75 "
Shafting, due to mean load on both cables	6.60 "
Total friction horse power	152.35 H. P.
Mean available horse power delivered to cars	89.35 "
Mean total indicated horse power developed by engine	241.70 H. P.
Summary of Percentage Distribution of Power.	
Percentage lost in engine friction	12.10
" " drum friction	7.60
" " uptown cable friction	8.90
" " downtown cable friction	31.80
" " shafting (due to use of both cables)	2.70
Percentage available power at cars	36.90
Total power developed by engine	100.00

POWER LOSSES IN TRANSMITTING THROUGH A COUNTERSHAFT.

These tests were made to determine the losses in the usual method of driving dynamos; namely, through two belted connections and a countershaft. They were made jointly by Clement R. Jones and the author, in the mechanical engineering department of the West Virginia University, in March, 1894.

Engine, Wheelock, rated horse power 40, at 75 revolutions, 80 lbs. gauge $\frac{1}{4}$ cut-off. Dimensions of cylinder, 11×30.

Indicator cards, and speeds of engine and dynamometer shafts were taken every two minutes. The engine friction horse power, tabulated

or (*c*) and (*d*) were taken from a curve plotted from the previously recorded results, on the usual assumption that it varies directly as the speed, regardless of the load.

TABLE IV.

DATA AND PERFORMANCE OF THE TRANSMISSION MACHINERY.

Dimensions and Data.

Band wheel of engine—diameter on crown.... $96\frac{5}{8}$ ins.; face, 17 ins.
Countershaft pulleys, driven—diameter on crown..... 48 " " $14\frac{1}{2}$ ins.
Countershaft pulleys, driver—diameter on crown..... 48 " " $12\frac{1}{2}$ ins.
Dynamometer pulleys (*c*) bare cast iron: diameter on crown..... $15\frac{1}{4}$ ins.; face, $14\frac{1}{2}$ ins.
Dynamometer pulley (*d*) covered with Shultz patent leather covering: diameter on crown..... $15\frac{1}{2}$ ins.; face $14\frac{1}{2}$ ins.
Main driving belt, light double, oak tanned..... $11\frac{7}{8} \times \frac{1}{2}$ in.
Dynamometer belt, single, oak tanned..... $8 \times \frac{7}{32}$ in.

Transmission Machinery Performance.

Plain cast iron pulley on dynamometer—column (*c*).
Shultz patent leather covering on dynamometer pulley—column (*d*).

	(*c*)	(*d*)
Time interval of run, minutes.....	60.	30.
Corrected mean boiler pressure.....	59.29	64.5
Mean revolutions per minute, engine.....	67.0	68.25
" " " " dynamometer.....	402.60	417.06
Calculated speed of dynamometer, ratio.....	6.34	6.235
" " " " speed.....	424.0	425.5
Loss in speed, from engine to dynamometer shaft....	22.2	8.44
Slip of belt, per cent. of calculated speed.....	5.23	1.98
Tension at which belts were laced and run, average of initial, and final tension on belts, pounds per square inch:		
Main driving belts.....	40.	80.
Dynamometer belt.....	75.	135.
Mean indicated horse power.....	19.122	13.210
Engine friction, horse power (from plotted curve).....	2.50	2.54
Horse power delivered to transmission machinery....	16.622	10.670
Dynamometric horse power absorbed.....	15.275	9 960
Horse power lost in transmission machinery...	**1.347**	**0.710**
Frictional loss, per cent., engine.....	13.06	19.23
Frictional loss, per cent., transmission machinery.....	**8.10**	**6.65**
Efficiency, per cent., engine.....	86.94	80 77
Efficiency, per cent., transmission machinery..	**91.90**	**93.35**

Cost of Indicated Horse Power.

Decourcy May, Niagara Falls, N. Y.

In the table presented by Mr. May and given below, the cost is given of one indicated horse power for 365 days of twenty-four hours each, and 308 days of ten and a fourth hours each, the ten and a fourth hours representing the running time in the ordinary mill or factory:

The interest on the plant is placed at.. 5 per cent.
The depreciation on the plant is placed at..... 5 " "
The insurance on three-fourths of the plant is placed at..... 1 " "
The taxes on three-fourths of the plants are placed at..... $1\frac{1}{2}$ " "

No rental or interest on the land occupied by the plant or cost of water is charged.

The value of the land occupied varies so largely, especially with electric lighting and trolley plants in large cities, as to make the insertion of these figures misleading.

	Cost of one I.H.P. 365 days of 24 hours.				Cost of one I H.P. 308 days of $10\frac{1}{4}$ hours.			
	Coal per 2,240 lbs.				Coal per 2,240 lbs.			
	$2	$3	$4	$5	$2	$3	$4	$5
Triple expansion pumping, Allis, 20 revs....	48	55	61	67	31	33	35	37
Triple expansion without pumps, Allis, 50 revs	27	33	39	45	16	18	20	22
Compound mill, best engine.....	29	36	44	51	17	19	21	24
" " average.....	39	46	52	58	22	25	28	30
" electric light, average.....	122	139	157	174	78	84	90	96
" trolley.....	48	58	68	79	29	32	36	39
Triple expansion trolley.....	45	54	64	74	26	29	33	36
Condensing mill.....	44	52	61	69	25	29	33	38
Non-condensing, 50 to 200 H.P.....	70	76	81	88	49	53	57	62

The figures for engines below fifty horse power vary so widely that they have been omitted. The above table, Mr. May states, has been calculated as far as possible from actual engines running under ordinary conditions.

Electric Railway at Lyons.

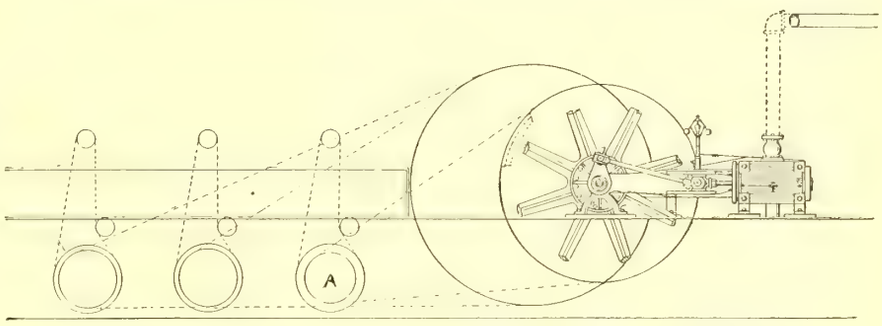
One of the recent electric railways to be put in operation and the fifth constructed in France on the overhead trolley system is that extending from the city of Lyons to Oullins. This is the second trolley road in Lyons, the other being the Lyon-Saint Just à Sainte-Foy. The Lyons-Oullins line has a length of about four miles with a maximum grade of $3\frac{1}{2}$ per cent. The track is double for the entire distance, and is laid with the Marsillon type of rail. There are no curves of short radius, but one grade of considerable length upon which, when horses were used, but slow speed was attained. The cars now mount this grade at a speed of about seven and a half miles an hour.

The trolley wire is of copper .326 in. in diameter, and suspended from span wires which are supported on the ordinary type of tubular poles.

The central station is located at Oullins and contains tubular boilers manufactured in Lyons, and two 150 H. P. engines of the Piguet type operating at 100 revolutions per minute. The electrical generating machinery consists of two 100 K. W. General Electric machines over-compounded for a loss on the line of 10 per cent., and operating at 650 revolutions per minute.

Flywheel Accident at Pittsburgh, Pa.

A bursting flywheel at the Ben Venue power house, of the Pittsburgh Traction Company, interrupted traffic, and seriously wrecked the station on the afternoon of April 19. The engine was a Wetherill-Corliss, consisting of a pair of 22 × 42 in. cylinders connected to cranks at right angles upon the main shaft. It ran at seventy-five revolutions per minute, and was rated at 450 H. P. Both cylinders were under the control of one governor, a shaft, one and a half inches in diameter, and ten feet long, extending across the engine for the purpose in the ordinary way, and passing within six inches of the face of the flywheel. At the time of the accident the engine was driving, as nearly as could be learned, about 700 H. P. The flywheel which burst was twenty feet in diameter, thirty-two inches face, and weighed about sixteen tons. It showed no defects, and would have doubtless stood for years any ordinary treatment. The accident appears to have been due to a short circuit which increased the load until the belt slipped, and the five foot driven pulley belted to the engine wheel, and marked *A* in the diagram, failed. This broken pulley parted the belt which was drawn toward the engine with such force as to tear up the flooring and break the governor cross shaft mentioned above, completely stripping all the governor connections from both cylinders. The engine, being thus uncontrolled, soon attained a speed beyond that which the flywheel could stand. The wheel was made in eight sections, and broke, in each instance in the arm, as shown by the sketch.



ARRANGEMENT OF MACHINERY—BEN VENUE STATION, PITTSBURGH.

The piece which caused the most damage weighed about 400 lbs. It flew back and up at an angle of 25 degs. from a line perpendicular to the floor line, and struck the steam main directly over a central point between the two cylinders, bursting the main, which deflected it towards the boilers, where it fell on the dome of one boiler, crushing it in, and allowing all the steam to escape. This was the most serious damage incurred. A second piece about the same weight, flew off forward at a similar angle. It struck a roof I beam at a central point, and bent it to an angle of 100 degs. It then dropped on the floor and through it. A third piece, about 300 lbs. weight, struck an arc light dynamo which was on the floor directly in line with the flywheel, smashing the framework, and penetrating the dynamo for several inches. A fourth piece, about 200 lbs. weight, struck the wall below the floor line. It did no damage. A fifth piece went through the roof at an angle of about 30 degs, and dropped on a high bank 100 ft. from the power house. Several pieces went backwards, under the floor line, but did no damage, being stopped by the wall and floor. Fortunately, no one was injured, though there were several witnesses, and the accident did not seriously cripple the road, as they had a surplus of power.—*Power.*

A CHARTER was granted last month to the Roxborough, Chestnut Hill & Norristown Traction Company, of Philadelphia, capital $5,000. The incorporators are Wm. H. Huelings, Jr., John T. Dunlap, Wm. J. Ferdinand, Henry C. Esling, of Philadelphia, and George W. Vanhorn, of Chester.

Established 1884.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

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The Meeting of the American Institute of Mechanical Engineers, held last month at Montreal, was one of the most successful in the history of that association. Questions of mechanical engineering enter so closely into street railway operation that the proceedings of this body possess an especial interest to our readers. We publish elsewhere abstracts of the principal papers bearing upon engine operation.

Double vs. Single Trolley Roads—using a legal phrase—present a case that has not as yet attracted very much attention, but in our opinion, should have a careful investigation. Under the thorough trial which the double trolley has had in Cincinnati, as detailed in another column, it has demonstrated its practicability, and eliminated many of the disadvantages which were supposed to attend the employment of a second overhead wire for the return circuit. The officials of the Street Railway Company using the system in that city speak well of it, and the advantages urged in its favor are worthy of consideration.

The Maintenance of Parks and similar attractions by street railway companies, with the object of stimulating traffic, is growing to be an important feature of this business. Reports from those railway companies which have undertaken enterprises of this character, seem to show that the results attained have been of the kind sought, and that the increase in gross earnings has been sufficient to pay for the investment made. As the land usually selected for the site of a street railway company's park is at the terminus of one of the lines, and is hence a considerable distance from the center of the city or town, it can generally be secured for a low price. The management of the entertainments provided usually devolves upon the superintendent, though it will often be found a better plan to have a special person appointed to look after this department exclusively. His duties should include that of attending to the engagement of the ball teams or other entertainment companies, advertising, care of grounds, supervision of restaurant privileges, etc. While most of the entertainments must necessarily be of an out-of-door character, a wide variety is presented to select from. One street railway company, whose park is described in this issue, has engaged a local baseball team under the captaincy of Mike Kelley, the ex-Boston player, while another, farther South, has secured the services of a prominent colored revivalist. Occasional exhibitions of fireworks will also often prove an attractive feature for such parks. The problem of encouraging traffic on street railway lines is one which is attracting more and more thought, and efforts in this direction will often be followed by a gratifying increase in gross earnings.

"The Conductor and Motorman (or Driver) were Arrested," is a statement which frequently appears in daily papers in connection with descriptions of street railway accidents, and usually without any proof that the arrested parties were in any way responsible for the accident. Generally the arrest of street railway employes and the publication of the fact is an imposition upon innocent persons, for which they seem to have as yet no redress. The practice of police officers arresting car men while on duty is quite too common, and something should be done by street railway companies to protect their men from such indignities. It is indeed an indignity to take men from their car, march them through the streets under arrest and lock them up in cells as common criminals and enemies of society, and hold them in confinement until bail can be procured. The practice and publication of the fact tends to create in the public mind a prejudice against car men as a class, causing many to hold them in about the same estimate as they do thugs and pickpockets. The practice of taking men from their car without notice often interrupts the service of a line, and is liable to subject a large number of passengers to delay and annoyance until other men can be found to supply the place of the arrested parties. A partial remedy is found in the practice which has been adopted in the city of Memphis, and which is detailed at length in another column. By an arrangement made between the operating company and police authorities, when it is the duty of an officer to apprehend a car employe, if the charge is not a serious one, the officer telephones the manager to have the man report at police headquarters at a certain time, and this the company agrees to do in all cases. If the charge is a serious one, then the officer telephones the manager to send an extra crew to relieve the men under arrest; then he boards the car and accompanies the men over their route until the relief appears. This practice prevents interruption of traffic, and when convenient to the police station the men are taken in without observation and without subjecting them to the humiliation of a march through the streets, followed by the rabble that might be drawn to the scene of the accident, whatever it might be.

The Editorial Correspondence relating to the street railway systems of Southern cities closes for the present with this issue. The Southern tour, to which reference is made above, began on the 12th of January,

when the editor of the STREET RAILWAY JOURNAL left New York by steamer of the Clyde Line for Charleston, S. C., and virtually ended on his arrival in Chicago on the 20th of last month. The cities visited on this trip in their order were Charleston, Savannah, Augusta, Atlanta, Chattanooga, Montgomery, Mobile, New Orleans, Algiers, Galveston, Houston, Ft. Worth, Dallas, Hot Springs, Ark., Memphis, Covington, Newport, Cincinnati, Dayton, Indianapolis, Chicago. On returning to New York, the total distance traveled on steam lines during this trip will be six thousand miles, and about one-third of the distance additional on street car lines. It is to be regretted that time did not permit of a visit to a number of other equally as large and interesting Southern cities from a street railway point of view, but these we will endeavor to reach in a subsequent trip. All the states of the Union, with the exception of three, have now been visited by our editor in the interests of the STREET RAILWAY JOURNAL. We have to express our gratitude to the street railway managers and others in the cities recently visited for the uniform kindness and attention with which he has been received. Only pleasant memories remain of every city visited, and of every street railway official.

* * * * *

We are sometimes asked why we go to the expense of keeping one of our editors constantly on the road, and why we do not edit the STREET RAILWAY JOURNAL from a single office, following the example of the majority of trade journals. Our answer is that, in our opinion, a description by the same observer, of the details of actual everyday practice as found in the different cities, is the most valuable class of matter that we can present to our readers. It places at the disposal of all, the mechanical and electrical devices that are being employed in different cities, as well as the methods of practice in discipline and operation. It gives us an opportunity to study the street railway business under every possible condition, so that we are better able to judge of the relative merits of the different appliances, plans of construction and methods of discipline, while by associating constantly with street railway men and the manufacturers of street railway supplies, we learn what matter will be of most value to them, and are able to provide it accordingly. We have evidence that our efforts to provide the class of matter to which reference is made above, is appreciated by our readers and patrons, and have the satisfaction of knowing that the STREET RAILWAY JOURNAL is most carefully read and studied.

The Car Service given by horse railways five years ago was frequently insufficient to meet the traffic requirements of growing municipalities. Ten and fifteen minute schedules on all except the two or three main streets of the principal cities were usual, and in smaller cities, where frequency of service is an absolute desideratum if traffic is to be secured, the schedules were often longer and the car speed less than in the larger. The introduction of electricity and the cable system has brought about a radical change in methods of management, particularly in this matter of car service. Street railway managers have found that the public is quick to appreciate increased speed and frequent cars. The great increase in gross receipts obtained by most of the street railway companies who were first to adopt electricity brought these facts forcibly to the attention of others, and the public has come to be far better served than ever before; car mileage has been doubled, trebled and even quadrupled in some places, owing to the increased speeds, the greater number of cars in service and the extensions of mileage. This increase of car service has been in some cases carried too far. In the larger cities it has been frequently a necessity and has been generally beneficial to the operating companies, although differences in comparative financial results between cities of the same general character can often be traced to differences in the car service given. In the smaller cities, however, the street railway companies are frequently obtaining large business at too heavy an operating expense, and their net income would often be improved by a reduction in car service, even should the gross receipts suffer slightly in consequence. To be sure, it is a matter of no small difficulty to reduce a service once established, and the unpopularity of such a policy is disagreeable, though usually only temporary. Nevertheless, the street railway manager has always to keep in mind the fact that in the interest of his stockholders, "net income" is always more important than "gross," and the problem of how to obtain the greatest profit with the least expenditure and without injustice to the public is one which must be carefully studied for each particular case. The question of profits in cities and towns of less than 25,000 inhabitants is perplexing. As a rule the distances are comparatively short, so that, in order to induce traffic, a car must be on hand at the moment wanted, and must travel at such a speed as to really save time to the passenger. It is in the accomplishment of these desiderata, without at the same time too greatly increasing the operating expenses, that the test of good management occurs, and if the ability to determine where economy ends and extravagance begins had been more common, many receiverships perhaps would have been avoided.

Conductors or Non-Conductors is a question which often presents itself in regard to the operation of street railway lines where the traffic is not great. The question is an important one with small railway companies, for there are many places where the employment of two men per car would make street railway operation practically prohibitive. While we are far from believing that where the traffic is sufficient to warrant the use of conductors their service can be dispensed with without loss to the railway company, there are many cities where the operation of conductorless electric cars is being carried on satisfactorily to the railway company and the general public. The practice followed in different cities has been mentioned in the descriptions of the different lines appearing in "Editorial Correspondence," and from these articles it appears that all the lines in the following cities are operated without conductors: Sioux City, Ia.; Great Falls, Mont.; Montgomery, Ala.; Dallas and Ft. Worth Tex. All the lines in San Antonio, Tex.; Dayton, O., and Anderson, Ind., two in Chattanooga, Tenn., and one or two in Atlanta, Ga., are also operated without conductors. The operating companies in the cities named do not report any increase of accidents, and no more liability to accidents, than when conductors are employed. We have observed that it is not always to the advantage of the street railway companies to thus operate cars at times of excessive traffic, as some of the passengers neglect to deposit their fares. It is the practice, however, in the cities named to employ inspectors on

special occasions, when there are crowds to handle, who board the cars at certain points, and assist in collecting the fares. In this connection, it may be said that where conductors are not employed the trolley wheel very seldom leaves the wire at crossings and switches, though when there is a man on the rear platform, the opposite of this often occurs. As a matter of fact, this point depends almost entirely upon the care with which the motormen pass the crossings and switches. When alone they generally exercise more care than with an assistant to watch out for the trolley. There is usually but little objection on the part of the traveling public to the running of cars without conductors. Of course, there are times when a conductor can give attention to passengers that is acceptable, but the latter soon learn to depend upon the motorman or upon their own resources, and when they understand that they are riding in a conductorless car they generally acquiesce in the practice of the company. In a city with wide streets there is very rarely any increased danger from the practice. It is often stated by companies who employ conductors that in their opinion a conductor can earn his wages under all circumstances and that there is no economy in operating cars without conductors, but we do not believe that this statement is generally true.

Legal.

Collision With Vehicle—Personal Injuries—Evidence.—1. In an action to recover for an injury resulting from a collision between an electric car and a vehicle, where the declaration alleged that plaintiff's ability to work and earn his usual wages were destroyed, *held*, there was no error in allowing him to testify that he was a granite and stone contractor, requiring him to be on his feet much of the time, and that he earned $5 per day.

2. In an action for collision with vehicle, plaintiff having testified that there was nothing to prevent the motorman from seeing him, may state that he thought the motorman would stop the car; this testimony illustrating and explaining the conduct of the plaintiff in managing his horse upon the occasion.

3. Before mortality tables are admitted in evidence to show expectancy so as to arrive at amount of damages he should recover, the age of plaintiff should be proven as a foundation.

4. Where a verdict for a large sum was awarded on the theory that plaintiff was in all respects a sound and healthy man, but newly discovered evidence discloses that he had previously been afflicted with rheumatism, and had received a gunshot wound, which permanently disabled his right arm, and that the injuries claimed to have been inflicted were not so serious as plaintiff alleged, justice will require a new trial. Judgment reversed. (*Atlantic, etc., St. Ry. Co.* v *Beauchamp*, Ga. S. C., Jan. 30, 1894.)

Municipal Grant—When One Street Railway Company May Appropriate Track of Another.—In an action to condemn the right to use the tracks and right of way of another company; and in an action to restrain such proceedings, and a subsequent *quo warranto* proceeding brought by the attorney general, all heard together, and from an adverse judgment the Consolidated Company appealed, wherein it is *held:*

That a street railway company, to which the council of a municipal corporation has granted the right to occupy a part of the track of another company in accordance with section 3,438 of the Revised Statutes, is authorized by section 3,440, without the aid of the amendatory provisions of April 11, 1890, to appropriate the track according to the grant, when the companies are unable to agree upon the compensation to be paid therefor; and the appropriation proceedings may be prosecuted under chapter 8 of title 2 of part 3 of the Revised Statutes. (*Toledo Consolidated St. Ry. Co.* v. *Toledo Electric St. Ry. Co.*, Ohio S. C., Jan. 5, 1894.)

Note: By Ohio statute, power of the municipal authority, within certain limitations, to grant a street railway company the right to occupy the tracks or other structure of a street railway existing in the municipality at the time of the grant, cannot be doubted. But such grant does not, of itself, confer upon the grantee the right to enter upon the occupancy of the tracks or structures. The owning company has a private property in them and their use, though devoted to a public purpose, of which it cannot be deprived without its consent, except by an authorized appropriation, in which it is entitled to have compensation therefor assessed. So that, to make effective the grant of the municipal authorities to one company to occupy the tracks or structures of another, it becomes necessary to obtain the consent of, or waiver of damages by, the owner; or, if that cannot be done, then to appropriate the tracks or structures to such use by judicial proceedings in which compensation may be assessed. (See *St. Ry. Co.* v. *St. Ry. Co.*, 36 Ohio St. 239.) And this notwithstanding the use by the owner company may be less convenient than before, and require greater care in operation. For this injury compensation must be made; and the inconvenience must be borne for the public good. But ample power is vested in a common council to prescribe by ordinance such reasonable regulations for the use by the companies of the tracks appropriated in such cases as may be necessary for the protection of both companies and the public.

Street Railroads—Injury to Passenger—Voluntary Act.—A person who voluntarily undertakes to go from the rear to the front of an open car, on the side step thereof, and is struck by an elevated railroad pillar, has no cause of action against the street car company. (*Vroman* v. *Street & Ferry Co.*, N. Y. S. C., Feby. 8, 1894.)

Note: This is an important question to modern street railways. The weight of authority upholds the statement that it is the duty of a street railway company to run its road along a way which is not dangerous. The fact that iron posts against which plaintiff struck and was injured was erected by the elevated company subsequent to the time when defendant built its road, would not justify defendant in continuing to use its road, so far as its passengers are concerned, if by so doing it became a dangerous thing to do. It should have prevented the elevated company from placing its pillars in a place where they would injure persons riding on defendant's cars who prudently and carefully did so, or else should have removed its rails further away from such pillars, or so constructed the platforms on its cars as to permit its passengers to use them without harm from such dangerous obstructions. This duty a street railway company owes its passengers. A failure to do so constitutes negligence on a company's part. In this case plaintiff may have been negligent; yet it is plain that he had a right to a seat in defendant's car; in fact it was his duty to take a seat as soon as possible. When he boarded it all the seats were occupied. He was compelled to stand. When a seat was vacated he exercised his right to have a seat by proceeding along the only passageway to the seat. Notwithstanding it was night time, and that he was not familiar with that part of the road, had he not the right to assume that it was free and clear from all danger? Such a question, at least, is one of fact for a jury to determine, and not a question of law for the court to decide.

Street Railway—Injury to Passenger—Collision. In an action by a passenger against a street car company for personal injuries, a verdict for plaintiff is sustained by the evidence where it appears that the driver of a car drove against a wagon standing across the track, and the collision threw plaintiff to the street, and injured him. (*Fox* v. *Brooklyn City R. Co.*, Brooklyn City Ct. Feby. 26, 1894.)

EDITORIAL CORRESPONDENCE.

HOT SPRINGS, ARK.; MEMPHIS, TENN.

Hot Springs, Ark.

This city, which has its origin because of the springs which are found here and from which it derives its name, is located on a spur of the Ozark Mountains, in the western part of Arkansas, fifty-five miles southwest from Little Rock, the capital of the state, and twenty-five miles northwest from Malvern, on the St. Louis, Iron Mountain & Southern Railway, with which it is connected by the Hot Springs Railroad, at present the only rail outlet.

Among the principal buildings are the hotels, boarding houses, bath houses and the military hospitals. The principal hotels are among the finest hostelries to be found at any of the health or pleasure resorts of the country. Hot water issues forth from the western slope of the Hot Springs Mountain from seventy-two springs, which are near together, most of them being from thirty to seventy-five feet above the level of the valley, while a few are near the margin of the creek. The Hot Springs Mountain, including the area in which the springs are found, is a government reservation embracing 300 acres. The waters and reservation are under the charge of the officers of the government. The springs are all housed in with low brick walls with arched roofs, cemented on the outside, from which the water is led in pipes to large airtight tanks, which have been built by the government, and from which pipes lead to the numerous bath houses and hotels. The government has a supervision over the construction of the bath houses and rates which are charged for baths, a revenue being charged for the water used. The temperature of the different springs varies from 105 to 158 degs. Fah., and contains eight and a half grains of mineral matter to the gallon. The waters are also thoroughly impregnated with free carbonic acid. These springs have the reputation of being received among the wonders of the world, and it is conceded that the efficacy of the waters excels many of the waters of the Old World.



FIG. 1.—ARLINGTON HOTEL—HOT SPRINGS, ARK.

Not all the visitors, however, to this locality are in search of health, a majority are pleasure seekers and lovers of sight seeing, and the location for the latter class is a very attractive one indeed. Horseback riding is one of the principal amusements here. There are many delightful drives through the neighboring valleys and up the mountains, along which are found a great variety of trees, pines and foliage plants predominating, while not far away are the celebrated quartz crystal deposits, where are found beautiful specimens of crystals.

The Hot Springs Street Railway Company.

All the street railway lines of the city, with one exception, are controlled by this company, the exception being a short mile line over which one car is run at long intervals into one of the many valleys, known as Happy Hollow, along which the town is built. The cars of the Hot Springs Street Railway Company are all operated by electric power, the transformation from animal power having been made in June, 1893, previous to which time fifteen mule cars were run, but, since the introduction of the electric power, the traffic has increased 60 per cent., although the average number of cars now run is only ten.

The equipment of the system is first class in every particular, and a very acceptable service is maintained, as is evidenced by the patronage which averages about 105,000 passengers per month. The line embraces about sixteen miles, nearly all double track. The road on Central Avenue is the trunk line of the system, and the branches strike off at an angle at both ends of this avenue, and penetrate the radiating valleys, the length of each division being about two and a half miles. The resident population of the city is estimated to be 15,000, and for this number the mileage would seem to be excessive, but when it is remembered that the average number of transient visitors is 6,000 per month, taking the year together, the patronage which the system enjoys is readily explained. The headway of the different divisions is from six to nine minutes, but as all the cars travel through Central Avenue the headway on this section is from three to five minutes, providing a very acceptable service through the business portion of the city.

A large number of the street railway patrons are invalids, and it is gratifying to note with what care and patience the employes treat the passengers of this class, assisting them to board or alight from the car, and on the crowded streets being careful not to run them down. The management of the local affairs of the company is entirely in the hands of C. G. Convers, who spares no pains to provide a proficient service, and the success attending his efforts, considering the limited resources at his command, is certainly very flattering.

PHYSICAL FEATURES.

The track construction consists chiefly of forty-five pound T rails spiked directly to the ties. The streets are paved with what may be termed macadam, the surface of which consists of a cement gravel mined from the foot hills immediately beside the streets in different portions of the city. This gravel makes a very firm and durable surface. The overhead construction is supported on side poles except on Whittington Avenue, where center wooden poles are employed. These poles are topped with a cast iron thimble or ferule six inches in diameter and about a foot in length, the top of the pole being turned down to receive it. The arms for the support of the trolley are composed of gas pipes which are attached to

each side of the thimble, a hole in the thimble being drilled and threaded ready to receive them. They are then braced by a truss rod over the top of the post. A No. 0 trolley wire is employed.

The rolling stock consists of fourteen motor cars and fifteen trail cars. Four open cars of latest design have recently been added to the equipment, with a seating capacity for forty persons. These were mostly manufactured by the American Car Company, of St. Louis. Some were also built by the St. Louis Car Company, and by the Brownell Car Company. These are all mounted on McGuire trucks, fourteen of which are of the Columbian type, and others of the improved 19 A type. A thirty-three inch wheel is employed and a three and three-fourths inch axle. A single equipment of motors is employed, and these are all of the Thomson-Houston type, some of them being W. P. 50, and others of the F 30 type. The latter are employed on some of the cars that have been built over by the company from horse cars. Metal shields are provided on most of the cars. These are attached to the trucks and are hung near the inside face of the wheels, and are designed to prevent mud being thrown upon the apparatus and upon the car. The power is rented at a very reasonable rate from the Hot Springs Electric Light & Power Company.

The office and principal car barn of the company is located on Park Avenue, near the terminal of the line on this avenue. The structure is of wood and has a capacity of twenty cars. There is also an auxiliary shed in which the cars are stored. There are three repair pits and a repair shop equipment with a fair complement of iron working tools, the power being furnished by railway motor. Along and beside the storage tracks in the barn is provided a foot board extending just over the top of the cars, from which the trolley poles and wheels are readily reached for inspection and repairs. There is also an inverted wooden trough above the trolley wires in the barn. There are two additional barns connected with the other divisions for the storage of cars.



FIG. 2.—ONE OF THE BATH HOUSES—HOT SPRINGS, ARK

As a means for increasing traffic the company has recently purchased and fitted up as a base ball park a large tract near the terminal of Whittington Avenue. This has been graded and inclosed by a high board fence, and a large and commodious grand stand erected. Opposite the baseball ground is a very pretty lake, which is stocked with game fish, and which has been formed by erecting a small dam across the outlet of a number of springs which border the basin. Among other attractions at this terminal is a large "merry-go-round," sheltered by a large tent and operated by steam power. One of the lines terminates at the race track, at which trials of speed are made at frequent intervals throughout the year. Trains of one or two open trail cars are run on special occasions to accommodate the traffic to the parks and race track.



FIG. 3.—COLORED BAPTISM AT WHITTINGTON PARK—TERMINUS OF LINE OF THE HOT SPRINGS STREET RAILWAY CO.

We have often recommended park and auxiliary attractions for the promotion of street railway traffic, but it has been left for the superintendent of this system to devise one of the most novel and legitimate attractions for inducing traffic. This consists in the encouragement of negro revival meetings, which are held in a large tent, and for the management of which a noted revivalist has been imported from St. Louis. Among the auxiliary attractions are occasional baptisms in the lake, and barbecues, which are introduced at stated intervals. The tent is moved as occasion requires from the terminal of one division to another to accommodate the people in different parts of the city.

OPERATING FEATURES.

Motormen are paid $40 per month and conductors $30, and they work from ten to eleven hours a day. A comparatively young class of men are employed, though none are under twenty-one years of age. Married men are generally employed for motormen, as they are considered to be more steady. Vacancies in the motorman class are filled by promoting the conductors. Usually the opportunity of promotion is held as an encouragement to faithful service on the part of the conductors. The extra men are paid by the regular men whose places they supply. Crews of extra cars are paid by the company. The average cost for operating a car per month, including power, is $70. The fare is five cents, with school tickets twenty for fifty cents. No free passes are issued to any parties. Policemen ride on their uniforms or badges.

Transfers are issued by an agent at one point only. This is at the junction of Park and Whittington Avenues with Central Avenue, and here is provided in the open space a discarded horse car which serves as a waiting room. The franchise of the company is for sixty-six years from 1892.

Hot Springs Electric Light & Power Company.

The power station of this company, which supplies power to operate the cars, and also for stationary motors, as well as for lighting the city, is situated on Malvern Avenue, just outside the business center of the city. The building is a one story brick structure, and is in the neighborhood of the gas plant. The same parties control the Garland Gas Light Company and the Hot Springs Water Company which furnishes the water supply for the city. The equipment of the electric power station consists of one 250 H. P. boiler, of the Stirling type, and three tubular boilers of the same capacity. The fuel consists of Arkansas coal, costing $3.60 per ton, and sometimes as high as $5. The power is principally supplied by a Hamilton-Corliss cross compound, condensing engine, of 400 H. P., which is belted direct to a General Electric M. P., 200 K. W. generator which furnishes the power for operating the cars. There are also two Westinghouse straight valve, rotary engines, of seventy-five horse power each. One of these is directly connected with an auxiliary shaft from which the lighting generators are driven, but in case the Corliss engine is idle the power generator is driven from the same shaft. The second Westinghouse engine is located in the basement of the station, from which power is transmitted by belting to the countershaft. The lighting generators consist of two Westinghouse machines, with a capacity of 250 incandescent lights each, and a fifty light arc machine manufactured by the Western Electric Company, of Chicago. The installation of an additional engine for power work is contemplated.

The water works station is erected some two miles from the city, and is equipped with Knowles pumps having a capacity of 2,000,000 gals. a day. The supply is obtained from springs, and is lifted into a reservoir having an elevation of 268 ft. above the city, thus giving a strong pressure upon the mains.

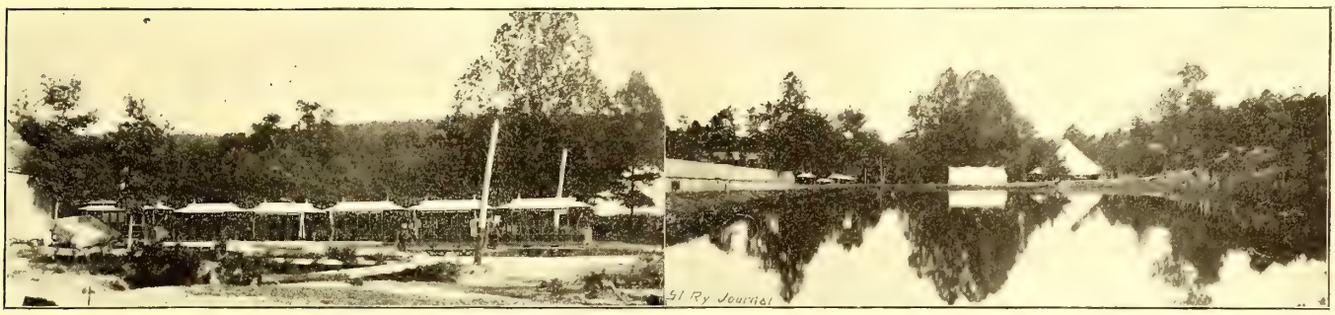
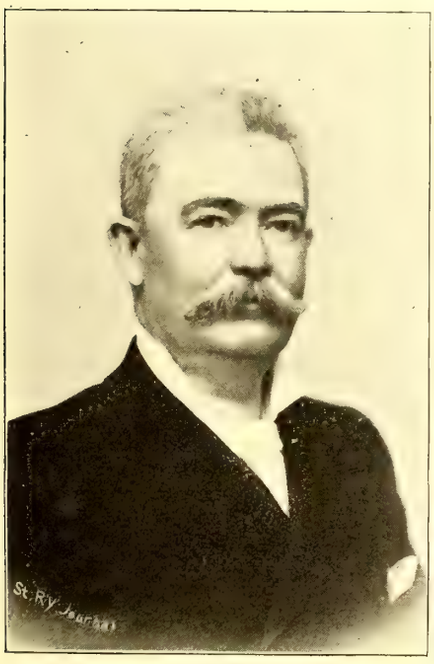


FIG. 4.—VIEWS IN WHITTINGTON PARK—HOT SPRINGS, ARK.



C. G. CONVERS,
TREASURER AND MANAGER HOT SPRINGS STREET RAILWAY CO.



PHILIP T. BIGLEY,
ELECTRICIAN HOT SPRING SSTREET RAILWAY CO.

Memphis, Tenn.

History tells us that Fernando de Soto, the discoverer of the Mississippi, first saw its yellow waters in 1541, from a bluff near where Jackson Mound Park, a part of Memphis, now stands. Here, a town was laid out as early as 1819 and named Memphis, probably after the old city of that name, the mistress of the Nile Valley. The new town was incorporated in 1827, but not until 1840 was there any evidence of the future great city, which by the census of 1860 showed a population of 22,643. This number has now increased to an estimated population of 100,000. This is not included, however, in the city limits, for these are quite limited, but it has spread beyond its original limits and now covers a closely filled up territory of at least six square miles.

The city is located on what is known as the fourth Chickasaw Bluff, on the east side of the Mississippi River, and has an altitude from thirty-five to fifty feet above high water and about 200 ft. above sea level. The location is said to be the only suitable place for the building of a city for several miles up or down the river. Memphis stands at the head of all-the-year-round navigation on the river, and is distant from St. Louis by river 450 miles and from New Orleans 818 miles, but in a direct line only 350 miles north of the Gulf of Mexico. Its position gives it great commercial advantage, and it disputes the claims of Houston as being the greatest inland cotton market in the world, and until recently, at least, the city has ranked second only to New Orleans as a cotton market. As a wholesale grocery center it ranks fifth in the country. The amount invested in this branch alone, by the clearing house figures of 1890, was $6,000,000 with sales for the year amounting to $16,000,000. As a hard wood lumber market it is the largest in the world. It is also the largest manufacturer of oil from cotton seed, while its bank facilities exceed those of any other Southern city, save New Orleans. Among its nine banks not one suspended during the recent troublous times, and during last year there was not an important commercial failure reported. For the year 1893, the volume of trade was $160,000,000. The capital invested in its 430 manufacturing enterprises is about $14,000,000.

The city also has unlimited advantages for the collection and distribution of the resources and commercial products of a large and productive region, in that there

are eleven lines of railway, seven on the east and four on the west side of the river and besides the free navigation of the mighty river, which with its branches has 18,000 miles of navigable water. In connection with its transportation facilities should be mentioned the great steel bridge which was completed a few years since, at a cost of over $3,500,000. The bridge is the property of the Kansas City, Memphis & Birmingham road and with its approaches is 7,400 ft. long and spans the river just below the city. Its business streets are wide, well paved and bordered by magnificent business structures of brick and stone. The government building, including the custom house and post office, is stone, of an attractive design, and stands alone at the foot of Madison Street immediately on the bank of the river and near the steamboat landing.

Near the business center of the city is a public park, which occupies an entire square. This is provided with a fountain and is shaded by large old oak trees. The principal attraction of the park, however, is a colony of gray squirrels to the number of 200 or more, which are provided with boxes or little houses among the trees in which they nest. These animals are all very tame and are great pets with the children. They can be easily approached and will take nuts and candy from the hands when proffered them. Everybody seems to have a special care for them and dogs are not allowed to approach the park. There are also tame ravens, pigeons, peacocks and other pets about the grounds, making it one of the most attractive of city parks in the country.



FIG. 5—EXTERIOR OF POWER STATION—CITIZENS' STREET RAILWAY CO., MEMPHIS, TENN.

STREET RAILWAYS.

There are sixty-six miles of street railway, all of which, with the exception of a suburban line to Raleigh Springs, is controlled by

The Citizens' Street Railroad Company,

the owners of which have within the past year purchased both the City & Suburban and East End Railways. The local manager of this system is F. G. Jones who is one of the principal owners. The lines of the East End Railway were, until recently, operated by steam dummies, but, since their purchase by the above company, the line, which embraces five and a half miles of double and single track, has been electrified, the transformation having been accomplished in five weeks after the purchase, but the roadbed was rebuilt, and the overhead equipment installed, within the period of thirty days. The lines, as a general thing, are advantageously laid out for the accommodation of residents in all parts of the city. Some few changes are, however, being made in the location of some of the interior tracks, in order to avoid curves, and to properly divide traffic between different lines.

It is worthy of remark at the beginning of these notes, that we have seldom found a city in which the relations between the street railway companies and the city officials were more pleasant than in Memphis. The people and their representatives have come to realize that the best interests of the city and those of the street railway company are virtually the same, and the officials in both cases are working together with a companionship that is commendable, and argues a good future for the development of transit facilities. The credit for this state of affairs is largely due to the general manager who spares no effort to make the service attractive and acceptable to the patrons. In the effort he is heartily seconded by his assistants in each of the departments, and by the employes who are, to a marked degree, polite and attentive in the performance of their duties.

PHYSICAL FEATURES.

The rolling stock embraces eighty motor cars and eighty trail cars, but the average number daily run is sixty. They were manufactured by the Lamokin and by the Pullman Companies. Fifteen open cars, recently purchased, were manufactured by the Pullman Company. Bemis, Brill and McGuire trucks are employed. Closed cars are provided with wire screens outside the windows, to protect passengers from accidents from the center poles by which the overhead construction is supported on Main Street. The new open cars have a double equipment of G. E. 800 motors, but the original motor equipment consisted chiefly of the Edison and S. R. G. types. Sixty equipments, of the Edison type, have recently been changed by the electrician of the company, and greatly improved, so that they are now doing very excellent service, and burnouts are rare. In the reconstruction, the commutated fields are changed to straight fields, and a rheostat employed, but which is cut out on the fourth point of the controlling switch. Strong fields, with 175 turns, are employed, and are connected in series. By this arrangement, three wires less are employed on the motor board, and one rheostat operates both motors. On some of the other motors the close coil armatures have been changed to open coil, and the cross connection of the

commutator avoided, so as to do away with two of the brushes, and with this arrangement no trouble is found with short circuits. It is also the practice of the electrician to equalize the two motors on each car after they are put in service. This is accomplished after testing the motors with amperemeters by the adjustment of the fields. Two meters are attached to a short board and placed upon the car in a convenient position (over the back of one of the seats in open cars), and are connected with the armatures in series. By watching the meters while the car is in service, a difference in the work they are doing is noted, and if one is found to be doing more than the other, the fields of this one are weakened by the spreading of the pole pieces, and the adjustment continued until a new one substituted with very little trouble and delay. This device was designed and is manufactured by the Livermore Foundry Company, of Memphis, and is said to be giving excellent satisfaction. This company is also the manufacturer of pinions, trolley wheels and other brass supplies for electric railways. The brake shoes on all cars are attached by means of adjustable slippers, and are cast to embrace the flange of the wheel. By this arrangement the shoes are readily removed and replaced. The cars are provided with a switch throw for the use of the motormen, which consists of a wooden handle an inch and a half in diameter and three feet long, which terminates in a thimble made from a two inch iron pipe, which is flattened at the lower end and slightly

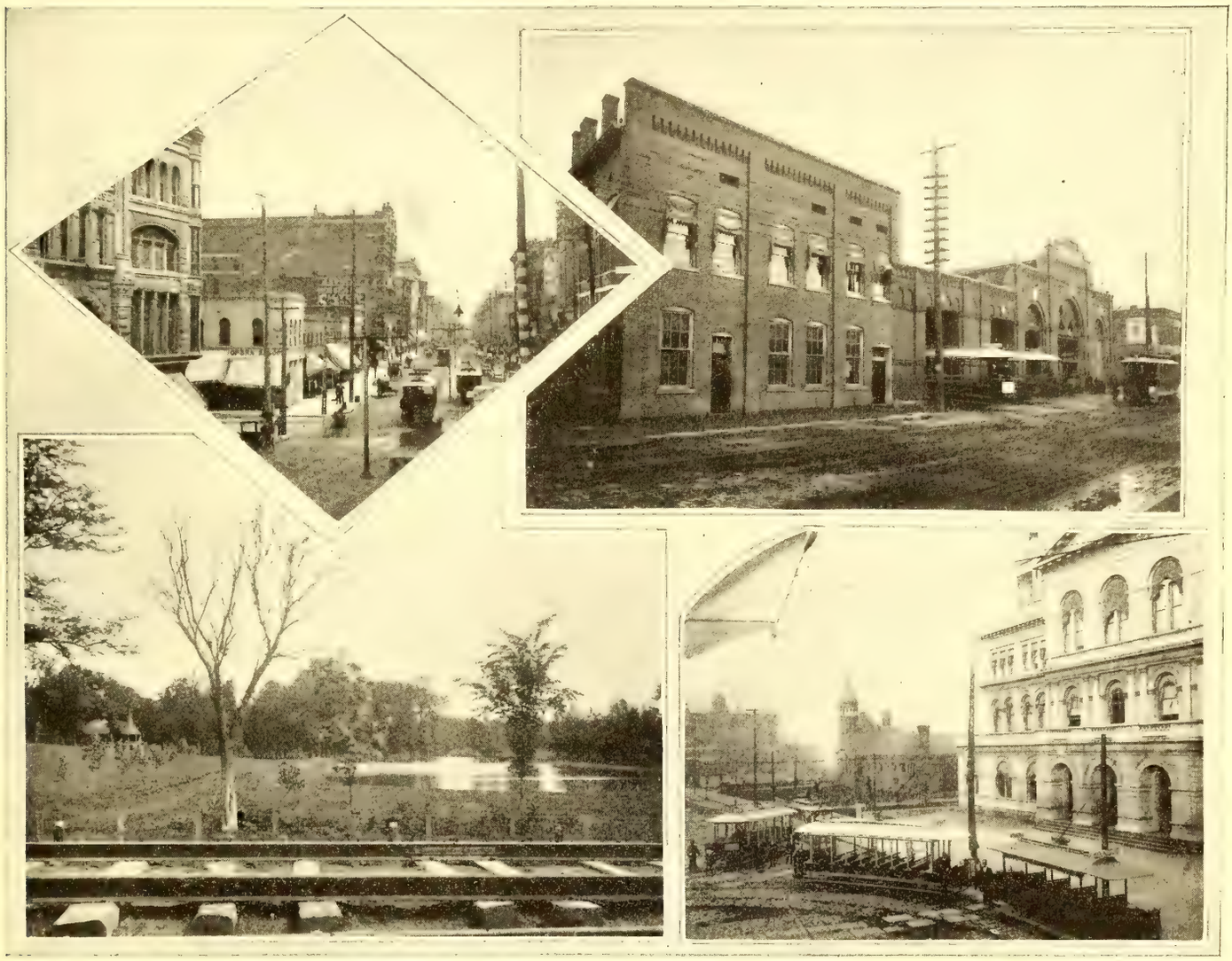


FIG. 6.—VIEW ON LINES OF THE CITIZENS' STREET RAILROAD CO.—MEMPHIS, TENN.

MAIN STREET CORNER OF BEALE.
EAST END PARK.
EXTERIOR CAR SHEDS AND OFFICE.
CUSTOM HOUSE ON FRONT STREET.

the work of the motors is equalized. The S. R. G. motors are equalized or adjusted by changing the position of the brushes. It is also found of advantage to use the same armature with the same fields. This, however, is more of a mechanical than an electrical advantage, as it insures a proper adjustment of pinions and brasses. Both solid and wave pinions are being employed, and the former are giving excellent satisfaction. A change is being made from six inch to four and a half inch gears and pinions. The narrow pinions have proven sufficiently strong, last equally well and make less noise. The pinions are all incased, and run in oil.

A composite gear is also being employed. This is constructed with a spider or split core which is attached to the axle by specially designed bolts and nuts. The removable rim is cast in two parts and held in position by bolts. When worn or broken the rim is removed and curved. This answers for turning the switch tongue, and also, in case of broken contact with the rail, the metal portion can be used to make contact between wheel and rail without danger of shocks to the person holding it.

The principal car barn, repair shop and office of the company is located at the corner of Gayoso and Hernanda Streets, near the business center of the city. The main building is a reconstructed horse barn, which has been enlarged by a brick addition containing the offices and repair shops. The repair shop is constructed with a brick floor and iron doors which make it practically fireproof. The power for operating the machinery in the repair shop is supplied by a ten horse power Eddy motor, and the machines embrace the usual equipment of iron working tools, together with a hydraulic wheel press.

The power station is located at the corner of Davies Avenue and Broadway, and is a brick building of pleasing

design. The engine room is 150 × 58 ft. and forty-five feet in height, with a truss roof support. The boiler room is about the same dimensions. The boiler equipment consists of three Hazelton tripod boilers of 500 H. P. each, with auxiliary equipment of Worthington pumps and Berryman heaters. The boiler sare provided with the Reliance water gauge whistle, of Cleveland, which sounds with a variation in the height of water of ten inches either way. Alabama slack coal is at present employed for fuel,

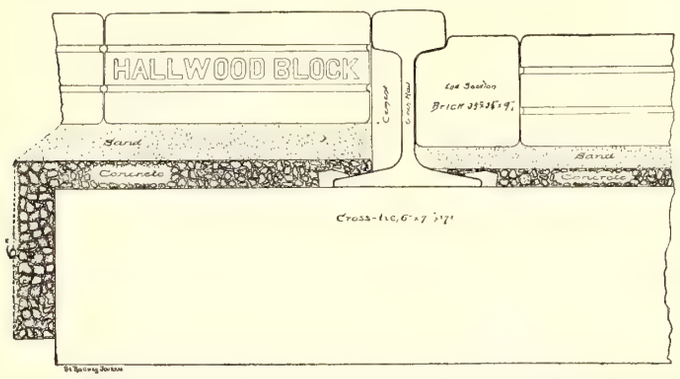


FIG. 7.—SECTION OF TRACK SHOWING T RAIL CONSTRUCTION—MEMPHIS, TENN.

which costs, delivered, $1.60 per ton, and it requires an average of twenty-five tons per day to operate the sixty cars. The feedwater is derived from two artesian wells, 500 ft. in depth, is comparatively pure, and forms no scale, but pits the iron with which it comes in contact to a considerable extent.

The power equipment consists of five Ideal engines of 250 H. P. each, making 230 revolutions. These are placed in a line to one side of the room, and are each belted direct to a 200 K. W. Edison generator, the shaft centers being from thirty to thirty-five feet apart. A slate switchboard is provided, on which Westinghouse instruments are employed. In connection with the circuit breakers, the electrician and engineer of the station have devised an alarm signal, which consists of a pair of V shaped copper springs placed just beneath the handle of the circuit breaker, so that when this falls the handle makes contact between the springs and rings a signal bell. The power is distributed over ten divisions by twenty-one feed wires. The minimum is 1,000 amperes to the maximum load, 1,600 amperes. The lights on the switchboard do not go out when the circuit breakers drop.

The auxiliary equipment consists of twelve Wason lightning arresters arranged in a case by themselves beside the switchboard. There are twelve General Electric lightning arresters and five Westinghouse on the outside lines. The station has suffered no harm from lightning discharge since September last, and only slightly then.

An overhead crane is mounted above the generators. This was built by W. C. Ellis & Son, Memphis. The metal oil tanks for the station supply are placed in a row near the entrance to the boiler room, and are joined by a half inch steam pipe, through which live steam from the boiler passes to keep the oils at a sufficient temperature to run freely.

Most of the original track construction consisted of a light girder rail supported on iron chairs, but chair construction is not in favor with the management, as it needs constant repairs. In the more recent construction on the paved streets a seventy-two pound, six inch T rail has been employed, which is spiked directly to the ties. Where the brick pavement is to be employed the tie is placed on a gravel foundation with concrete between and over the tie, so that the tie is enclosed in a pocket of concrete. Above this is a one inch layer of sand on which the bricks are placed. The bricks are of the Hallwood type. The T rail construction for paved streets, of which two additional miles are now being built, is both satisfactory to the city authorities and the street railway company. The experimental section which was first constructed on this plan is standing up excellently well. It is claimed that a T rail does not vibrate or disturb the pavement as much as rails of other types. The lines of the East End, outside the city limits, were constructed with a seventy-two pound T rail with gravel foundation.

The original bonding consisted of No. 4 iron wire, which had a short life only. In the present practice the rails are bonded with No. 0 copper wire. There are several overhead return wires, and an additional return has been made through the bayous. At points where the track crosses the bayous a nest of eight or ten old thirty-eight pound rails has been driven thirty feet into the soil by pile drivers, and to these the tracks are connected. In addition, old rails of the same weight are bonded with double 0 wires and connected with the driven rails, and are strung along the bayou to the power station. After the return conductors thus described were provided, it was noted that although fifteen additional cars were operated, less current was required than formerly.

OPERATING FEATURES.

The fare is five cents, with twenty-two tickets for a $1, excepting over the East End line where, beyond a designated point, the fare is ten cents, with tickets to residents twenty for $1. The line runs to the race track, and during the sporting season enjoys an enormous traffic. Ordinarily the headway is of fifteen minutes, but on race days it is reduced to four or five minutes. This line also passes East End Park, which is owned by the company. The park is provided with a handsome pavilion, where the usual park attractions are given. A very pretty lake with pleasure boats is a pleasing feature.

Conductors and motormen are paid fourteen cents

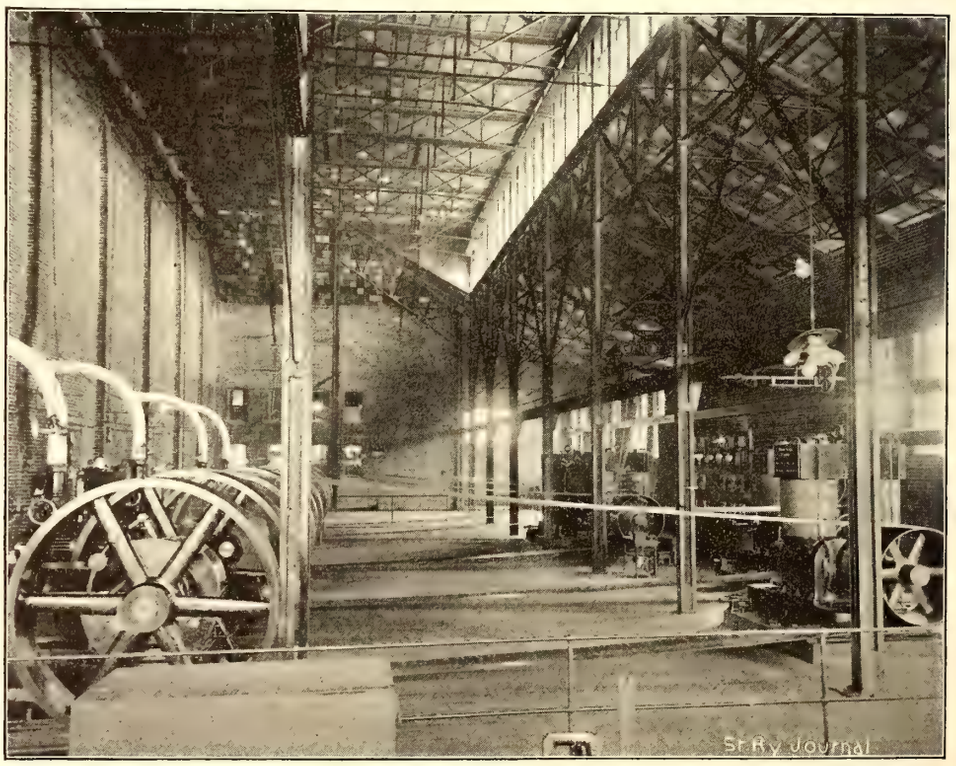


FIG. 8.—INTERIOR OF POWER STATION—CITIZENS' STREET RAILROAD. MEMPHIS, TENN.

an hour. 150 car men are employed and forty extras, and consist of a very superior class of men. It is not the custom of the company to employ men who have been engaged in street railway service in other cities. The assistant manager, Frank Smith, who has charge of the car men prefers to break their own men and accustom them to work according to the rules of the company; this also, in a measure, prevents the introduction of "tricks of the trade" that may be practised in other cities. The car men are required to wear a regulation uniform and when employed to make a deposit of $20 with the company, which is held as a guarantee against dishonesty or damage to property through carelessness.

An arrangement has been made with police authorities so that in case of accident men who are arrested are not taken from their cars. If the accident is not serious, the policeman telephones the street railway company, who guarantees to send the man to police headquarters as soon as relieved from duty. In case of serious trouble the policeman telephones the company to send relief and he accompanies the arrested person on this car until the relief appears, so that traffic is not interrupted. It is also a rule of the company that one car shall not pass another while discharging passengers without first coming to a full stop, nor are cars allowed to pass each other at street crossings.

Raleigh Springs Street Railway Company.

This is the line referred to above as running into the suburbs. It is a single track line about nine miles in length, constructed of T rails, and connects with Raleigh Springs, a resort northeast of the city. At the springs is a large hotel, the property of the street railway company. The line passes the United States Military Cemetery, about five miles distant from the city. Cars are run every thirty minutes to the cemetery, and every hour through to the springs. They are not run late at night. The line also passes through Binghamton, a new suburban manufacturing town, where is located the Memphis Car & Foundry Company, which was formerly located at Litchfield, Ill., and known as the Litchfield Car Works. The company manufactures steam cars and gives employment to a large number of people. It is expected the place will develop into a large village in the near future.

The rolling stock of the company consists of eight eight wheel cars mounted on the Brill maximum traction trucks. Only three cars are being run at present, however.

The power station is about midway of the line. The equipment consists of two Armington & Sims 100 H. P. engines, and two eighty horse power Thomson-Houston generators. There is a new 400 H. P. Reynolds & Corliss engine, and a 400 H. P., M. P. Thomson-Houston generator on the grounds, but not yet set up. The steam is generated in tubular boilers.

Single fares are fifteen cents, with round trip tickets for twenty-five cents. For about five months the line has been in the hands of Tate & Grosvenor, receivers.

C. B. F.

The Commonweal Movement in Spokane.

The managers of the Spokane Street Railway Company are enterprising men, and ready to improve any opportunity for increasing the traffic of their railway. A chance offered itself during the recent passage of one branch of the Coxey army through that city. One of the leaders of the movement, and member of the Pacific brigade of the Commonweal Army was Jumbo Cantwell, and his name became well known to everyone in Spokane during his stay in that city. His services were secured one Sunday as an umpire for a baseball game, and as the grounds of the club were on the line of the street railway company, banners announcing his engagement were placed on the cars for several days before the game. He proved to be a drawing card, and both the gate receipts of the ball clubs and the passenger receipts of the street railway company were materially increased. Our engraving gives a view of one of the cars with announcement.



ADVERTISING A BASE BALL ATTRACTION—SPOKANE.

THERE are a number of indications that business is improving, one of which is the statement of the Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., that for the thirty days previous to June 19 that company received orders for 1,077 of its improved alarm passenger registers.

The Bayard Street Station of the Third Avenue Railway Company, of New York.

Full particulars of the main cable power station of the Third Avenue Railway Company, New York, and of the track construction and rolling stock of the company have been published in the Street Railway Journal. The downtown station of the company is located at the corner of the Bowery and Bayard Street, and operates that portion of the line from 6th Street to the Post Office. This station has just completed its trial run of ninety days after installation by the Pennsylvania Iron Works Company under the supervision of the company's engineers, B. W. Grist and E. A. Moore. The run has been accomplished without a single hitch in the operating of the plant, a record which is especially remarkable, and we believe deserves comment at this time.

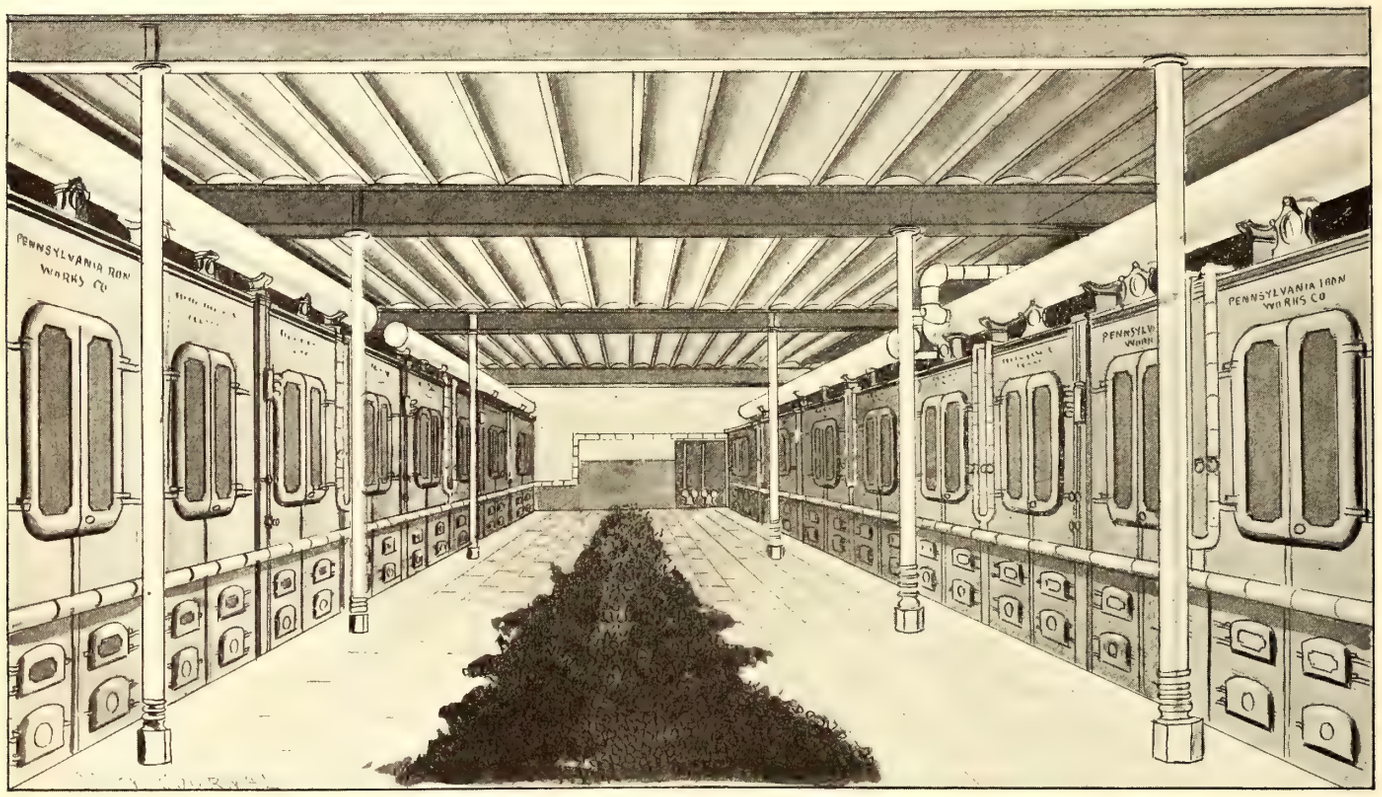
The plant operates three ropes and contains two engines of the George H. Corliss type, with cylinders forty inches in diameter by seventy-two stroke. They are connected to the main line shaft direct by means of plate couplings with crosskeys made of cast steel. The main line shaft is made up of three sections, each provided with a coupling similar to the ones connecting the engines. The shafts are eighteen inches diameter in the journals and twenty inches diameter in the swells, and are mounted in extra large pedestals supported on heavy cast iron adjusting stands, in every respect similar to those that have been described and illustrated heretofore in connection with the 65th Street power station.

The system of driving at this station is by means of the Lambeth cotton rope, and there are three sets of driving gear. The small driving drums are three in number; two of these are nine feet in diameter, and one seven feet six inches in diameter, each containing grooves for twenty-two two and a quarter inch diameter cotton ropes. They are mounted loosely on the sections of main shafting, and are fitted to engage with the Weston Walker friction clutches. The large rope driving drums are thirty-two feet in diameter, and contain the same number of grooves. These are mounted on shafts twenty-four inches diameter in the swells and twenty inches in the journals. A steel spur gear sixteen feet in diameter, sixteen inch face and four and a half inch pitch is mounted on each of the large rope drum shafts, and is geared into an overhanging pinion which in turn transmits the power to a spur gear of equal dimensions with the larger ones, for the purpose of driving the secondary cable drum.

The shaft of the secondary cable drum is eighteen inches diameter in the swell and fifteen inches in the journal, is substantially mounted in pedestals similar in design and construction to those described for the other part of the plant. The cable drums are fifteen feet in diameter for the fast rope and thirteen feet in diameter for the slow rope. The fifteen foot diameter drums are for operating the fast ropes, and the smaller diameter for the slow or loop rope. The fast ropes out of this station run to the terminal vault at the Post Office, back to the 6th Street vault at 6th Street and Third Avenue, thence to the station. The slow rope merely operates from the station to and around the balloon loop at the Post Office, and carries the cars back to the pick-up point opposite the *Times* Building, as described in our issue for January, 1894.

A pair of auxiliary engines has been provided, together with the necessary line shafting, sliding gear, pinions, etc., for overhauling either of the cables at will for purposes of examination, thereby dispensing with the necessity for using the large engine.

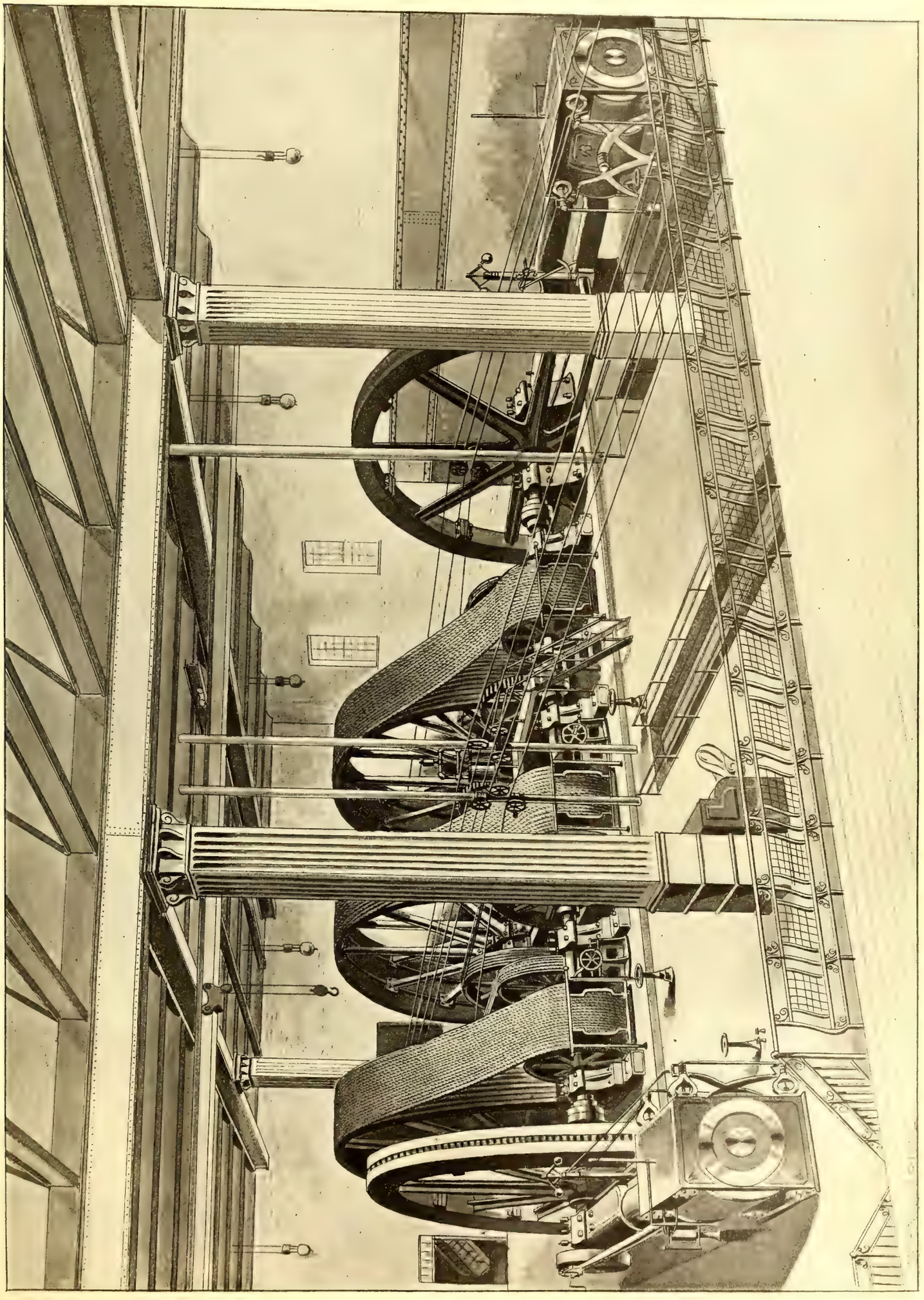
The steam service at this plant is composed of six-



BOILER ROOM—BAYARD STREET STATION OF THIRD AVENUE RAILWAY, NEW YORK.

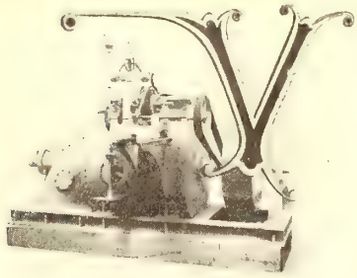
teen horizontal tubular boilers six feet in diameter by eighteen feet long. They are placed in two batteries of eight boilers each, and these in turn are divided into two nests of four each. The boiler room is placed on a grade level with the sidewalk, while the machinery floor level is forty-five feet below this point. The heaters, two in number, of 1,000 H. P. capacity each, of the Goubert type, are placed in the boiler room, as are also the two 10 × 6 × 10 in. Snow duplex pumps and two Monitor injectors, all in close proximity to each other, and are especially well arranged for their accessibility and manipulation.

Owing to the short distance which this plant afforded for tension runs and apparatus, it has been imperative to devise some special means for securing the maximum amount of travel on a short run to obviate the necessity for shortening the ropes. A special type of tightening agent has been provided in the "direct tension" weights, whereby a sufficient travel has been obtained equal almost to the length of the run, and the take-up gear instead of being a part of the tension carriage, as in most instances, is permanently fixed at the extreme end of the run. The lead of the ropes, to which the weights are suspended, is secured by means of an overhead structure, to which the carriage sheaves and brackets are attached, thus maintaining the much desired space in the reel room, which is on the same level with the machinery floor.



INTERIOR OF BAYARD STREET POWER STATION.—THIRD AVENUE RAILWAY, NEW YORK.

The Electric Long Distance Transmission Plant at Portland, Ore.



VERY many street railway managers are now directing their attention to the subject of the long distance transmission of power, and believe that in many sections of the country where cheap sources of energy are available it will often prove more economical to carry this power for some distance to the point of use than to employ more expensive methods of power generation on the spot. An interesting example of a long distance transmission of power plant is that at Portland, Ore., a number of illustrations of which we present herewith.

The Portland General Electric Company, of Portland, Ore., of which P. F. Morey is president, H. W. Goode is manager, and W. C. Cheney electrician, was organized two years since with a capital stock of $4,250,000, has purchased the entire water power embraced in the falls of the Willamette River at Oregon City, twelve miles above the city of Portland. The minimum capacity of the river at this point is estimated to be 50,000 available H. P., under a head of forty feet. The steppe of the falls is composed of basaltic rock, and has a very irregular outline, being worn into fantastic shapes by the action of the water. A dam was thrown across the river some years since following the irregular lines, and there are numerous factories and mills in operation, to which over 4,000 H. P. of direct water power is now leased (Fig. 1).

One of the principal plants that are here operated by water is an electric station, situated on a rocky island near the middle of the river, at which an electric current is generated and transmitted to Portland, where it is employed for lighting the streets and dwellings of the city,

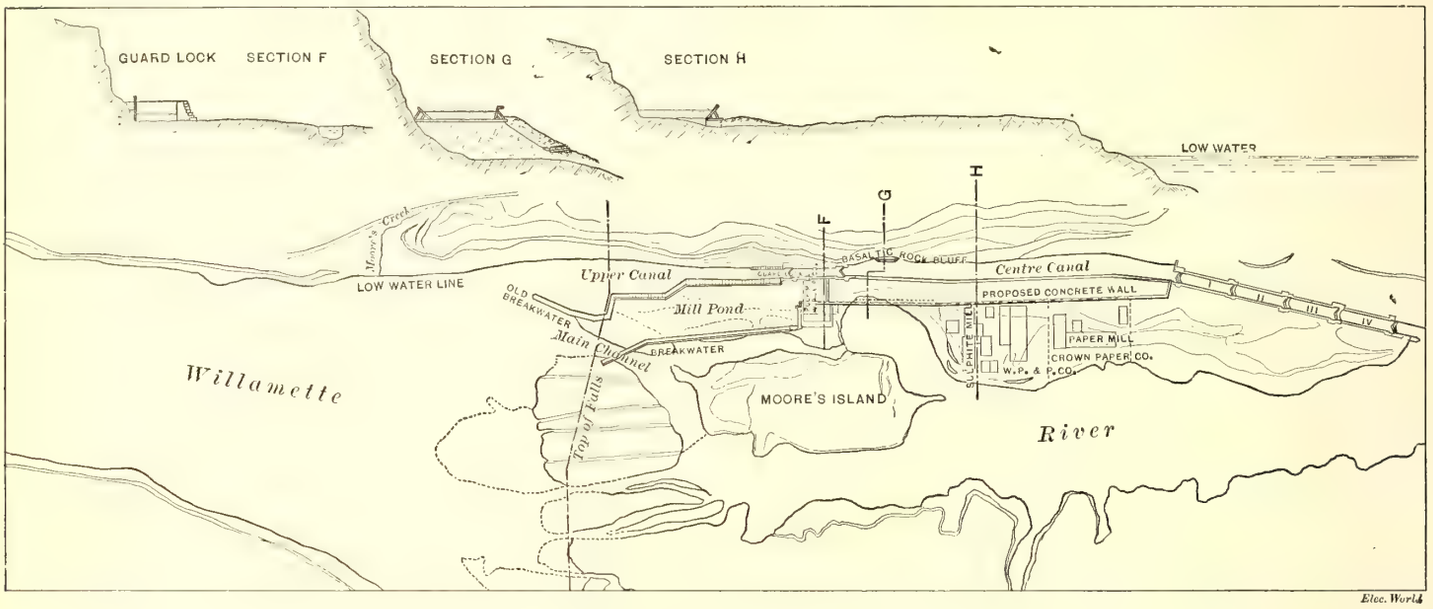


FIG. 1.—MAP SHOWING LOCATION OF ELECTRIC LONG DISTANCE TRANSMISSION PLANT—PORTLAND, ORE.

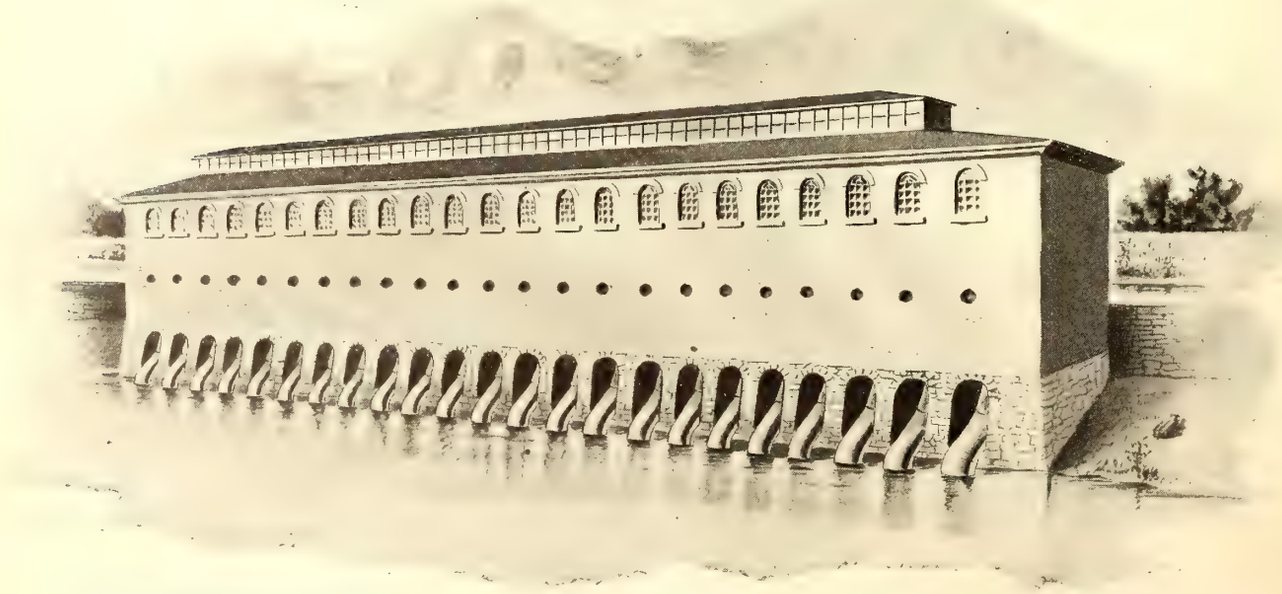


FIG. 2.—EXTERIOR OF POWER STATION—ELECTRIC LONG DISTANCE TRANSMISSION PLANT, PORTLAND, ORE.

and also for the operation of that section of the East Side Street Railway lying between Oregon City and Milwaukee, a distance of seven miles. For the running of the lighting generators, seven vertical Victor turbine wheels are employed and one 500 H. P., horizontal wheel of the same type, while one 200 H. P., horizontal wheel drives the railway generators. The loss, it is claimed, in the transmission of the lighting current to Portland, a distance of twelve miles is only 10 per cent.

The purchase embraces 1,600 acres of valuable land in the neighborhood, having a river frontage of about three and a half miles, which takes in all the valuable sites of manufacturing institutions. It also embraces a ship canal and locks on the west side of the river, which were constructed some years since under a subsidy from the state of Oregon of $200,000, the entire cost being about $650,000. By means of the canal and locks the large steamboats which ply on the river between Portland and up-river points, are carried past the falls, the river being navigable for about seventy-five miles above.

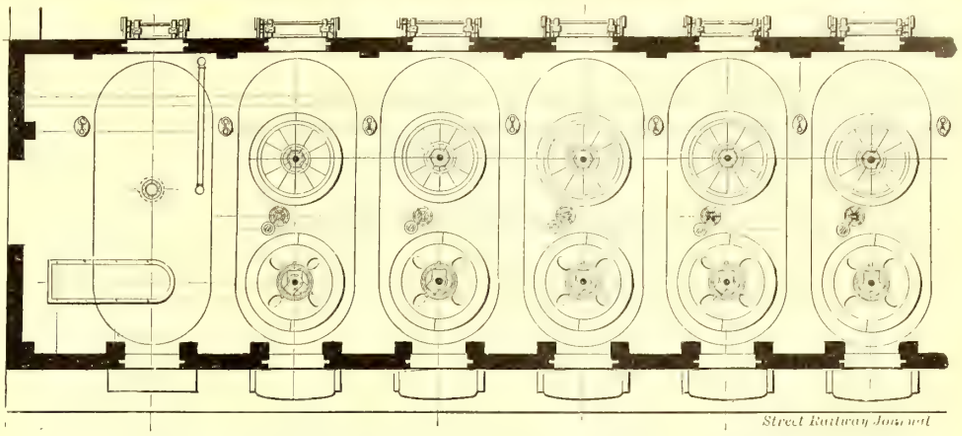


FIG. 3.—PLAN OF DYNAMO ROOM—ELECTRIC LONG DISTANCE TRANSMISSION PLANT—PORTLAND, ORE.

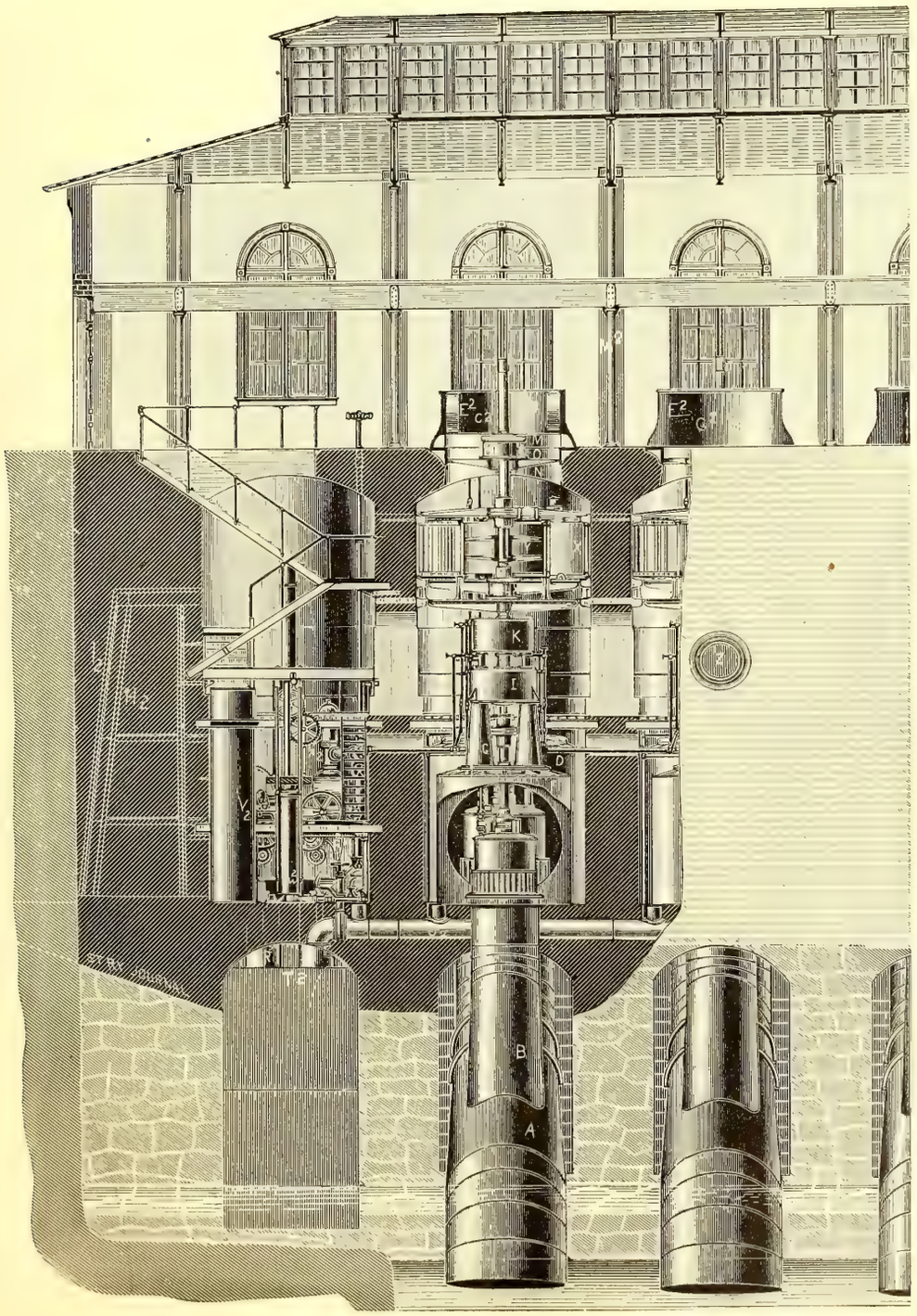


FIG. 5.—LONGITUDINAL ELEVATION OF THE UP-STREAM END OF POWER STATION, SHOWING PART IN SECTION—PORTLAND, ORE.

The new power station (Fig. 2) which is now being constructed and which was briefly described in the May, 1893, issue of the STREET RAILWAY JOURNAL after a personal visit, is located on the west side of the river, opposite Oregon City, and borders the canal, the front wall being a portion of the new concrete wall which has been built for the purpose of widening the canal, and through which the water is to be led to the wheels, and new and substantial bulkhead gates have been installed. The ultimate capacity of the new station is to be 12,000 H. P.; only 6,000 H. P., however, is to be at present installed.

The structure is to be of concrete, stone, iron and brick, is to have an ultimate length, parallel with the river, of 364 ft., and the eaves are seventy-seven feet above mean low water mark, the width of the building being thirty-eight feet. The water is to be taken from the canal, and after passing through the wheels is discharged into the river below. The accompanying illustration (Fig. 2) presents the river side of the structure, from which it will be noted that the upper floor is lighted from transoms in the monitor roof, and by a row of ordinary windows, while the middle floor is lighted through circular openings in the wall, four feet in diameter, but which terminate on the inside with a bull's-eye sash and glass, three feet in diameter, and made

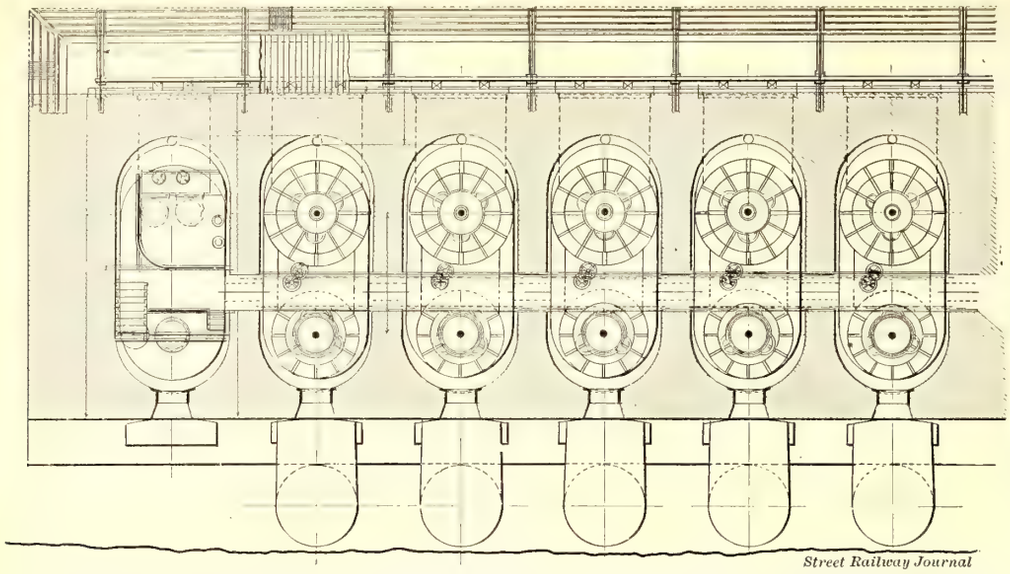


FIG 4.—PLAN OF STATION ABOVE WHEELS AND FLUMES—ELECTRIC LONG DISTANCE TRANSMISSION PLANT, PORTLAND, ORE.

to close watertight, like the bull's-eyes in the sides of ocean steamers. These are designed to protect the interior during periods of excessive high water. Figs. 3 and 4 are the floor plans.

The units of power, of which there are to be ten in the present equipment, each entirely independent of all the others, are located as shown in the engravings, and consist of a pair of vertical, cylinder gate, improved Victor turbine wheels, of forty-two and sixty inches diameter, respectively (Figs. 5 and 6). The large wheel is auxiliary to the other, and is provided for use only at periods of excessive high water which, according to the records, occurs, usually, every five years. The wheels, it will be noted, are located on the same level, one in the rear of the other, and only about one-half the distance below the level of the water, the theory being that the weight of the water in the discharge or draft pipe is as thoroughly utilized as if it were all above the wheel. The lower end of the pipe being always below the surface of the water in the tail race, it is hermetically sealed, so that the weight tends to form a vacuum next the wheel.

The generator of each unit is of 600 H. P. capacity, and is located on the upper floor of the building, with the armature in a horizontal position attached to the vertical shaft of the forty-two inch wheel, and is thirty feet above the wheel which is designed to run at a speed of 200 revolutions per minute. The shaft of the sixty inch wheel, which is to be employed only at periods of high water, is provided with a horizontal belt pulley, twelve feet in diameter, with a forty-eight inch face, from which the power is transmitted by a leather belt to a six foot receiving pulley on the generator shaft, both being placed twelve feet above the wheel. By this reduction the large wheel, which makes but 100 revolutions per minute, will drive the generator at a uniform speed of 200 revolutions, the same as the forty-two inch wheel. When it becomes necessary to employ the large wheel, the generator shaft is uncoupled from its wheel at a point just above the flume, and the belt is brought into contact with its pulleys by means of the tightener pulley shown in Fig. 7

In order to support the belt in place when not in use, the pulleys are all surrounded by a shelf and rack, with perpendicular pipe guards, which is also attached to the tightener pulley, and which, by the movement of the latter away from the belt, carries the belt with it, and causes it to spring away from the surface of the small pulley, so that it receives no frictional wear while idle.

The most interesting features of the equipment are the bearings (Fig. 8) which are employed to support the weight of the vertical shafts, which in the case of the armature and shaft aggregates 33,500 lbs. The wheel shafts are supported on double step bearings, as is customary in vertical turbine wheels, but these not being sufficient to carry the weight of the shaft and armature, extra bearings

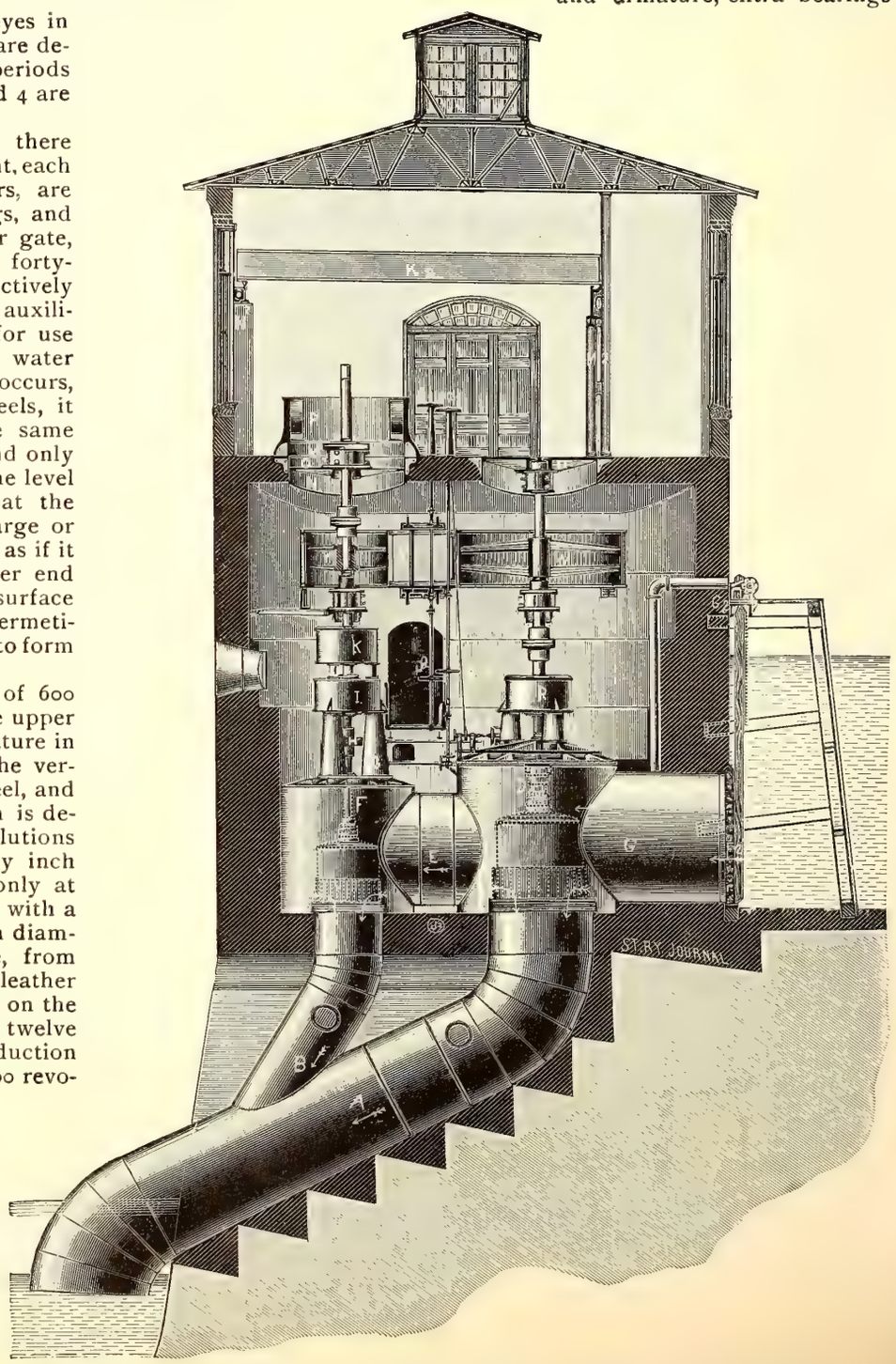


FIG. 6.—SECTIONAL ELEVATION OF 42-INCH AND 60-INCH WHEEL ROOMS, LOOKING UP STREAM—PORTLAND, ORE.

are provided, and these are of two types; a ring thrust bearing, similar to those commonly employed on the propeller shafts of steamboats, and an hydraulic oil bearing which supplements the ring bearing on the generator shaft. Both types are enclosed in cases to which the oil is delivered by hydraulic pressure, and all the cases are waterjacketed, for the purpose of absorbing the heat generated by the excessive friction. The ring bearings are adjustable, and so constructed that the oil cannot fly off or run down the shaft. The generator shaft which is twenty-nine feet in length and eight and three-eighths inches in diameter, while it is an extension of the shaft of the forty-two inch wheel, does not rest upon the latter, but the faces of the disk couplings, through which the power is transmitted, are ordinarily about one-half inch apart. The couplings are connected by twelve two inch vertical bolts, which are tapered at the lower ends, and held firmly into the lower plate by means of

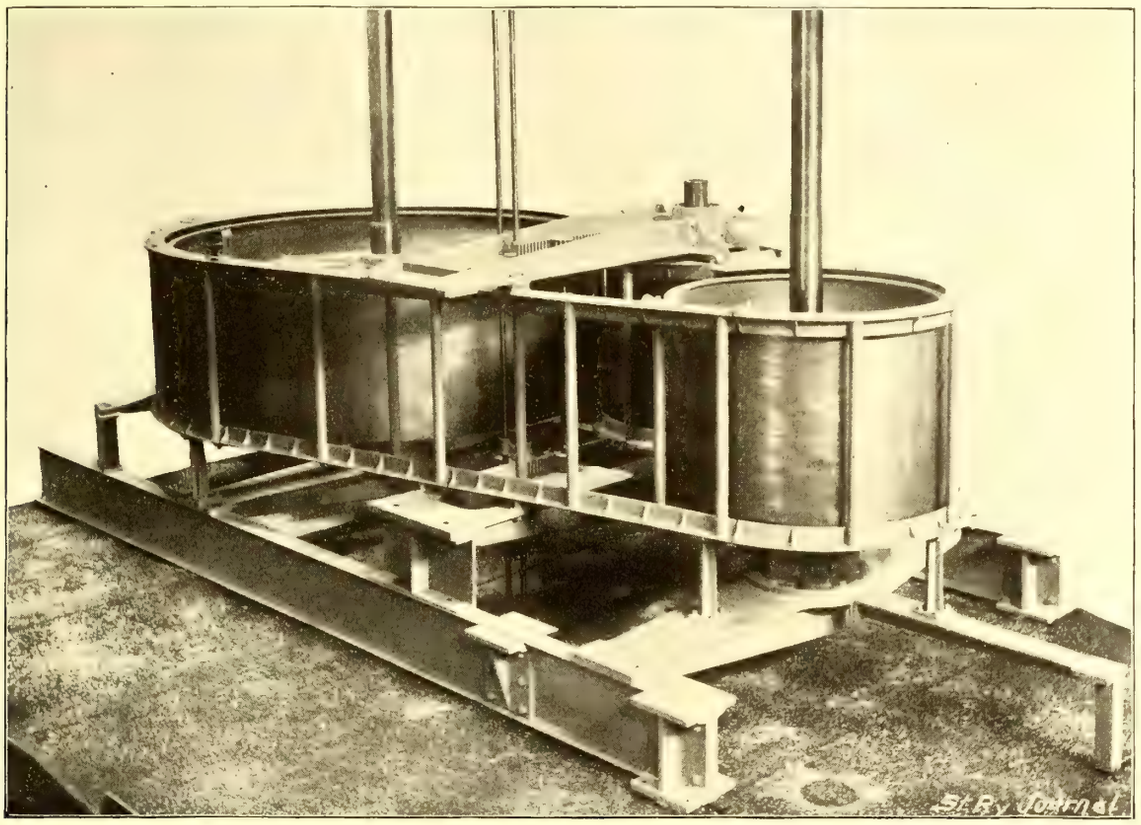


FIG. 7.—COUPLING PULLEYS, BELT TIGHTENER AND SHELF FOR SUPPORTING BELT WHEN IDLE—PORTLAND, ORE.

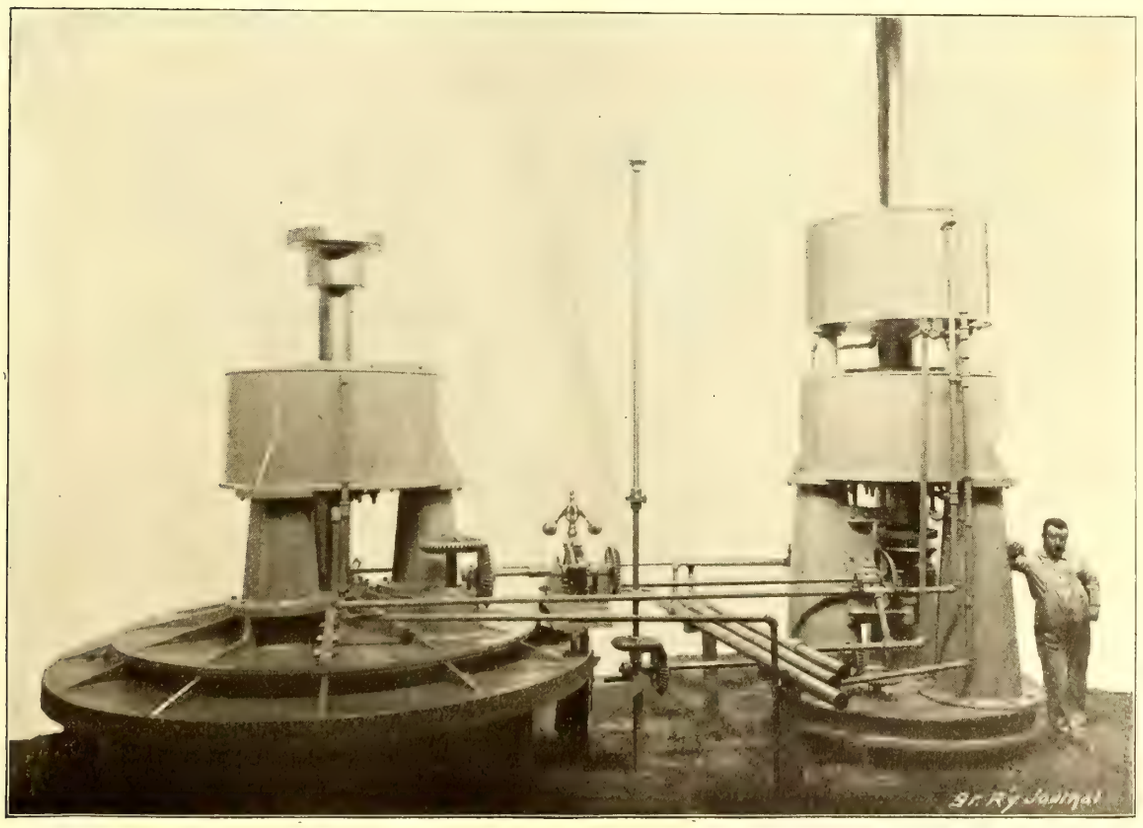


FIG. 8.—HYDRAULIC AND THRUST BEARING CYLINDERS TO CARRY GENERATOR SHAFT—PORTLAND, ORE.

heavy nuts, but simply pass through close fitting holes in the upper plate so that the generator shaft has a slight free movement up or down, and may be readily uncoupled from the wheel shaft by removing the nuts and lifting out the bolts. The extension of the sixty inch wheel shaft is twenty-three feet long and nine and three-eighths inches diameter and is supported by a ring thrust bearing only. It is designed that the hydraulic oil bearing shall carry the load of the generator shaft under ordinary conditions, but it may all be transferred to the ring bearings when necessary. In the construction of the hydraulic bearing the shaft is encircled by a four inch ring, which has its lower face inserted in a sealed case which is filled with oil and kept at a constant pressure of 275 lbs. per square inch. The thrust bearing cases, it will be noted, are supported in each instance on cast iron pedestals which rest on the top of the wheel flumes.

Both water wheels are controlled by the same vertical shaft which is provided with a hand wheel on each floor, marked C, and B (Figs. 5 and 6), and both are regulated by the same governor (shown in Fig. 8). By the shifting of the beveled gears on the governor mechanism, the gates of either wheel are operated by the one hand wheel and governor as desired. The belt tightener is also controlled from either floor by means of a hand wheel (Figs. 6 and 7).

The water is admitted to the penstock from the race by means of head gates operated from a platform alongside of the building, each of which is provided with a small gate which is first opened and which allows the penstock to fill, and so balance the pressure against the main gate when it is readily raised. The penstocks are each ten feet in diameter, and are constructed of riveted steel plates. The flumes which enclose the wheels have cast iron heads and steel sides, and are so arranged that the water passes first through the large flume and on through a short penstock to the flume of the forty-two inch wheel, and from the wheels it is discharged directly into the draft tubes, which are re-united before reaching the tail race. The draft tubes are thoroughly anchored to the steps of the foundation as shown.

The wheel guide, or case, is shown in Fig. 9. The paddle-like openings, are the intake chutes, which are closed by means of a hollow cylinder gate which fits the openings closely all around. The turbine is mounted within the gate, which, on being raised, allows the water to pass through the chutes on all sides, when it comes in contact with the curved buckets of the wheel, and passing through is discharged at the under side of the wheel, so that the force of the water is practically applied to the wheel at two points, first by impact against the buckets, and second by the reaction of the discharge. The cylinder gate is raised or lowered by means of the beveled gears shown in the figure, and is balanced by means of a wire rope and weight operating over the grooved pulley shown on the opposite side of the wheel case from the gears. Ordinarily the Snow governor is employed for the regulation of the Victor turbine wheels, but more recently a combined electrical and mechanical governor has been devised for use in electrical power plants, which has proved sufficiently sensitive to readily conform to the widely fluctuating loads that are characteristic of electric power plants.

The auxiliary power equipment of the station consists of a set of pumps, including an hydraulic pump for supplying oil to the thrust bearing cylinders, and a duplex water pump for keeping up the circulation in the water jackets about these cylinders. The pump room occupies the first, or left hand section of the building shown in Fig. 12, and the pumps are operated by means of two fifteen inch horizontal Victor turbines, enclosed in the same flume, one of which operates the duplex power pump for supplying the cylinder jackets, and the other the hydraulic oil pump. The oil is first delivered to the accumulator shown in Fig. 11, the plunger of which is weighted so that the pressure is kept uniformly at 275 lbs. to the square inch. The arm of the accumulator is connected with a governing mechanism, and automatically regulates the supply of oil in the cylinder. The pipes connecting the pump with the accumulator are provided with check valves, so that in case there should be a break in the pipes at any point, the pressure would not be reduced in the supply pipes or cylinders.

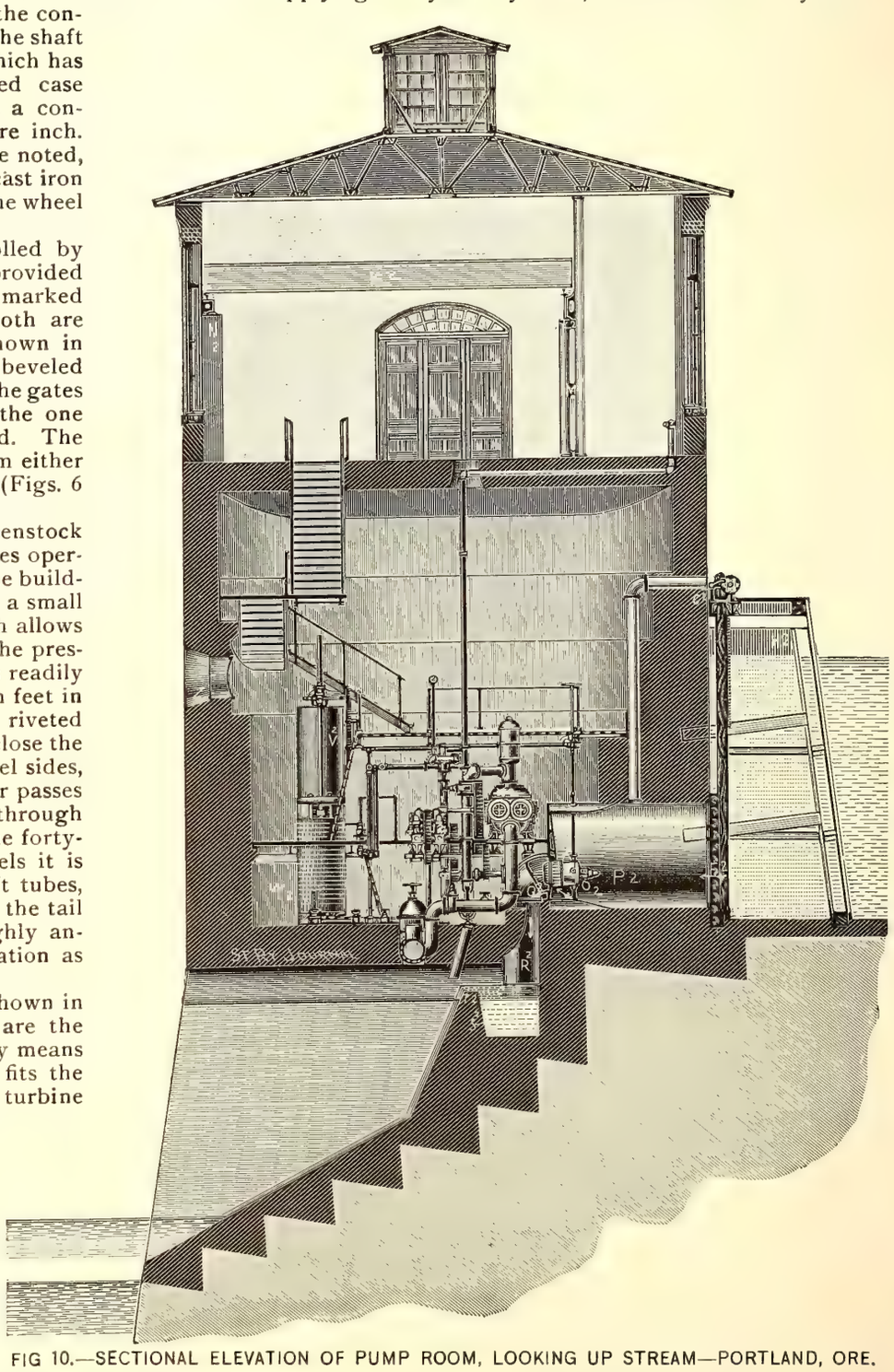


FIG 10.—SECTIONAL ELEVATION OF PUMP ROOM, LOOKING UP STREAM—PORTLAND, ORE.

Another chamber which occupies the center portion

of the building, or the first one to the right of the first ten units, is known as the exciter room (Fig. 12), and is provided with a pair of vertical turbine wheels and generators. The wheels are each forty-eight inches in diameter, and operate a pair of exciters of 400 H. P. capacity at 125 revolutions per minute, each of the armatures of the exciters being attached to the vertical shafts of the turbines in the same manner described for the generator armatures, both shafts being provided with ring and hydraulic thrust bearings. In this case the shafts are not belted together as in the generator room. The turbines are controlled by hand wheels from both floors, as shown at A_4 and B_4 (Fig. 12). Ordinarily it is expected that one exciter will be sufficient to energize the fields of all the generators, but two are provided in case one is idle from any cause. Adding the capacity of the exciting generators to that of the power generators, the ultimate electrical capacity of the station will be 12,800 H. P., divided into twenty-two separate units.

An electric overhead traveling crane of twelve tons capacity is provided in the generator room for the purpose of handling armatures and other heavy parts. This crane has a longitudinal movement of about 360 ft., and a cross movement of twenty-four feet six inches. The switchboard is to be located near the center of the station, and supported against the columns which carry the crane.

RECAPITULATION.

Fig. 1 is a map of the falls, and not only shows the location of the new plant, but also the industrial plants now in operation. Fig. 2 is an exterior view of the power station of the Portland General Electric Company, looking from the river side. Figs. 3 and 4 are ground plans of the upper and lower floors, showing the position of the wheels and generators together with the draft tubes. Fig. 5 is an elevation of the building with the side broken out, showing to the left the interior of the pump room, one of the power units, and a portion of the second unit, looking shoreward from a position in the river. Fig. 6 is a cross section showing a pair of wheels and the generator, from a position looking up stream. In these figures, A and B are the draft tubes, C and E the penstocks, D and F the flumes enclosing the wheels, which are shown by the dotted lines, G and Q the pedestals supporting the bearing cylinders, H the shaft coupling, I and R the ring thrust bearing cylinders, K the hydraulic cylinder, which are also shown enlarged in Fig. 8, W the twelve foot transmission pulley, Y the six foot receiving pulley on the generator shaft, X the belt tightener. Views of these parts are also given enlarged in Fig. 7. P is the generator, C_2 and B_2 the hand wheels for controlling the gates; E_2 and D_2 the hand wheels for controlling the belt tightener pulley, and A_2 the governing mechanism, which is also shown in Fig. 8.

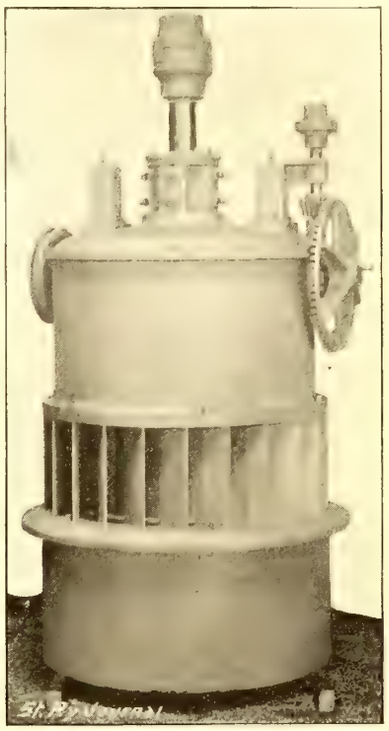


FIG. 9.—NEW UPRIGHT VICTOR WHEEL COMPLETE, SHOWING INTAKE SHOOTS—PORTLAND, ORE.

Figs. 10 and 11 show the arrangement of the pump room, in which P_2 is the penstock and O_2 the two fifteen inch wheels which operate the pumps from which the water is discharged through the draft pipes, R_2, to the well, S_2, from which it overflows and passes to the river below. X_2 is the duplex water pump and U_2 the hydraulic oil pump, from which the oil is delivered to the accumulator, V_2.

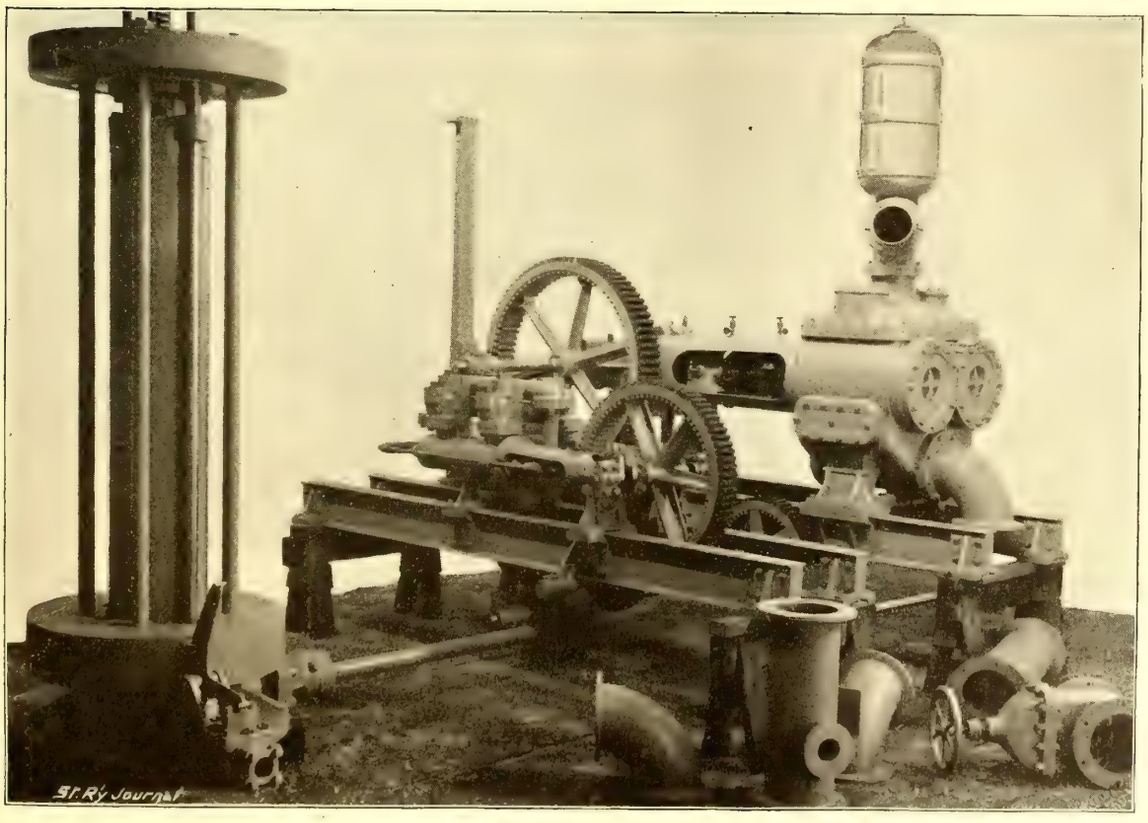


FIG. 11.—PUMPS AND ACCUMULATOR FOR SUPPLYING OIL TO HYDRAULIC GEARINGS AND WATER TO JACKETS OF ALL CYLINDER BEARINGS—PORTLAND, ORE.

Fig. 12 is a cross section showing the pair of forty-eight inch wheels and the two exciters, from a position looking up stream. Corresponding parts are lettered the same as in the other figures, but it will be noted that each shaft is supported by both a ring and a hydraulic bearing.

L_2 and N_2 (Fig. 12) are the tracks which support the traveling crane, Z is the bull's eye through which light is admitted to the lower room, and G_2 indicates one of the race gates.

There is a drain pipe extending the whole length of the building for the purpose of removing the seepage water, should any penetrate the walls during periods of high water. C_4 is the drain pipe, by means of which the water in the race may be discharged.

The entire power equipment of the station was manufactured by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, O., of which R. N. King is president, after designs made by the general superintendent and engineer of the company, A. C. Rice, who also made the building plans, and plans for the enlargement of the canal and of the head gates.

The entire electrical equipment is furnished by the General Electric Company, of New York, Boston and Chicago, and the generators are among the largest yet to be constructed where the armature revolves in a horizontal position. The electrical equipment of the plant, although not described in detail, is of as equally high order as that of the power equipment, and it is expected that the transmission can be made to Portland, a distance of twelve miles, with less loss even than that of the old plant, which, as before noticed, is only 10 per cent. When fully in operation it is expected sufficient power will be delivered to operate all the street cars of the city, light and warm the houses, and supply power to most of the manufacturing establishments, as well as for the operation of store and hotel elevators. The operation of the plant will be watched with a great deal of interest, at it is among the first attempts in this country to transmit so large a horse power to so great a distance by electricity.

THE STILWELL-BIERCE & SMITH-VAILE COMPANY, OF DAYTON, O.

The company controls and operates two large shops in the above city, one of which (Fig. 13) formerly known as the Stilwell & Bierce shops, is located about a square below the Main Street bridge on the Dayton View Hydraulic, or race, leading from the Miami River, and from which the water is drawn for power purposes. The other, formerly known as the Smith-Vaile shops, is at North Dayton, on the Mad River, above the point at which it joins the Miami (Fig. 14).

The former plant consists of a number of brick buildings which cover a large area, and is devoted exclusively to the manufacture of turbine wheels, penstocks, flumes, shafting and gearings for a complete water power equipment. The second plant is devoted to the manufacture of hydraulic machinery, steam pumps, including oil mill machinery, and feedwater heaters and purifiers. The company employs about 750 hands in the two plants. The machine equipment for the manufacture of turbines is very complete, including a number of machines designed and manufactured in the company's plant. Among these are large pit lathes, on which the turbines, or large pulleys, can be bored and faced at the same operation. There are hoists and transfer cars for the convenient handling of heavy parts.

Great care is exercised in the construction of all the machinery, even the foundation frames for the turbines being surfaced on the planer, and all junction parts are carefully faced by machinery, so that close fitting joints are obtained. The company has gained a wide reputation in the manufacture of the Victor turbine wheels, and has had the contracts for the equipment of many of the largest water power plants in this country, including many in New England for the operation of cotton, woolen and pulp mill machinery, and also in many foreign countries.

This company was the first to employ to any extent the turbine wheels in a horizontal position, and it has a number of these wheels operating street railway electric power plants, several of which have been illustrated and described in our columns during the last year; notably, the plant of Great Falls, Mont.; Spokane, Wash.; Oregon City, Ore.; Augusta, Ga., and other points.

Interior views of the erecting room are shown in Figs. 15 and 16, and illustrating an equipment of twin turbines, twenty-seven inches in diameter, with penstocks ten feet in diameter in process of construction. Fig. 17 shows a single twelve inch Victor turbine manufactured

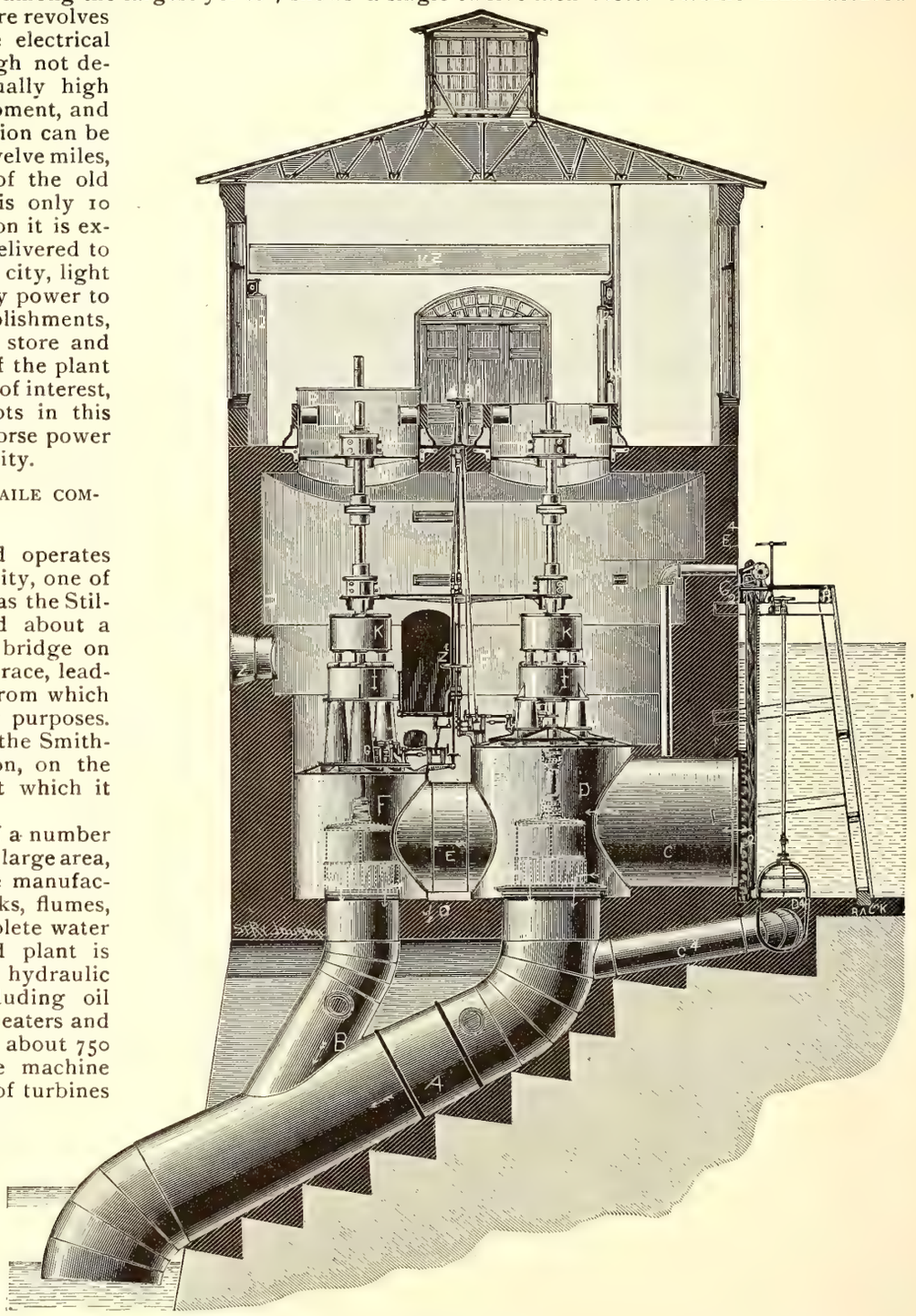


FIG. 12.—SECTIONAL ELEVATION OF 48-INCH WHEEL ROOM, LOOKING UP STREAM—PORTLAND, ORE.

for Fred. Nell, London, Eng., and in Fig. 18 is a single ten inch turbine of the same type, provided with friction couplings designed to operate two generators.

Fig. 19 shows the latest design for a flume for a pair of wheels. The company manufactures two types of Victor turbines, those with a register, and with a cylinder gate. The register gate is provided with openings which, when it is revolved on its axis, register with the intake chutes, and allow the water to come in contact with the wheel. The cylinder gate is a closed cylinder which is raised vertically, or drawn sideways, horizontally, so that

the water passes underneath the gate, and the volume depends upon the distance to which the gate is opened. The company builds either a register or cylinder gate type, but recommends the latter in most cases.

It is needless to say that in design and mechanical structure the turbines manufactured by this company are of a very superior order.

One of the most interesting plants recently designed is that of a wood pulp mill, at Plattsburgh, N. Y., in which eleven horizontal turbines are employed, which are operated from a single penstock, thirteen feet in diameter, and about 500 ft. long, to the shafts of which the grindstones, which reduce the logs to pulp, are directly connected.

As said above, the east shop, of which a birdseye view is presented in Fig. 14, is devoted to the manufacture of hydraulic machinery, steam and power pumps, cotton and linseed oil machinery, filter presses, etc., and was formerly known as

THE SMITH-VAILE SHOPS.

The buildings are very extensive, and are equipped with a larger and better assortment of iron working tools than is usually found in similar establishments. The large tools are all served by pneumatic lifts and trolleys, the air cylinders being supported by trolleys, and all are very quick acting. Lifts of this character are essential in a plant of this kind, for some of the castings are very heavy,



FIG. 13.—BIRD'S EYE VIEW OF THE STILWELL-BIERCE WORKS—DAYTON, O.

ilar to those employed in hotel offices, and whenever a workman is in need of a tool of any kind he touches a button, a boy responds to the number, and then brings whatever tool is required, a check for the number of the workman being deposited for every tool drawn from the tool room. By this arrangement an accurate record is kept of the tools, and if one of the tools should be broken or lost it can be at once traced to the man who drew it. There is also a time record clock provided, and the employes are checked in and out of the shop.

The foundry is provided with an overhead traveling crane, which spans the whole floor. It is operated by hydraulic lifts through the medium of wire ropes. There are three hydraulic cylinders located on one side of the shop, and two on the other, so that the crane has a movement in four directions. The lifts are controlled by levers on a platform on one side of the foundry.

For making the smaller standard parts two or three moulding machines are provided.

There is also a hydraulic elevator or lift, by means of which the metal and coke are elevated for the purpose of charging the cupolas.

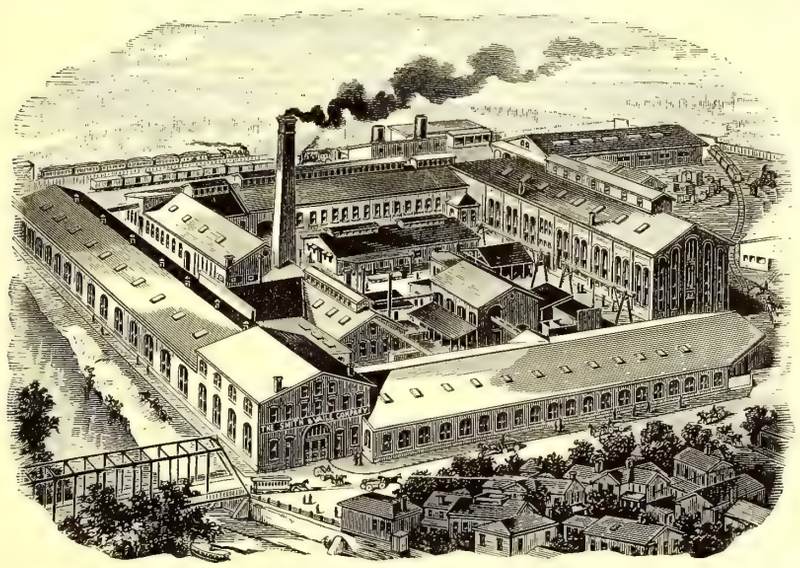


FIG 14.—BIRD'S EYE VIEW OF SMITH-VAILE WORKS—DAYTON, O.

especially those for the cylinders of the hydraulic oil presses that have a shell eight inches in thickness, and the castings have to be made from metal of a very fine texture, in order to stand the pressure, 5,000 lbs. per square inch, to which they are subjected. In ordinary castings, water under this pressure would be forced through the pores of the metal.

The tool room is fenced off from the shop, and none of the workmen are allowed to apply personally for tools. The shops are equipped with electric calls, sim-

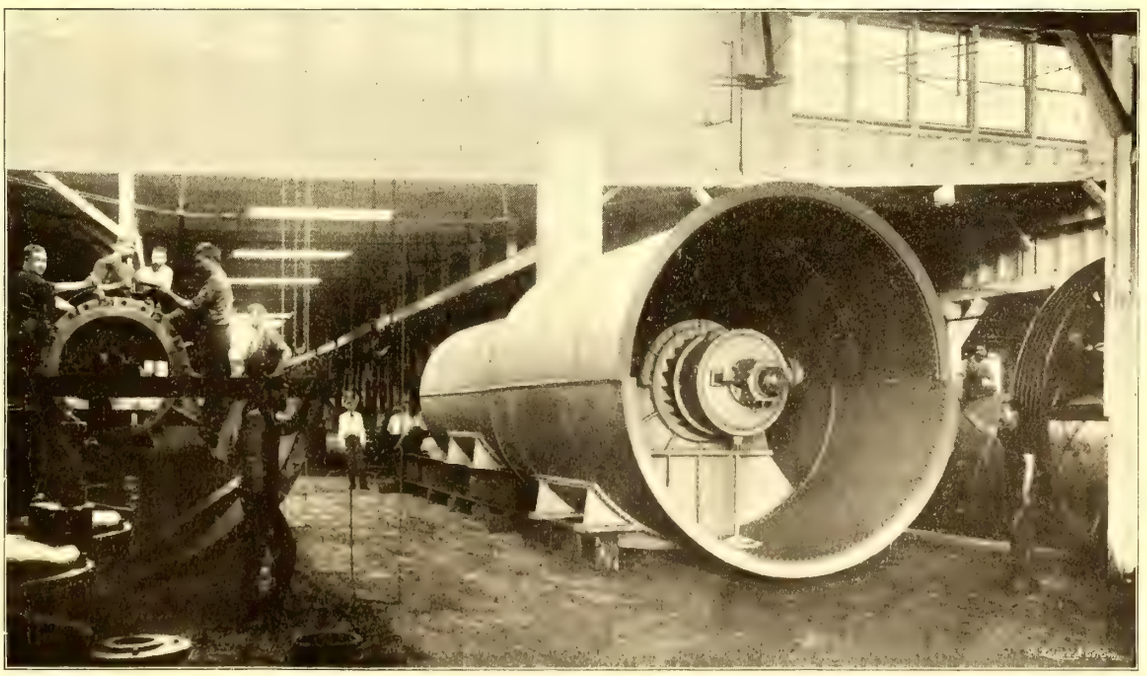


FIG. 15.—INTERIOR VIEW OF THE ERECTING ROOM—STILWELL-BIERCE & SMITH-VAILE CO., DAYTON, O.

There are also pneumatic lifts for the ladles, and for handling the smaller parts. A steam riveter is provided for riveting together the side parts and plates for oil presses. There is also one steam hammer. A very large pump and receiver are provided for supplying the water to the hydraulic cranes and elevators. The pump is self-acting, depending upon the pressure in the receiver.

A testing room is provided near the boilers, which is also supplied with a hydraulic lift, where all the pumps and presses manufactured are first tested before being shipped away. A side track from one of the steam lines enters the yard. All shipments are made directly from the shop, hoists and cranes being provided so that all parts are delivered directly on board cars. None but skilled workmen are employed, while the engineering talent, like that employed in the turbine department, is of a high order. The erecting engineers having had long training, are able to put the machines in position in a skillful and workmanlike manner.

The Smith-Vaile pumps are too well known to require a lengthy description in this connection. They are manufactured in a great variety of styles and sizes, and designed for every class of service.

Stilwell's live steam purifier is also well known to the street railway fraternity, and is employed for removing impurities from feedwater to prevent the formation of scale in boilers, while the improved open heater and filter combined removes the impurities, separates the cylinder oil from the exhaust steam and clarifies roily water, while in it the feedwater is heated to the boiling point.

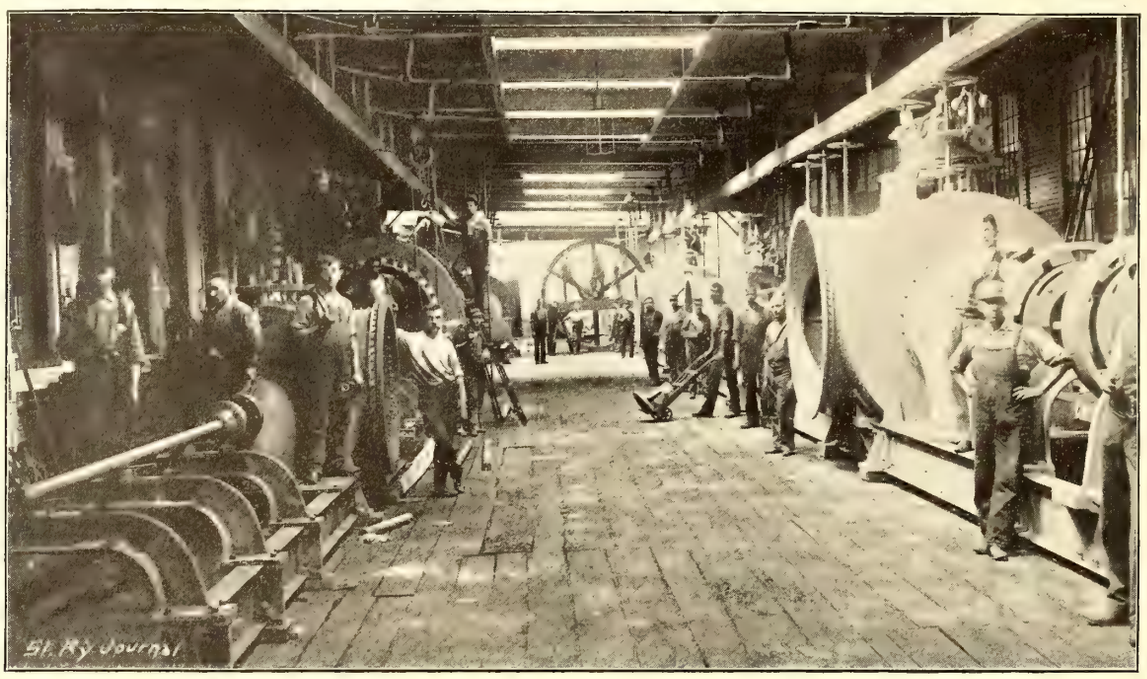


FIG. 16.—INTERIOR VIEW OF THE ERECTING ROOM—STILWELL-BIERCE & SMITH-VAILE CO., DAYTON, O.

An international electrical exhibition will be held at Paris from July 1 to October 31, 1895. It will consist of two sections connected by an electric railroad. The generating plant will be in the Palais des Machines, at the Champs de Mars, while the different electrical plant accessories will be shown in operation in the Palais de l' Industrie at the Champs-Elysées.

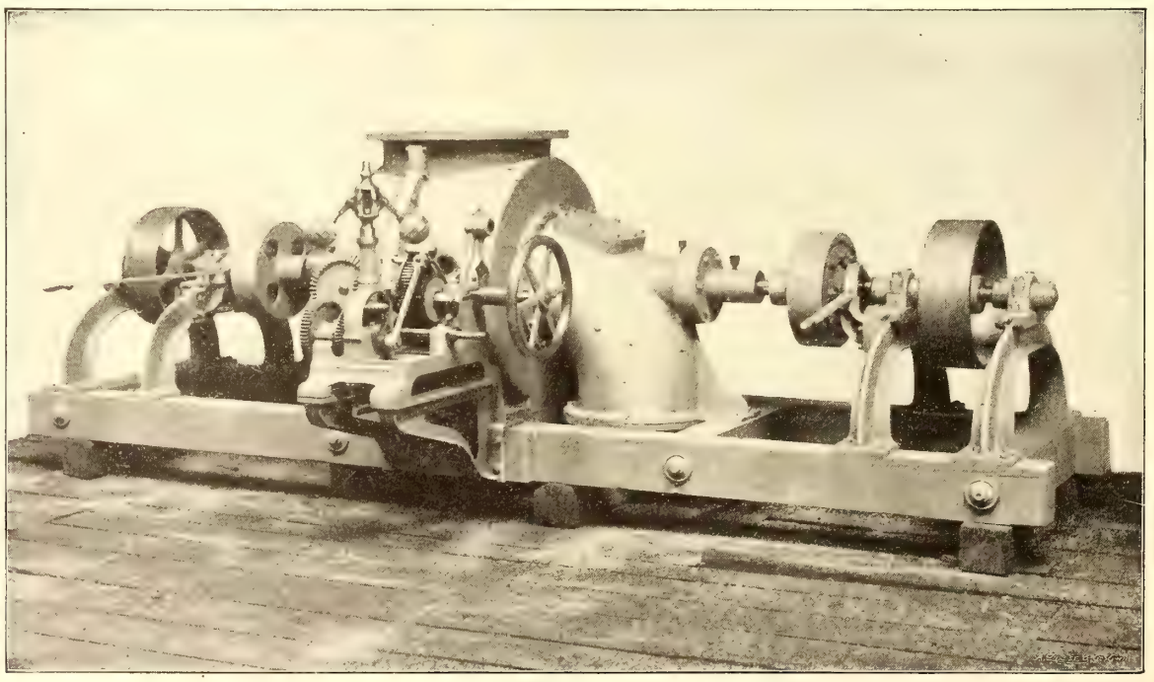


FIG. 17.—SINGLE 12-INCH VICTOR TURBINE.

Electric Conduit Road in New York.

President Vreeland, of the Metropolitan Street Railway Company, in an interview last month stated that a contract had been given to the General Electric Company to construct three miles of conduit road over a route not yet selected. The voltage used will be 300. The roadbed and conduit will be built precisely in the same manner as if a cable were to be used, and the road can be changed to a cable road later, if it should prove desirable. The Siemens & Halske Company will not build a section of conduit track in New York, as was at first proposed.

The installation will probably be made on Lexington Avenue, and owing to the fact that the system will be adopted in case it should prove a success, the construction of the cable railway on that avenue will be suspended for the present. It is stated that both the Siemens & Halske Company and the General Electric Company own fundamental patents covering the feasible construction of a conduit railway, and, as a result, patent litigation on the subject is extremely possible in case the experiment is successful.

Large Electrical Contract Awarded in Chicago.

On June 22, the Metropolitan West Side Elevated Railway Company let its contract for generators, switchboard, motors, line and construction work to the General Electric Company. The amount of the contract is said to be about $200,000. There will be two generators of 1,500 K. W. each and two 800 K. W. machines. At present the road will be operated by fifty-five three-car trains, each motor car being supplied with two 100 H. P. motors. The third rail, and in general many other details used on the Intramural road at the World's Fair last summer, will be adopted. The line is about five miles long and runs due West between Van Buren and Congress Streets with a northern branch at Paulina Street.

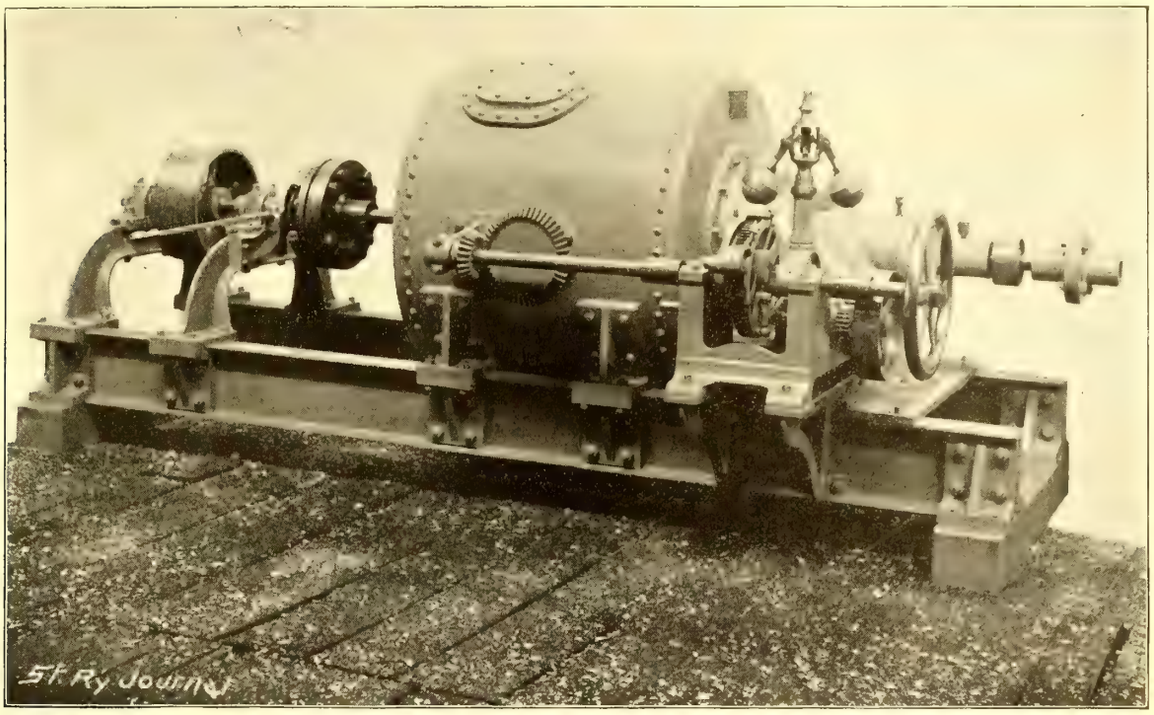


FIG. 18.—SINGLE 10-INCH VICTOR TURBINE ON HORIZONTAL SHAFT.

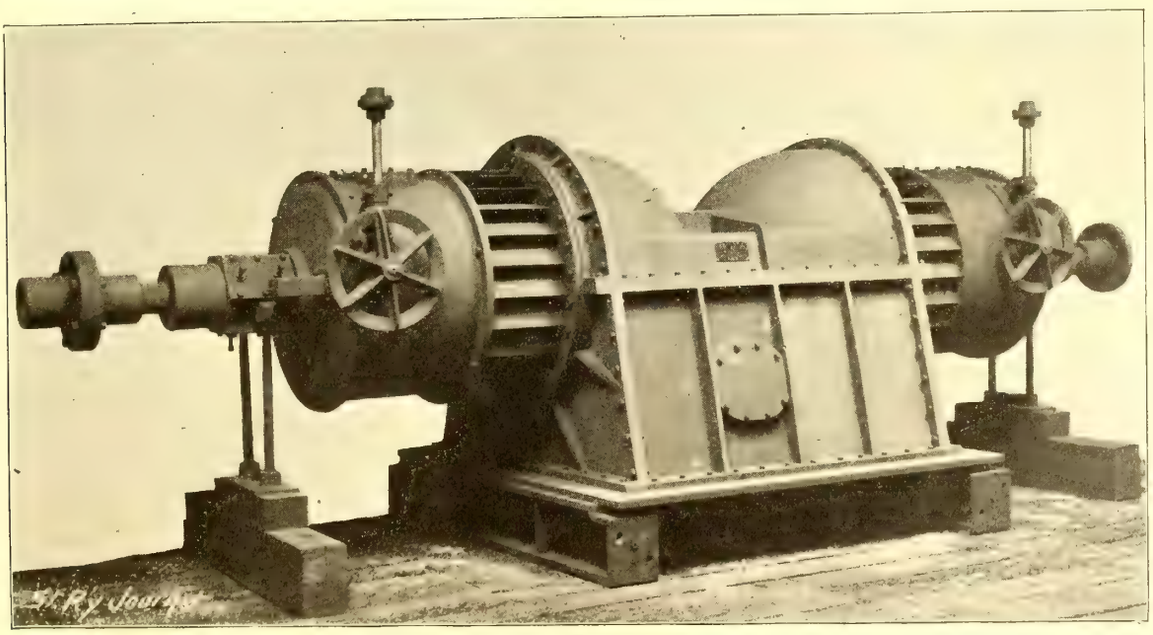


FIG. 19.—PAIR OF 33-INCH CYLINDER GATE VICTOR TURBINES DISCHARGING INTO ONE DRAUGHT TUBE.

Electric Welding in Brooklyn.

Work on the track construction of the Nassau Electric Railway of Brooklyn is going on rapidly on 39th Street, South Brooklyn. From the plans of this company, which have already been published in the Street Railway Journal, it will be remembered that from fifty to sixty miles of track will be laid this summer, and that the company contemplates the ultimate installation of an exceedingly important system in Brooklyn. A. L. Johnson, of Cleveland, O., is largely interested in the road, and is president of the Nassau Electric Railway Company, while the work of installation is carried on under the direction of Mr. Heffton, of Johnstown, Pa.



FIG. 1.—RAIL WELDING EQUIPMENT—NASSAU ELECTRIC RAILWAY, BROOKLYN.

Electrically welded rails will be used throughout. Fig. 1 gives a view of the electric welder now at work on 39th Street, near Fifth Avenue. This machine differs in a number of particulars from that in use in St. Louis and elsewhere, the equipment being in two cars instead of one. The car farthest from the observer in Fig. 1 contains the transformer or motor-dynamo. This is operated by current taken from the overhead wire, which at present is receiving its current from the power station of the Atlantic Avenue Railroad Company. Leads from this motor-dynamo carry the alternating current, which is at 300 volts, to the forward car. This contains the welder, consisting of an enormous clamp made of gun metal, so as to be non-magnetic, supported on a frame operated by an hydraulic jack. The 300 volt current is transformed at the point of use to an alternating current of about four volts and 50,000 amperes, the amount of current being varied by a reactive coil carried on the forward car.

When the rails are laid the ends of two joints out of three are butted, and at the third joint a space of one-sixteenth of an inch is left. The process of welding then is as follows: The sides of the webs for a distance of three to three and a half inches from the end at each joint are ground with an emery wheel carried on a tender car. This is to make good contact at all points and to insure a perfect weld. At the butted joints two pieces of soft steel, conforming in shape to the rail, are then placed on each side of the joint, there being four pieces in all, two for the head of the rail and two for the lower flange. The jaws of the clamp are then brought to bear on the joint by a handwheel holding the pieces of steel tightly to the joint. The current is then thrown on, when the steel pieces rapidly fuse together and to the rail. Against the head of the rail is pressed a non-conductor of heat, so that the temper of the rail at the joint is not reduced. A circuit of water is kept up through the welder so as to keep it cool during the process. Where the joints are not butted a thin section of rail is slipped in between the ends so that there may be no break in the rail. After the process of welding, which takes about thirty-seconds, is completed the clamp is removed and the joint is ready for use. The rails are also connected together for the return circuit by welding a flat steel bar, ½ × 2½ ins. from rail to rail every 600 ft. In a double track the interior rails of each track are also connected by similar bars, also located every 600 ft.



FIG. 2.—INTERIOR OF TRANSFORMER CAR—BROOKLYN.

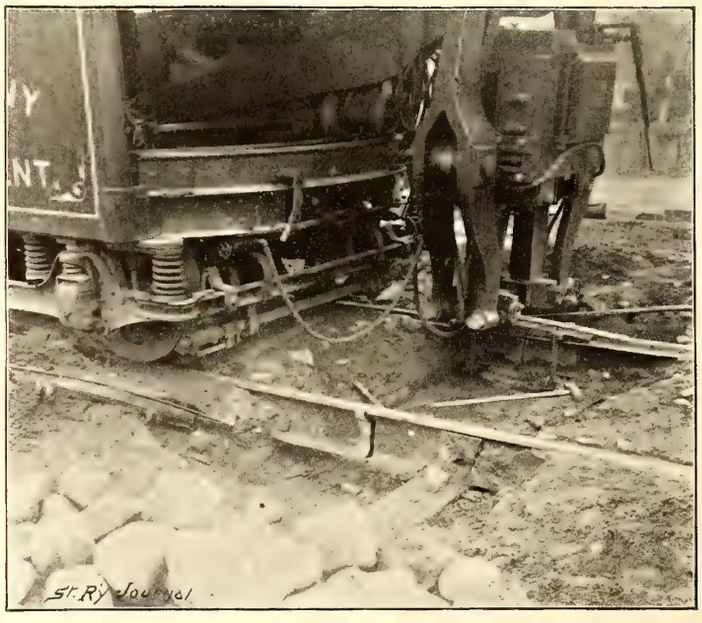


FIG. 3.—METHOD OF WELDING RAILS.

Summer Meeting of the Northwestern Electrical Association.

The summer meeting of the Northwestern Electrical Association will be held in St. Paul, July 18, 19 and 20. At the last meeting, held in Milwaukee, 150 were present, and a larger number of attendants is expected at this meeting. Representatives from Illinois, Iowa, Michigan, Wisconsin and North and South Dakota have written that they will be present. An excellent programme has been prepared.

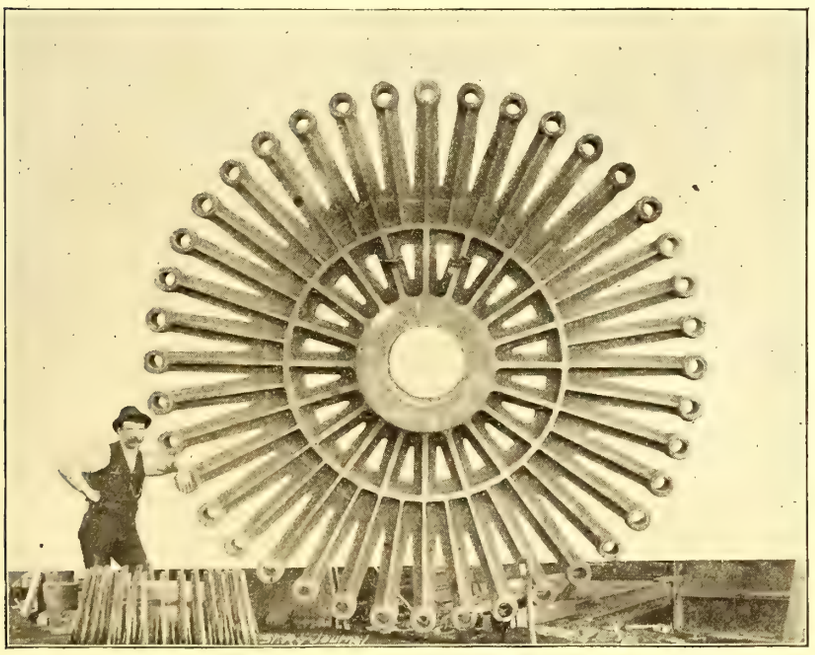
An exhibit of electrical appliances will be made in connection with the meetings of the Association by manufacturers, who will be accorded every courtesy by the Association.

A Large Armature Star.

What is claimed to be the largest armature star or carrier casting in the world has recently been constructed for the Siemens & Halske Electric Company of America by the Wells & French Company, and is shown in the accompanying engraving. A pair of these has been made, and they will be used at Toronto, Ont., for street railway service. The machines, when completed, will weigh about sixty tons each, and will have a nominal capacity of about 1,200 K. W. or 1,600 E. H. P., and will be overcompounded for 12 per cent. drop in the lines. They are to be direct connected to a pair of horizontal, cross compound, condensing engines, making eighty turns per minute.

The armature stars are thirteen feet in diameter, and weigh something over ten tons each. The brush carriers will be about fourteen feet six inches in diameter, being made by the same concern. These castings came from the mould absolutely perfect, without warp, crack, flaw or blow hole, and are now being finished for the armature.

Considering the form and size and the difficulty of making castings, the Wells & French Company is to be highly commended for the skill and workmanship in successfully turning out such perfect work on its first order of this kind.

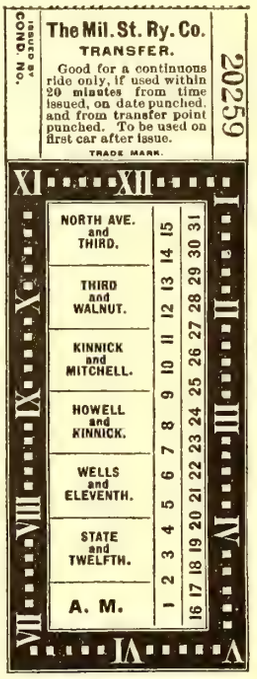


LARGE ARMATURE STAR.

AN inspection of the Calumet Electric Street Railway was made June 16, by the officers of that road and guests upon invitation of John Farson. A special train was provided by Superintendent Oliphant, gaily decorated with flags, and both officers and visitors expressed themselves as greatly pleased with the result of the inspection.

New Type of Transfer Ticket.

We present herewith an engraving of a novel transfer ticket, recently adopted by the Milwaukee Street Railway Company, and devised by the officials of that company. The principal point of interest in this ticket is its simplicity. As will be seen, the ticket bears, distinctly marked, the time of day in clock figures. The passenger receiving the ticket, therefore, naturally has his attention called to the question of time, which might, perhaps, not occur where arabic numerals are used without explanation. The limit as to time is explained in a note at the head of the ticket, so that a passenger looking at the dial on the ticket and then at the note sees readily that the intention of the ticket is to limit him to the next car, or to twenty minutes. As will be seen, the month of issue is not put on the ticket, as the serial numbers are thought sufficient indication of the month. This reduces the number of figures and printing, and makes the ticket very simple, while securing the objects of a ticket of this kind.



NEW TYPE OF TRANSFER TICKET.

While transfer tickets have not been used before in Milwaukee, and as, in consequence, they were a novelty in that city, it is interesting to note that they were put in use with hardly any friction, and transfers are now being made smoothly and easily.

The Ottawa Electric Railway Company.

This is the title of a new company which will include all of the electric railways in Ottawa, Can. The bill before the Dominion Parliament amalgamating the Ottawa City Passenger Railway Company, and the Electric Street Railway Company passed its final reading June 15. The authorized capital of the new company is $1,000,000, and the rolling stock consists of twenty-two open and thirty-one closed motor cars, four trail cars, three postal cars and five sweepers.

A Deserved Testimonial.

During the recent May musical festival at Cincinnati, the facilities of the cars of the Cincinnati Street Railway Company were taxed to their uttermost. In spite of the enormous crowds of passengers, the service was very efficient, and all the patrons of the company were carried without a single accident. The officials of the company recognizing the fact that this record was owing to the efficiency of the superintendent, Mr. Harris, and was deserving of special recognition, passed resolutions at its meeting held May 29, and voted that thanks and commendation be tendered to the superintendent "for his very efficient services and very satisfactory manner in which the cars and passengers were handled during the above named occasion."

THE Wabash Electric Street Railway Company is the title of a new corporation to build an electric railway in Wabash, Ind. James P. Ross is largely interested.

Notes on European Street Railway Practice.

By G. Braet, Engineer to the Minister of the Railway, Postal and Telegraph Departments Brussels, Belgium.

SICK BENEFIT FUNDS OF STREET RAILWAY COMPANIES IN HOLLAND.

In the December issue of the Street Railway Journal the writer described the organization of sick and accident funds among the street railway companies of Germany. Below are presented some particulars, which it is thought will prove of interest, of similar benevolent institutions adopted in Holland by the principal street railway companies, operated by animal and steam power, such as those of Rotterdam and of Guelders, in favor of their employes, these affording the latter important aid, not only in case of sickness or accident occurring through circumstances over which they had no control, but also during their old age, when arduous labor has become practically impossible.

The Steam Street Railway Company of Guelders.—The object of the establishment of a benefit fund for the employes is three-fold. First, in case of sickness, to provide for the employes prompt and good medical care and supplies. Second, to afford a certain weekly pension during sickness when the employe's regular salary is stopped. Third, so far as the conditions of the benefit fund permit, to allow a certain weekly pension to employes when they have reached the age of fifty-five years, and when they are no longer capable of performing their work in an efficient manner. Participation in the liabilities and benefits of this fund has been obligatory upon all the regular employes of the company since January 1, 1890. Clerks and others employed in the office of the company, receiving a salary of less than 500 florins ($210) are also obliged to become members.

Administration of the Fund.—The regular and permanent income of the fund consists, first, in an assessment on each member of 1 per cent. of his weekly salary; second, a fixed and annual contribution of 500 florins paid by the street railway company. The dues of the members are payable quarterly, January 1, April 1, July 1 and October 1, to the manager of the fund or his regular authorized agent. A statement of all receipts is printed, and a copy mailed to each member. The street railway pays its assessment on July 1 of each year.

The extra receipts of the fund consist of the following: First, a portion of the annual profits of the company; second, gifts, bequests, etc., given the fund.

The board of managers of the fund is composed of the general manager of the street railway company, who acts as manager of the fund, and of five commissioners elected by and from the members. A board meeting of the fund must be held at least twice a year. The fiscal year of the fund commences January 1 and ends December 31, on which day the books are closed, and there is rendered as soon as possible to each member, a report giving the exact condition of the fund. Each member has the right to criticise this statement, on condition of doing so in writing.

Each year the term of one of the board of managers expires, but he is re-eligible. Votes are taken by written ballot.

The doctor and druggist are appointed by the manager. Employes who desire medical aid have to address the general manager or the local manager of the fund in order to obtain the necessary certificate. If the employe does not live more than twenty minutes distant from the office of the doctor, he is visited at his home by the latter. If he lives farther, he is obliged to go to the doctor's office. For the delivery at homes of medicines, the same rules are applied as for the visit of the doctor. Each recipe given by the doctor bears the letters G. S. T. M. (the initials of the company's name). In taking this to the druggist to be filled the employe must provide a bottle or other receptacle for the medicine. If this is not done, the druggist can make a charge for anything provided in addition to the medicine.

When a member, through causes for which he is not responsible, has for fourteen days been incapacitated for service and this incapacity has been attested by a medical certificate, he receives his entire daily or weekly wages. If his sickness lasts a long time he is given, by the sick fund, a certain pension, equal at least to half his daily or weekly wages.

When the total receipts of the fund are not sufficient for the minimum quantity of medicines and medical aid specified, the deficiency is made good by the street railway company.

Pensions.—The board of managers of the fund decides just when it is capable of affording a pension to those employes who have reached the age of fifty-five years, and who are no longer capable of performing efficient service. The amount which can be disposed of in this way is calculated each year on the number of pensionaries. The decisions of the board of managers are determined by a majority vote. The votes concerning persons are taken in writing; those relating to general business *viva voce.*

The Rotterdam Street Railway Company.

All the employes who are paid by the week are obliged to become members. Only the employes paid by the month or by the year are exempted from participation. The administration of the fund is entrusted to a commission composed of a president, a secretary, who is also treasurer, and three other members. The president and the secretary-treasurer are appointed by the general manager of the street railway company. The three members participating in the management of the fund are elected by the members contributing. Vote is taken by sealed ballots. If on counting the ballots no one has secured a majority, a new ballot is taken between the two candidates having the highest number of votes. If one of the members of the commission is prevented from acting for a long time he is replaced by another member. The president and the secretary-treasurer are obliged to perform the duties of their office from the date of their appointment until they have been discharged from office. Each year, at the end of December, the board submits a statement of the fund to the general manager of the tramway company.

The funds necessary for the creation and maintenance of the fund are obtained by the retention of 1 per cent. on the weekly salary of all the employes or members of the fund; by rewards paid for property found in the cars, etc.; by fines inflicted; by different gifts, legacies, etc., in favor of the fund, and by interest on the moneys of the fund obtained in the manner above and placed on loan.

The benefits of the fund are extended to each member provided he has been at least three months in service, and in cases of sickness not occurring in service or on acount of service, and in case of accident without his fault, in service or on account of service. If the financial condition of the fund is very favorable, special payments will be made in addition, with the approval of the general manager of the railway company and at the suggestion of the board of managers in extraordinary cases.

In case of sickness not occurring in service or on account of service, the employe receives one-half his daily wages for six weeks of sickness. This payment commences on the third day after the street railway company has ceased the payment of salary. In case of accident incurred in the service or on account of service, for which he is not to blame, the employe receives from the street railway company half of his daily salary during those weeks, or a longer time, as is determined by the general manager of the company. If the distribution of the benefit funds exceeds the capacity of the fund, the street railway company may temporarily supply the deficiency, but is not obligated to do so.

All participation in the fund ceases when the employe leaves the service of the tramway company, or when he voluntarily ceases to pay his assessments. In these two cases such a member has no right to demand any sums which he may have paid.

The money of the fund is placed at interest as advantageously as possible, with the advice of the manager of

the street railway company. The board of managers has the right, with the approval of the manager of the company, to make such changes in the rules as experience may demonstrate to be useful and necessary.

The general manager has a right to suspend the operation of the fund for just reasons, and in such case the amount of money on hand is to be divided among those persons then members of the fund.

Pensions.—In the interest of its employes, the Rotterdam Street Railway Company has made a contract with the Holland Life Insurance Company, of Amsterdam, having for its object, first, the payment of a pension to the employes of the company after reaching the age of sixty years, and, second, in case of death to pay a certain sum to the heirs of the deceased.

All employes in regular service, whose salary is less than seven florins per week, except those less than twenty years of age, are obliged to become insured. In order to pay for this insurance, 2 per cent of the salaries of each member is retained, and in addition the street railway company contributes a sum equal to that provided by the assessment mentioned on the salary of the employes. Every member at sixty years of age, who has left the service of the company before or at that age, has a right to a pension. Those who wish to, can remain in the service after sixty years of age, and are not then obliged to pay any assessment.

At the end of each year the contributions of the company and the assessments are devoted to paying up these annuity policies, and the sums thus paid are themselves reinsured so that in case of death a certain sum can be paid to the heirs of the deceased. If a member receives honorable dismissal before, at or after sixty years of age, these annuity policies, if for more than fifty florins, are given to the payee, and they mature at the sixtieth year in the first case and immediately in the two other cases. In the case of a discharge, pure and simple, the employe receives only a policy of the value of the assessments paid by himself, the value of the premiums paid by the street railway company being retained. In the case of the death of a member, his heirs are paid the assessments paid him.

Members who, on their honorable discharge, manifest the desire of not remaining members of the society, can withdraw the sums turned by them during the duration of their service, as well as the assessments paid for their benefit by the company, after a deduction has been made from the latter, of the amount paid for the "reinsurance" mentioned above. Those employes, who are simply discharged, are entitled only to the sums which they have paid in.

The $50,000 Prize of the Metropolitan Traction Company.

The Railroad Commissioners of the State of New York who, it will be remembered, were asked to act as judges in the prize competition of the Metropolitan Traction Company for a motive power system for street railways, which should be superior to the trolley system, have issued a statement giving the recent correspondence between them and the Metropolitan Traction Company relative to the withdrawal of this prize. The general interest which has been felt in the competition and the large number of plans presented in answer thereto make this correspondence so interesting that we print it in full. The Commissioners state that they regret exceedingly the unsatisfactory termination of the affair.

CORRESPONDENCE.

BOARD OF RAILROAD COMMISSIONERS.

ALBANY, MAY 3, 1894.

Secretary Metropolitan Traction Co., Cable Building, New York City.

DEAR SIR:—We herewith enclose a copy of Senate Bill P. No. 186 which was to-day signed by the Governor.

This Board is now in position to accept your proposition of November 29, 1893, offering a prize of $50,000, to be awarded by the Board of Railroad Commissioners for the best "actual working system of motive power for street railway cars, demonstrated to be superior or equal to the overhead trolley," but without its objectionable features, and does hereby formally accept the same. The Board believes that the offering and awarding of such prize will stimulate invention and result in rapid and vast improvements in methods of street car propulsion.

At conferences in December and January last between representatives of your company and the members of this Board, the determination of the Board to act only under legislative authority was made known and the impossibility of having the tests properly conducted within the time fixed in your letter of November 29th, viz., by March 1st, 1894, was pointed out, and your representatives then stated that the time limit was waived and that this question would be left to the discretion of this Board.

The results of these conferences were made public, and prompted by the prospect of an opportunity to compete for the prize offered by your company, inventors from all over the world have entered their applications; hence, in spite of the delay in the passage of the bill before the Assembly, much progress has been made, at least toward locating possible competitors and ascertaining their number.

In replying to the letters received relative to the prize, the Board has notified its correspondents that the time limit has been waived by your company and that the acceptance of your proposition by this Board depended upon the action of the legislature. This authority having been given and your proposition having been formally accepted, the Board is now ready to confer with representatives of your company in regard to arranging the necessary details in connection therewith.

By the Board,
CHARLES R. DEFREEST,
Secretary.

ENCLOSURE.

AN ACT TO AMEND THE RAILROAD LAW IN RELATION TO IMPROVEMENTS IN RAILROAD APPLIANCES.

The People of the State of New York, represented in Senate and Assembly do enact as follows:

SECTION 1. The Railroad Law is hereby amended by adding thereto a new section, to be known as section one hundred and seventy-two, and to read as follows:

SECTION 172. The Railroad Commissioners may, in their discretion, act as judges to award prizes which may be offered by any responsible person for improvements in machinery or appliances for operating railroads.

SECTION 2. This act will take effect immediately.

METROPOLITAN TRACTION COMPANY OF NEW YORK.

NEW YORK, May 15, 1894.

Secretary Board of Railroad Commissioners, Albany, N. Y.

DEAR SIR:—I am directed by the Board of Directors of the Metropolitan Traction Company to acknowledge receipt of your letter of May 3d, 1894, notifying this Company of the passage of the act conferring upon your Board power to act as "judges to award prizes which may be offered by any responsible person for improvements in machinery or appliances for operating railroads."

Your letter further states in substance that in December and January last, at a conference then held, it was stated by representatives of this company, that the time limit fixed in our letter of November 29th would not be insisted upon, and you notify this company that you are now ready to proceed to arrange the details in connection with the proposed award.

In reply to your communication I am directed to say that at this conference in December last it was stated by your Board, and agreed by us, that the proposed amendment to the railroad law, being unobjectionable in character, would doubtless be passed by the first or second legislative week of the then coming session, so that only a short time would be lost and the matter could be proceeded with at that time with expedition. It was solely upon that supposition that this company proposed to extend the time. We have had no subsequent conferences with the Board, but, as it soon appeared that long delay was likely to occur in the passage of the act, which has since occurred, this company proceeded to employ experts, and conduct the investigations which it was originally proposed to have the Railroad Commissioners conduct, and has spent a large sum of money, exceeding the $50,000 which the company proposed to award, in determining the same question which was to be the subject of investigation and award.

This company is about to enter upon a large expenditure, based upon the results of its enquiries, and should prefer to await the results of some practical experiments which it is now entering upon as the result of contracts with one or two electric companies, before deciding to go on with the matter of the award.

In other words, the company has itself conducted the investigation, and has passed beyond the stage of inquiry, and has determined for itself upon an improved motive power, and is about to put it in. It will, of course, be seen that such a state of affairs presents an entirely different situation.

Yours very truly,
CHARLES E. WARREN,
Secretary.

BOARD OF RAILROAD COMMISSIONERS.

ALBANY, May 22, 1894.

Secretary Metropolitan Traction Company.

DEAR SIR:—I am directed by the Board to acknowledge the receipt of your favor of the 15th inst. in relation to the proposition of the Metropolitan Traction Company offering a prize of $50,000 for an improved system of motive power, etc., and to express regret that the Board was not notified at an earlier date of the decision of the company to withdraw the prize, which seems to have been arrived at as early as last January. Such notification would have permitted the Board to inform the public and legislature of the abandonment of your offer, and it would seem in justice, particularly to the persons who have been induced by the publication of the offer to make application for permission to compete for the prize, that such notice should have been given. As agreed to in our circular letter to competitors, the

Board will immediately take steps to inform them that your offer has been withdrawn, and so far as it is concerned we consider the matter closed.

Very truly yours,
CHARLES R. DEFREEST,
Secretary.

The Commissioners state that any letters, plans, drawings or models sent to them for competition in connection with the above prize will be returned to the senders if requested.

Electric Car Heating.

W. S. HADAWAY, JR.

There are many theoretical and practical considerations upon which electric car heating by electricity may be urged. Questions of economy are not the only considerations in the car heating problem. In a car subject to draughts it is practically impossible to distribute the heat from a stove uniformly to all parts of the car, and unequal temperatures result, a source of discomfort and danger to health. These facts are in themselves sufficient to warrant the use of other means of heating than by stoves, even at an increased cost.

The price of electricity varies greatly in different localities, according to the size of the road, cost of coal, labor, etc., so that the figures obtained from the cost of operating one road cannot be used in figuring the cost of heating by electricity in general. The only fair basis of comparison is from average figures, and not extreme figures. It has been found in actual practice, this practice including several hundred cars, that 100 watts are sufficient to warm thirty cubic feet of space in an average well built twenty foot car, having from 100 to 125 sq. ft. glass area and a monitor roof with windows of moderate tightness. This value does not apply to extreme northern latitudes, and is a representative value for the Southern New England and Central States. The value for the northern latitudes can be computed from the foregoing figures by comparing the weather extremes in the two cases.

Carrying out the value given in the preceding paragraph, we find that in a twenty foot car in latitudes stated, 3,000 watt hours, or 4 H. P. H., sufficient to allow for weather extremes; and the average running value will be determined by the severity of the season, exposure to winds, average running speeds, and what may be generally termed local conditions. The practical application of heating in cars is substantially the same problem as offered in conservatory heating, with the disadvantages of the car in motion and many loose fitting windows and doors, and the advantage of a considerably decreased proportionate glass area. In practice no competent heat engineer would attempt to heat a conservatory by distributing the heat by direct radiation or convection from one point only. As the space to be heated is comparatively large, a small boiler can be successfully employed distributing the heat through pipes by either steam or hot water, but preferably the latter. The relatively small size of the car, however, permits the use of stoves or heat storage systems, and these consequently have been largely resorted to. The claim can be successfully substantiated that the factor of uniform heat distribution from electric heaters giving to all portions of the car proper increments of heat warrants the use of the electric heaters at figures even in excess of what is claimed to be the actual cost of heat from stoves.

There are two forms of electric heaters by which an equable distribution of heat can be effected. First: By radiation from a heated surface in which convection currents enter to some degree. Second: By direct air heaters or registers in which little or no radiation surface is offered, the hot air rising from the heater and setting up air currents which circulate about and thus distribute the heat.

Of course, in an enclosure in which there are no draughts, and given time enough, one form of heater will ultimately heat the car through as many degrees as another. But we find in actual tests of cars in practice, that on windy days, and especially according to whether the car is going with the wind or against the wind, the front end of the car is frequently 7 or 8 degs. colder than the rear end, and if we depend too largely on air circulation to effect the warming, the same currents that cause the warm air in the car to rush towards the rear end, deflect the hot air currents rising from the heater, and leave the front end of the car without source of supply of heat. There appear to be few reliable records of the differences in temperature under varying weather conditions, between the front and rear ends of a car when heated by stoves. It is certain, however, that these differences are very much greater than when the car is heated by properly designed electric heaters.

The forms of electric car heaters so far proposed are heaters by simple resistance, so that the form of heater to be chosen is dependent upon its durability, first cost and manner of distributing heat throughout the car. During the past winter the opportunity was again taken advantage of to make an exhaustive study of electric heaters in actual use on cars equipped by the Central Electric Heating Company, of New York, and the New England Electric Heating Company, of Boston, and valuable data were obtained. These tests were made with a thermometer on the front end of the car and one on the rear end of the car, each about five feet six inches from the platform floor. The inside temperatures were obtained by placing one thermometer on the inside of the front end and one on the inside of the rear end, and two thermometers on opposite sides, but equidistant between the two ends. These two intermediate thermometers were varied in position, being attached part of the time to the window frames and part of the time to the straps, and at a height to which persons of average size would feel the temperature most keenly, viz., at the back of the neck. These tests were carried on with heaters of four distributing points, of six distributing points, and of radiating surface distributed uniformly throughout the car. It was found that the electric heaters successfully warmed all portions of the car, and that the distribution of warm air was far superior to the distribution attained in cars heated by stoves, which were run on neighboring lines. There is no doubt that the popular verdict is very strongly in favor of the electric heater.

As regards the bare cost of operation, every railway manager can figure for himself on the data given. A case in point of a road figuring its power at $2. per horse power, per month, shows the operating cost of the heater to be twenty-seven cents per day when run at maximum heat, but that on an average the cost is less than twenty cents per day by reason of the full heat not being needed all the time. There are instances where it is claimed that electric heaters are operated more cheaply than stoves could be, and it is apparent from the excellent results obtained in practice that the cost of operation of electric heaters is not as serious a problem as it has appeared to be, especially as it has been found in actual practice that the fares obtained from the space appropriated by the coal stove fully compensate for the cost of running an electric heater.

To those who have followed the progress of heating and ventilation in vehicles for public carriage the use of the electric heater makes one further step in the progress of public interest. The writer remembers when Prof. W. R. Nichols published his first determinations of air analysis from smoking cars running into Boston on various lines. The filthy conditions of the air there shown have been powerful factors in securing proper heating and ventilation of such cars. The least value which experts place upon the air capacity per person per minute for proper ventilation is thirty cubic feet. The average twenty foot car contains about 900 cu. ft. of air, and these cars frequently carry on the inside from twenty-five to thirty people so that for proper ventilation the air should be changed about once per minute. No such provisions are made in car heating by any system, but from the fact that the doors are so frequently opened partial supply is obtained in this way, setting up, however, cold draughts of air which require appreciable intervals of time to become diffused throughout the car. If, as in electric heating, a source of heat is placed near the doors to cause warm air heated either by radiation or convection to rise with the cold air, the air is tempered to a considerable extent, and in practice this is found to be an essential feature of the electric heater.

As in the present construction the passenger sits with shoulders and back of head exposed to the window, he is so situated as to be peculiarly sensitive to cold, and a slight amount of warmth circulating around each occupant is found in practice to counteract the chilliness resulting from the rapid heat radiation from the glass surface.

There appears to be as yet no feasible plan suggested for properly ventilating a street car. It is an important step in advance, however, to heat large quantities of air to moderate temperatures through the entire length of the car, causing uniform displacement of vitiated air and more rapid heat diffusion without introducing into the car any products of combustion or noxious gases. There is a cleanliness in air supplied for breathing as in food, and while it is a repugnant comparison, there is as much reason for filth in the preparation of foods as in the breathing of air over and over again by occupants in varying stages of health and cleanliness. In fact, heating by stoves is a sort of free lunch in which each occupant only secures his quota by reaching over the heads of his neighbor, and in the passage from hand to hand what is obtained is contaminated by passage. The air arising from the electrical heaters is, on the other hand, akin to a well ordered table, in which each participant receives his quota by proper means of distribution.

The items of space occupied, cleanliness, freedom from damage to car, and from carrying in coal and taking out of ashes, and generally decreased depreciation, are strong factors in favor of the electric heater. We thus see that in practice there is no reason why electric heaters cannot be successfully operated.

The fact that makes it more profitable to operate street cars by electricity than by other methods of propulsion, also makes it possible to heat the cars by electricity. Long continued heavy loads with load lines of moderate maxima and minima, render the cost of the power to the street railroads a comparatively small one, and while the transformations through which the heat energy passes before its expenditure in useful work are many, the prerequisites, outside of cost, which the electric heater is called upon to fulfill warrants its use.

Railway Supplies: Western Electric Company.

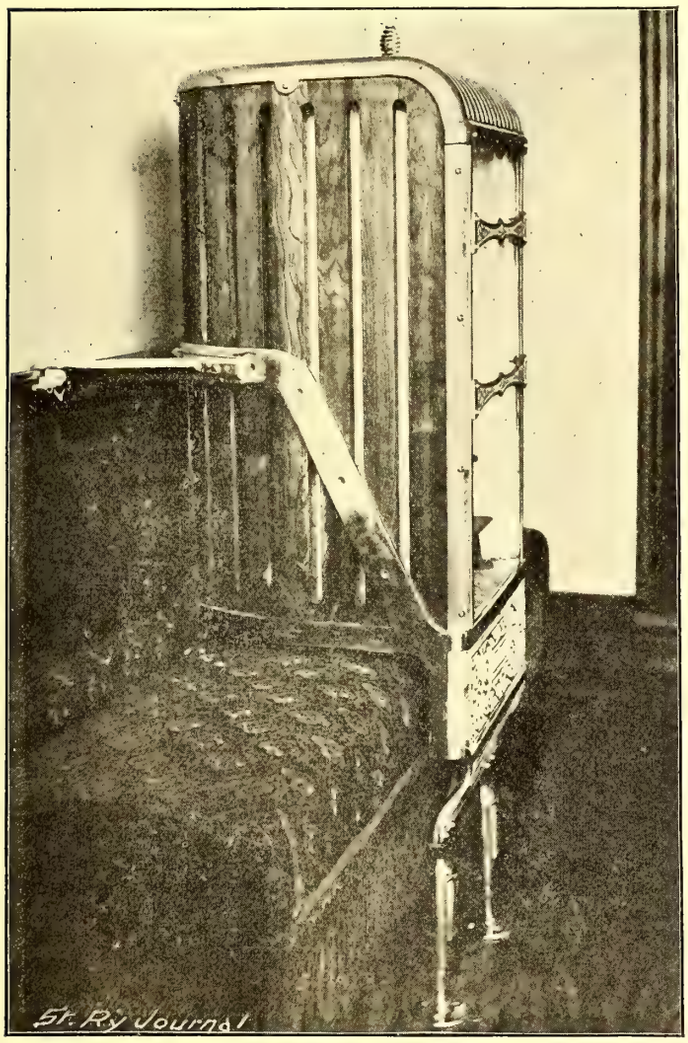
The Western Electric Company, of New York, which has a very wide reputation as a manufacturer of electric lighting, telephone and telegraph apparatus and supplies, and which is probably the largest manufacturer in the country in the "supply" business, is about to go into the railway supply business on an extensive scale and make a specialty of it. This company has a large factory at Greenwich and Thames Streets, this city, as well as a separate building located one block distant from its factory, from which the entire supply business is handled. The company, we understand, intends to handle the railway supply business on a large scale as it is now handling the lighting supply business.

If the record which the Western Electric Company has made in lighting supplies can be taken as a criterion, its success in railway supplies is certainly assured.

THE Market Street, Richmond & Frankford Street Railway Company, of Philadelphia, Pa., was incorporated May 28, with a capital stock of $180,000. Walter N. Boyer, 1215 Filbert Street, Philadelphia, is president of the company. Others interested are Radcliffe B. Mills and Milton M. Dorland, of Philadelphia, and Edwin D. Graves, of East Berlin, Conn.

"Columbia" Magazine, Cast Iron Street Car Heater.

The accompanying cut shows the "Columbia" street car heater, as manufactured and sold by the McGuire Manufacturing Company of Chicago. It will be noticed that very important additions have been made since last year. In the first place the frame intended to hold the stove in position is made of a solid casting, and embraces the front apron, the strap that passes around the back, and the arms that fasten it to the top of the seat rail are all in one piece. It will be noticed that the legs are made adjustable, so that the frame can accommodate itself to any form of car seat, and when in position look like the arms of an easy chair and are as firm as any part of the car. This frame is first set in over the car seat, the legs adjusted and fastened, and then the stove is simply lifted into position. This operation can be done inside of ten minutes by any ordinary mechanic, and when the stove is in position it cannot be disturbed except by the use of tools. It is adjusted so as to rest above the cushion, apparently resting upon it.



"COLUMBIA" HEATER.

The stove can be placed in any car without cutting or fitting either the stove casing or the car seat. It does not rest upon, and, consequently, does not wear out either the seat, cushion, or coverings, either front, top or back. It can also be set upon the floor of the car, and for this purpose a handsome stand is used, placing the stove at any height desired by the railway manager. In either position it is not an eyesore, as is the case with many car heaters, but actually an ornament to any car.

The stove is a self feeder, holding twelve hours' fuel, and, it is claimed, requires no attention whatever from conductors. The fire is usually started before the car leaves the barn, so that the car goes out warm in the morning. It burns one pound of hard coal per hour, heating a twenty-one foot car, equal to a cost of about five cents per day. The exterior is always cool, so that the passengers can sit in actual contact with it and cannot burn themselves. As the sample is seen in the office of the McGuire Manufacturing Company, it is attractive in appearance, and if it accomplishes all that is claimed for it, it should prove a great success. Patents have been allowed, and the McGuire Company has purchased the sole right of sale and manufacture.

THE Brooklyn Heights Railroad Company has applied for consent that it may extend its lines through a number of streets and avenues in the town of New Utrecht, N. Y.

A New Arc Lamp.

We present herewith engravings of a new arc lamp, applications for a patent covering the main features of which were made by William Jandus in 1887. The lamp, which is manufactured by the Manhattan General Construction Company, of New York, has a number of novel features, one of which is that it is so designed that it will burn at six amperes and about seventy-five volts or one in series on incandescent circuits. An engraving of the lamp complete is shown in Fig. 1, and a view of the skeleton in Fig. 2, the airtight shell at the center being removed to show the feed mechanism.

In Fig. 2, A is the magnet, B the armature carrying the clutch pan, C, and engaging through suitable slots in the armature of the clutch rings, D. In the upward travel of the armature, B, the flaring pan, C, engages the clutch rings, D, against the inserted upper carbon, raising it to form the arc. B is the negative terminal casting, into the lower part of which is threaded the negative carbon frame. G is the negative carbon clamp suitably insulated from the dust pan, H. M is

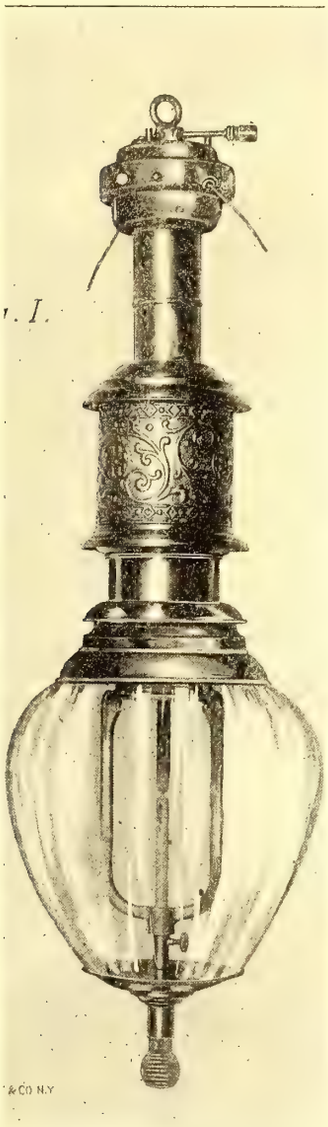


FIG. 1.—LAMP COMPLETE.

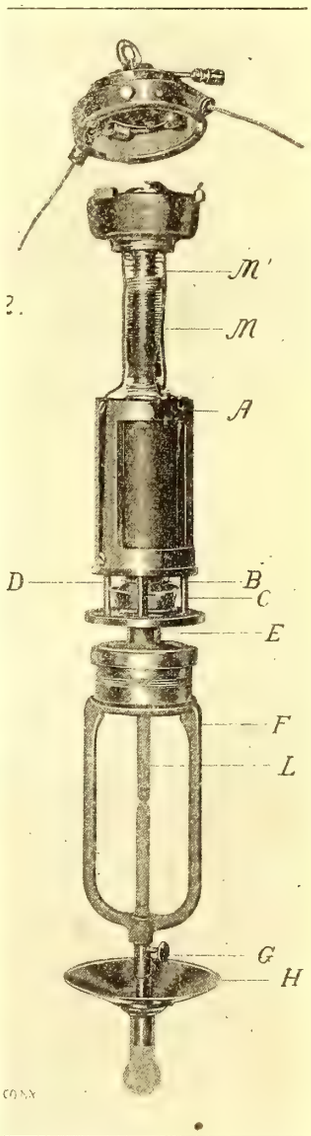


FIG. 2.—LAMP SKELETON.

a resistance path to the cut-out ring. M^1 (part of same resistance coil) is a shunt on the main coil of the magnet to regulate the length of the arc.

The circuit through the lamp is as follows: The current passes from the positive terminal through the main coil of the magnet into the magnet, A, and through to the brushes and clutch rings to the upper carbon, to the lower carbon and out through the negative terminal. It is provided with two paths, one through the main coil and carbons, and the other through the resistance, M, spring and cut-out ring, to the seat of the casting, E, and out through the negative terminal. An insulating washer separates the armature, B, from the cut-out ring.

On the formation of an arc the enclosed air is heated and rarified, the surplus air escaping through the lower vent. The contained oxygen is soon reduced by combustion with the carbon points to carbon monoxide, and this with the remaining nitrogen surrounds the arc and protects the points from further combustion. These highly rarified gases being much lighter than the surrounding comparatively cold air, have a tendency to rise, and finding no outlet at the top,

remain in the globe to the exclusion of the surrounding air which, is much colder and heavier, and which can enter only by slow diffusion.

The distance between the brush rings conveying current to the top carbon and the socket holding the lower is only about eight inches. The small distance being constant and the resistance between the two carbons remaining constant, there is introduced no variation of voltage in the arc; and copper covered carbons, with their objectionable features, are unnecessary. Owing also to the greatly reduced length of the lamp, it is particularly susceptible to decoration.

This lamp does not require a special grade of carbon, and it is found that ordinary carbons burned in this enclosed chamber will last about five times as long, and a better quality of carbons about six times as long, as the same carbons burning in the open air. The lamp illustrated in Fig. 1 is designed to burn one week on half night service without retrimming or renewal of carbons. A similar lamp is made to burn about four nights on all night service, or will require trimming but twice a week.

It has been found that in this enclosed chamber it is possible to successfully burn a longer arc than in the open air, and when desirable in series arc work a 2,000 candle power lamp can be run at about seventy-five volts and six amperes.

New Method of Motor Support.

The development of the electric street railway in America during the past ten years, furnishes a unique and remarkable example unparalleled in the history of engineering. One difficulty after another has been successfully overcome, until, to-day, with respect to economical operation, freedom from breakdowns, and durability of apparatus, there is little left to be desired. One of the last problems to be taken up, since it lay outside of actual motor design, was that of the deterioration of the track. This question has been constantly increasing in importance, proportionate to the increase in traffic, and consequent demand for heavier cars and higher speeds. It is a problem, the solution of which will be warmly welcomed by every street railway manager and stockholder, since, at present, the heaviest item in the cost of maintenance is that for roadbed. The obvious and essential condition necessary to the solution of this most important difficulty is that all rigid contact between motor and axle shall be avoided, thus lessening, to the greatest possible extent, the impact of the wheels at the rail joints.

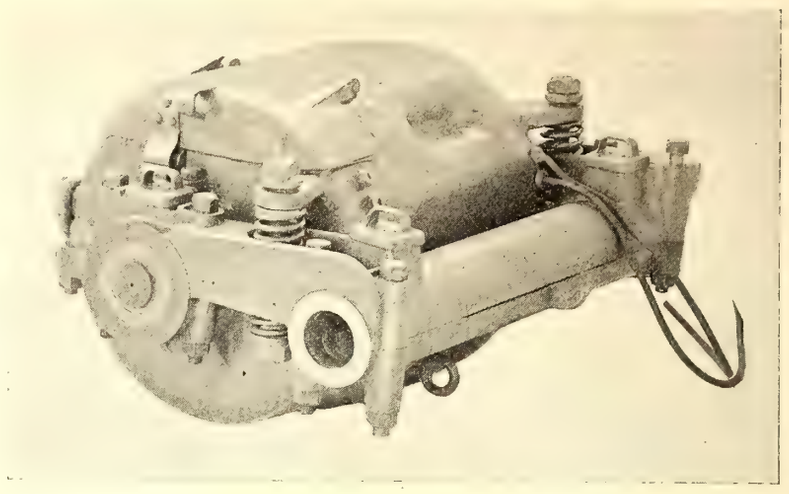


FIG. 2.—WALKER MOTOR—SHOWING METHOD OF SUSPENSION.

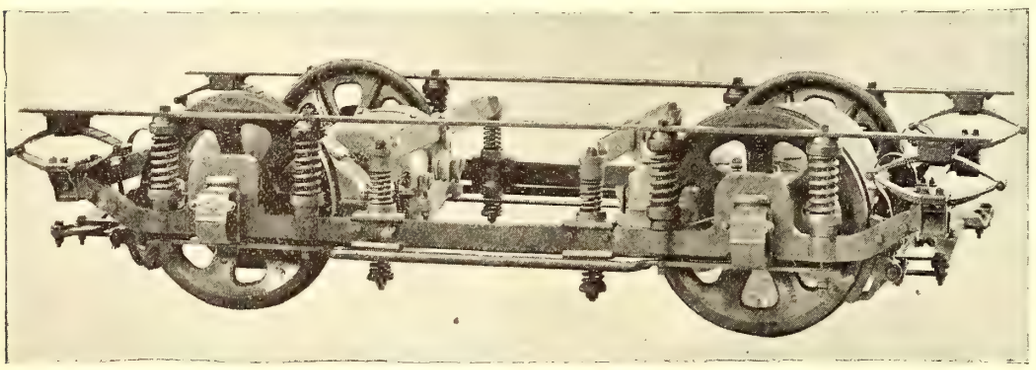


FIG. 1.—TRUCK WITH WALKER MOTOR, SHOWING METHOD OF SUSPENSION.

In the earliest application of electricity to street car propulsion, the motor was supported at one end by springs, while the other was journaled directly to the axle. But this was done more for the purpose of relieving the gear teeth from shock than out of consideration of the impact effect upon the rails, and it is only recently that this latter consideration has been seriously taken up by manufacturers.

In placing upon the market a new system of electric railway equipment, the Walker Manufacturing Company, of Cleveland, O., has aimed to produce a system that should combine all the long tried and approved principles of construction with the solution of the problem of suspension. In addition, the matter of cleanliness, and the exclusion from the commutator, armature and field coils of all oil and grease has been studied, and a design has been produced which is thoroughly effective. The method of suspension embodied in the Walker Manufacturing Company's system is a very simple one, and accomplishes very efficiently and practically its purpose. The Walker Company believes that the only way to avoid the impact at the rail joints is to disconnect the motor from rigid contact with the axle in such a way as to prevent, not only the hammer blow, due to the weight of the motor, but the inertia blow, due to its yielding mass. It considers that suspending the motor at its center of gravity may remove the direct dead weight from the axle when in a state of rest, but that any upward thrust, due to imperfect rail joints or other irregularities in the track, is still opposed by the mass of the motor, whose inertia is very considerable, and the consequent inertia blow on the rails is not avoided.

The engravings herewith presented show the ingenious and novel, yet simple method by which the elimination of both these effects is accomplished in the system under consideration. The motor is trunnioned by its bearing cases, and swings freely between the arms of a U shaped yoke. The part corresponding to the rounded end of the U is journaled on the car axle in the ordinary way. The motor is then supported at the rear by springs between the arms of the yoke, and heavy lugs projecting from the casing. At the front end it is supported by a swinging arm from the regular spring cross bar.

In this arrangement it is obvious that the only rigid connection between motor and axle is in the horizontal plane, in which lie the gear centers, and the only direct dead weight upon the axle is that of the U shaped yoke, which is insignificant. Thus, not only is the torque of the pinion against the gear doubly eased, but all thrust due to irregularities in the track is immediately met and cushioned by the springs. It is found in practice that this method of suspension, combined with the fact that this new motor has been reduced to a very light weight for its output, has made possible a very great saving in the cost of maintenance of way, not to mention the increased life of the motor itself, by reason of the reduction of destructive vibration and shocks.

Another feature of this system well worth mentioning is the disposition of the bearings. These are made extra long and large, and their inside ends are removed about three inches from the openings in the housing which is only just large enough to allow a small clearance for the shaft in passing through. In this three inch space are the thrust collars, and all the grease that is forced out between the ends of the bearings and these collars is thrown by the centrifugal action against the walls of the recess, from whence it finds its way, through a large opening in the bottom, to the ground. Thus, no oil or grease can possibly get to the commutator or windings.

The shaft is so constructed that in case of wear of the journals it can be withdrawn from the armature body on the removal of a single locked nut, and a new one can be inserted without the least disturbance of the windings. The motor, as will be seen by the engraving, is entirely encased, and proof against snow, dirt, moisture and physical injury. The gears are in a detachable, dustproof housing, and run in oil.

Grooved Raw Hide Belting.

It will be remembered that one of the features of the Shultz sable rawhide belting is that it is tanned on the surfaces only, instead of all the way through. This preserves an interior of rawhide, retaining, it is claimed, the original strength and greater durability. A driving surface is also provided which to the touch much resembles kid and is capable of excellent contact with the pulley.



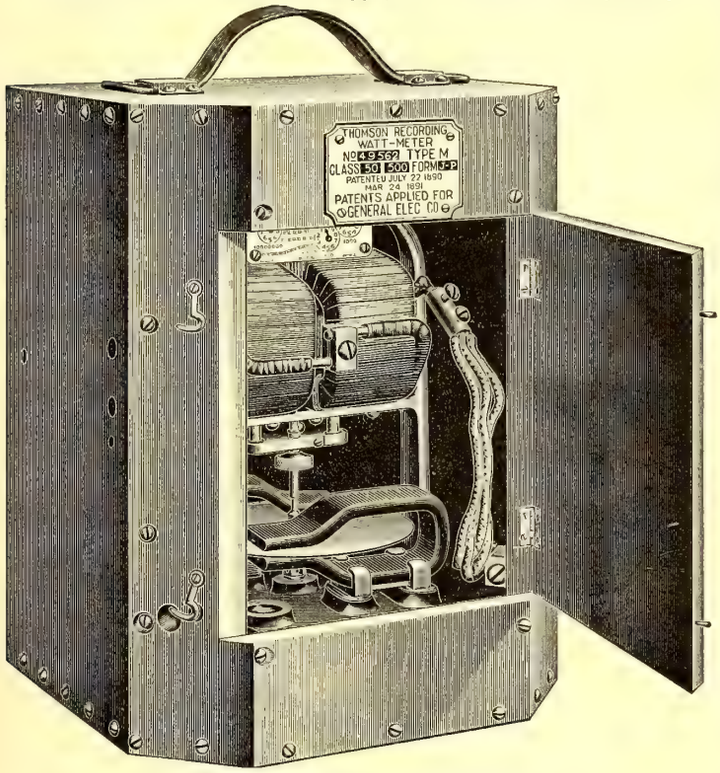
GROOVED RAW HIDE BELTING.

The section of belting shown herewith is manufactured by the Shultz Belting Company, of St. Louis, and is called by this company patent grooved sable rawhide belting. It is made of precisely the

same material as the Shultz sable rawhide belting, but also has grooves running lengthwise. These serve the purpose of channels to permit the escape of air from between belt and pulleys, and to such a degree that the air cushion is said to be overcome, making it possible for the belt to run very nearly as slack as link belting: The grooves are kept constantly clean by the current of air passing through them. It is also possible to run the belt satisfactorily with either slack top or bottom, and it is practically noiseless. This belt has been employed in the station of the St. Louis Electric Light & Power Company for about two years, where it has given excellent satisfaction.

Portable Recording Wattmeter.

The latest development in the electrical meter line is the new Thomson portable recording wattmeter, which, identical in general character with the standard meter of that type, is constructed with special provision for transportation from place to place, and for use in places where it is exposed to jarring and rough shaking. While it may, of course, be used for any and all classes of testing work in which a portable recording meter is requisite, its special use is for the testing of street car work and in this field it will be found most valuable.



PORTABLE RECORDING WATTMETER.

The meter is mounted on a skeleton frame suspended between strong elastic rubber nettings within the case. Detrimental shocks and vibrations become absorbed in these nettings, and no interference with the movement of the meter occurs. Its accuracy is unaffected even when placed on the floor of a rapidly moving car. The meter is mounted in a handsome polished wood case. The twenty-five ampere size will be found the most suitable for general car testing; it will stand and accurately record extreme overloads for short intervals.

This meter is the result of long and careful experiment on the part of the General Electric Company, and has manifest advantages over the rigidly mounted and bulky portable meters, formerly used for car testing in default of a superior device. This meter is claimed to be the only portable recording wattmeter on the market and is the outcome of an important demand from the street car companies for a meter which would enable them to check the efficiency of every car equipment and the average number of horse power hours needed to take any car over any route of their systems. They are manufactured in the following sizes: Three amperes one and a half horse power; fifteen amperes seven and a half horse power; twenty-five amperes, fifteen horse power; fifty amperes, thirty horse power; all for 500 volt circuits. They can also be made for any other voltage according to order.

The New Robinson "Ajax" Four Wheel Truck.

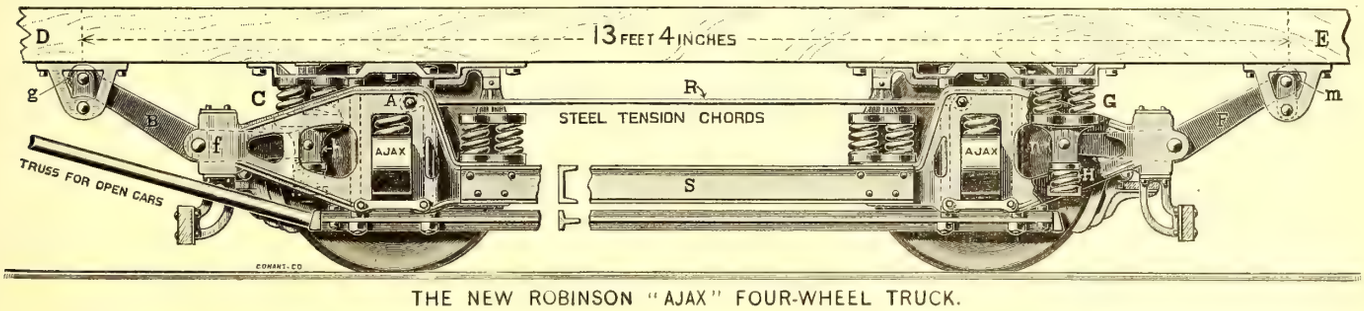
Most of the trucks heretofore introduced for use under four wheeled electric cars have been constructed on the same general principle, the difference consisting merely in details of construction. The principle involved in these trucks is to lessen the end teetering motion of the car by introducing springs between the car body and extensions of the truck frame projecting outwardly some distance beyond the axle boxes, the descending end of the car body compressing the springs from the top only. Some of these trucks have materially diminished the teetering of the car, while others have been less successful in this regard. The question is not an easy one to solve. The modern four wheeled car is virtually a natural teetering rack, approximately thirty feet long, mounted on two fulcrums six feet or six feet six inches apart. The problem of rendering this monstrosity non-teetering, without moving the axles out near to the end of the car where, from a mechanical standpoint, they should be, is difficult.

The new Robinson Ajax four wheel truck therefore, shown on this page, will prove of especial interest to our readers from its claim of presenting a solution for this important problem. It is the invention of William Robinson, inventor of the well known Robinson radial truck and general manager of the Robinson Electric Truck & Supply Company, of Boston, Mass.

The novel features of the Ajax truck will be best understood by referring to the illustration, below, in which the saddle casting, A, which embraces the journal box, forms, at f, a fulcrum for the bent lever, B, one end of which is flexibly connected to the car sill, as shown at g, while the other end of said lever, B, supports the springs, C, upon which the car body rests. The lever, F, at the opposite end of the truck is arranged in the same manner as the lever, B, just described, and it will be observed that both levers are located wholly beyond the journal boxes outwardly. The operation will be understood as follows: Assume that the end, D, of the car body descends, as in teetering; this depresses the outer end, g, of the lever, B, raises the inner end, h, of the same and compresses the springs, C, from the bottom, thus resisting the downward tendency of the end, D, of the car.

Now if the end, D, of the car descends, in teetering, the opposite end, E, of course must ascend, raising the outer end, m, of the lever, F, lowering the inner end, n, of the same, thus removing support from the springs, G, and compressing the cushion spring, H, all of which resists the rising tendency of the end, E, of the car. In this connection it will be observed also that the action of the spring, H, is peculiar. This spring is supported by a spring seat in the saddle casting, and exerts an upward pressure on the inner end of the levers. Now when the outer end of the lever, F, for instance, is raised by the rising end, E, of the car body, the inner end of said lever, F compresses the spring, H, which thus directly and positively resists the rising tendency of the end, E, of the car body. At the same time this pressure on the spring, H, exerts a positive pressure to push the truck frame downwardly. In other trucks the cushion spring, when one is used at all, exerts a positive pressure to raise the truck from the boxes, or the boxes from the axles, as the case may be, when the end of the car rises in teetering. Additional springs, supported on the truck frame between the boxes, as shown, are used, and a portion of the weight of the car body is carried on these. The number of springs and their arrangement make the riding extremely easy.

It will be seen, furthermore, that there are springs located between the axle boxes and the truck frame. The advantages of these springs in taking up shocks, preventing strain on the truck frame and tending to ease of riding, are too well known to need comment here. The Ajax truck is provided with lever brake hangers, adjustable brake release springs of a novel character, and anti-rattlers, all of which are found to work in the most satisfactory manner.



THE NEW ROBINSON "AJAX" FOUR-WHEEL TRUCK.

Six men stood on the extreme end of a twenty-eight foot body mounted on one of these trucks with a six foot six inch wheel base. These men got up a swaying up and down motion together, doing their best to teeter the car. The springs showed great sensitiveness and ease of movement, but they failed to teeter the car.

The lower side members of the frame are composed of steel channels hot riveted to the lower part of the saddles. The upper side members of the frame are composed of steel tension chords, a construction giving the greatest possible strength with lightness and simplicity. The ends of the truck are composed of specially heavy and strong channels securely hot riveted to castings similarly riveted to the sides of the frame. The whole design and construction is expert work, the result of many years of expert experience.

The Hunt Air Brake.

The increasing demand for surface rapid transit brings with it the demand for some means more powerful than hand power by which a car can be quickly brought under control, under all conditions, by the operator. It is with this in mind that the air brake shown herewith has been put on the market by H. E. Hunt, of Pittsburgh. It is a combination of an air pump supported by trunnions and worked by an eccentric and piston rod attached to the car axle; a reservoir for compressed air located under seats of the car; an air brake cylinder of ordinary type and brake connections; the connection of the brake cylinder to the air reservoir being controlled by a specially made three-way valve located in the cab. An automatic pressure regulator is so constructed that when air pressure in the reservoir is up to the desired amount, all pressure on the pump is relieved and discharged into the atmosphere directly; thus relieving the work of the pump and power required to operate it.

With these facts in view, it has been the inventor's aim to provide a very simple, durable and reliable air brake for a low figure; and he now feels that, after three years of continuous practice and developments, he is justified in making the above statement.

The following cuts and description of the system will be readily understood.

Fig. 1 shows the arrangement as applied to the rear truck of a double truck cable car. The pump is double acting, four inches diameter, eight inches stroke, and oscillates to take the up and down motion of eccentric. All parts are so constructed as to stand the greatest amount of wear and in case of breakage to be easily repaired

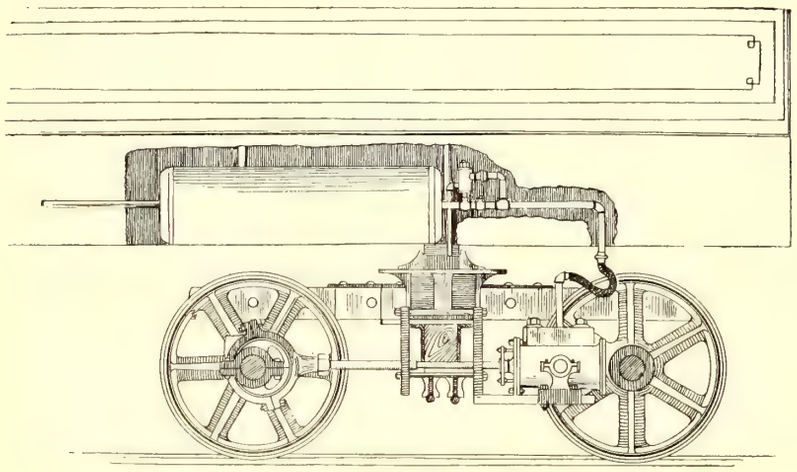


FIG 1.—GENERAL ARRANGEMENT HUNT AIR BRAKE.

or replaced. To show the durability of the apparatus, it need only be mentioned that one set at this writing is on its twenty-first month of steady running and has never required repairing.

The reservoirs are made of steel, and lap welded and tested to 200 lbs. cold water pressure. It is also supplied with a valve for the blowing-off of condensation. The automatic pressure regulator is placed next to reservoir, and is made of brass, to prevent corrosion or rust, and contains no complicated mechanism to get out of order. Its operation is different from any other valve of its kind, and immediately takes all load from pump, when reservoir pressure is attained, as it acts directly on pump simultaneously, the pump working through it direct and not through reservoir or reservoir pressure, as do other valves designed to accomplish the same object. It is very sensitive and has a movement of only one-sixteenth of an inch. The valve is also capable of being adjusted to carry any pressure—from thirty pounds per square inch up—desired. Its release is such that no disagreeable noise is heard.

The three-way valve is shown in Fig. 2 and is made entirely of brass. The valve seat and valve disk contain nine ports and by-ports, so arranged and registered with each other that the brake can be applied with any degree of pressure desired, held or released at will. In ordinary stopping or slowing up, the valve handle has a movement of only one-half inch. When an emergency stop is required, the handle has a movement of one inch, which brings the brake cylinder in connection with the reservoir through four ports, and releases through five. There is no noise in releasing.

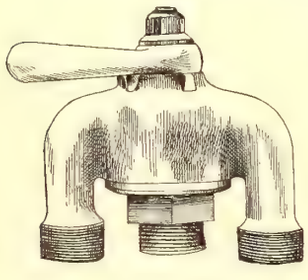


FIG. 2.—HUNT 3-WAY VALVE.

The claims made for this system over any other are: Its simplicity, compactness, durability, least possible number of wearing parts, easy access to all parts that wear, small power required to run pump, and that all parts are made interchangeable; also:

That a car fitted with the brake will run on any track after power has been released, as far as any cars without it.

That a car fitted with the system can be stopped in one-half the distance of a car under some conditions with any hand brake, and will wear a set of shoes longer than a car without it.

That a cable car has run with the brake for 577 days, covering 46,160 miles; and the cost of all repairs to brake system, including labor, has been less than $5.

The Spillman Trolley Ear.

The accompanying cuts show different views of the Spillman trolley ear which the Ohio Brass Company, of Mansfield, O., has recently made exclusive arrangements to manufacture and is now offering to the trade. The ear has several features peculiar to itself which commend it to the users of similar devices. The great objection raised to the use of soldered ears, namely, that of burning the trolley wire, the time and material consumed in soldering, the difficulty of adjusting

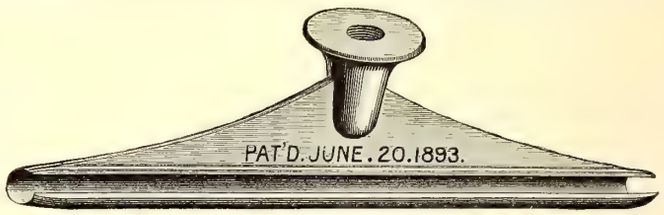


FIG 1.—TROLLEY EAR.

the hanger after once in place, as well as the objection to many clamps, that of sparking when the trolley wheel passes over it, have all been overcome in the design and construction of this ear. It has been given a practical test both on straight line and curve work for over a year past on one of the largest roads in the West, and its utility thoroughly demonstrated.

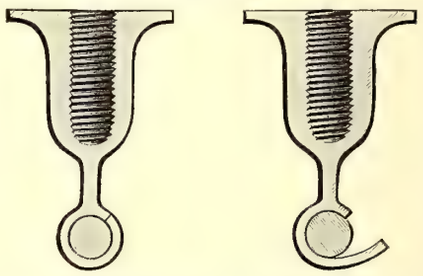
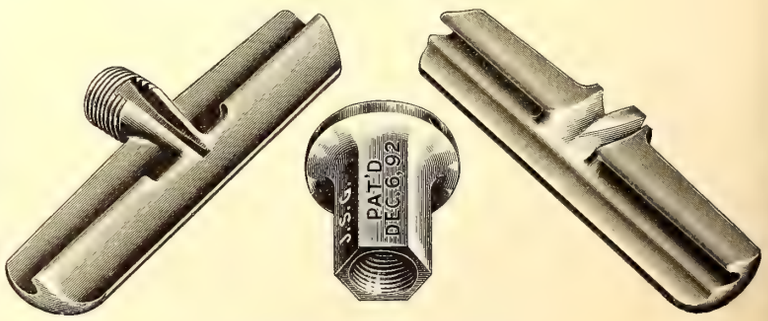


FIG. 2.—SECTIONS OF EAR SHOWING METHOD OF FASTENING LINE WIRE.

The ear is screwed onto the hanger body and the trolley wire placed in the concave lip. The trolley wire is then pulled to the necessary tautness and the lip of the ear is compressed over it. A metal block is held on the back side of the ear and a copper hammer used to do the forming with, beginning at the center and working toward the ends. On curves the ear should be hung so that the side strain of the trolley wire is against the web. If it is necessary to adjust the hanger the lips can be opened sufficiently to slip the ear along the trolley wire.

Hercules Trolley Clamp.

The difference in cost between two trolley lines, one of which is put up with soldered ears, and the other with trolley clamps, or automatic ears, as they are sometimes called, is said to be at least five to one in favor of the line put up with trolley clamps. The Hercules



HERCULES TROLLEY CLAMP.

trolley clamp, manufactured by J. S. Gustin & Company, of 84 Market Street, Chicago, is claimed to have the particular merits of the soldered ear, viz., the strong hold on the wire, and the smooth passage that it affords the trolley wheel, and yet it does not, at any point of its entire length, enclose but little more than half of the trolley wire, so that it

affords a perfectly smooth path for the trolley wheel. The Hercules trolley clamp consists of but three parts, the smallest number it is possible to make any clamping device of. Two of these parts grip the wire, and the third, the nut, holds the others in engagement, and also fastens the complete device to the insulators. The threaded shank being all on one part of the clamp, it is readily seen that when the nut is brought to bear on the loose part, the pressure on the nut is all on one side; consequently the nut is locked, and the clamp cannot be jarred loose. Whenever it is desired to adjust this clamp on the wire, which, by the way, has to be done frequently on new lines, it is not necessary to take the nut off completely, but simply unscrew it for three or four turns, when the clamp will be loose enough to be moved to the required position, and can then be refastened.

The Hercules trolley clamp is made of malleable iron, subjected to a very heavy pressure, so as to make the metal perfectly homogeneous. After the several parts have had the machine work done on them, and have been carefully inspected for any flaws there might be, they are each given a heavy electroplating of copper, and finally assembled. To show on just what grounds the manufacturers base their guarantee, we were shown a report of a test made recently by the Robert W. Hunt & Company Testing Bureau, of a Hercules trolley clamp and a fifteen inch soldered ear. This report stated that the Hercules trolley clamp was subjected to a strain of 1,000 lbs., and yet was not injured in any way, while the soldered ear, with a strain of only 500 lbs., was so distorted that it could never be used again.

The Hercules trolley clamp is made for three sizes of wire, namely, Nos. 0 and 1, B. & S. gauge, and No. 2, Birmingham gauge, and it can be furnished for any size stud from seven-sixteenths of an inch to five-eighths of an inch, inclusive.

New Style of Convertible Car.

One of the most important questions in street railway economy is how to run a road without being obliged to have a double equipment of cars, trucks, motors, etc. This is a very important item, for if a full equipment of both open and closed cars is kept, one set remains idle in the car house continuously. This represents a large amount of unproductive capital, the interest on which is a direct loss to the railway company. Many car builders in this country have tried to solve this problem, but the Convertible Car Manufacturing Company, whose office is in the Old Colony Building, Chicago, Ill., claims to have removed all the difficulties heretofore existing in cars of this type. The car manufactured by this company is run on the 63d Street line of the Chicago City Street Railway Company, where it is giving excellent results. A good idea of the satisfaction which the car is giving to the general public was shown by the statements of the conductor, who has been running the car for about a month, to a representative of the STREET RAILWAY JOURNAL. The conductor said that during the cold weather early in June, the car did more business than any other car on the line, for the reason that during the early part of the day and in the evening the car was kept closed, and run as a closed car, but during the middle of the day, when the weather was warm, the car was operated as a summer car, open on both sides. He said the car can be operated with one side closed and one side open, so that in cases of a sudden rain or extreme weather, one-half of the car can be closed and the other open. The car can be changed from an open to a closed car by the conductor in three minutes, and with the assistance of the motorman it can be changed in one-half the time. In fact, no emergency can arise, in the way of inclement weather, that cannot immediately be overcome by those in charge of the car.

When the car is open as a summer car, it can be used as an end car or a side car, or both. This car is equipped with a full length side step which is only used when the car is used as an open car, and folded up in a compact way against the side of the truck when used as a closed car. The car is equipped with leather upholstered, reversible seats, eight on a side, thus giving a seating capacity of thirty-two. The seats are very comfortable and easy to ride.

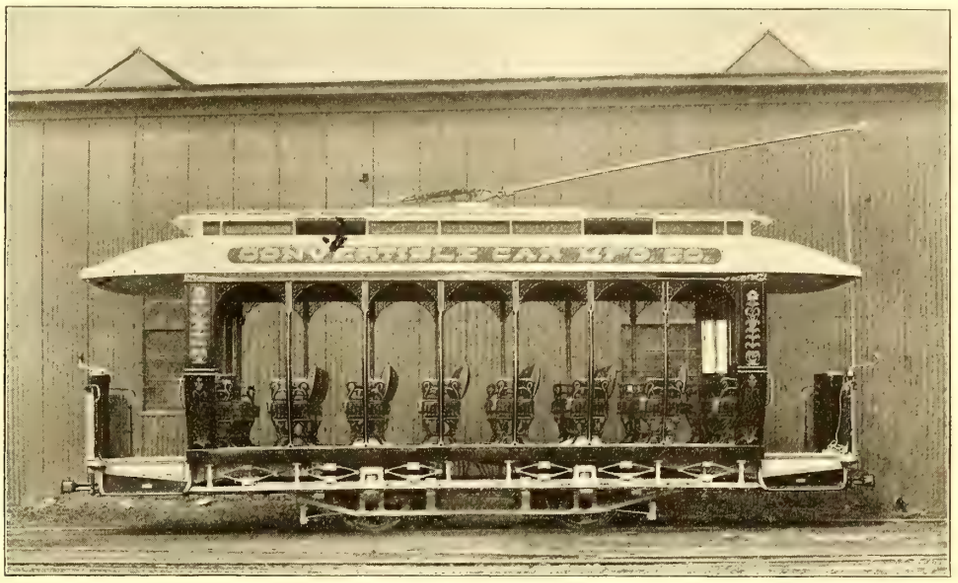


FIG. 1.—CONVERTIBLE CAR.

This car is mounted on one of the Chicago Electric Truck Company's trucks, having a fifteen foot spring base and seven foot wheel base. One of the most extraordinary things about this truck is the fact that it was one of the first trucks built by the company, and went direct from the designer's hands into actual use, where it has been run every day since first started. The motor used is the G. E. 800 type.

The originator of this car, T. H. Lovejoy, has had considerable experience in street car business in the city of Portland, Ore., where he occupied the position of superintendent of the car works in Portland, and he built a number of cars of this type, which are now being used in Portland, San Francisco and Tacoma.

Mr. Lovejoy has come East for the purpose of giving his time and attention to the building of these cars, and to putting them on the market. A company has been formed, under the name of the Convertible Car Manufacturing Company, with officers as follows: Horace Tucker, president; J. M. Thompson, vice-president; Horace M. Johnson, secretary; E. C. Talmadge, treasurer; J. W. Alderman, manager, and J. H. Lovejoy, superintendent.

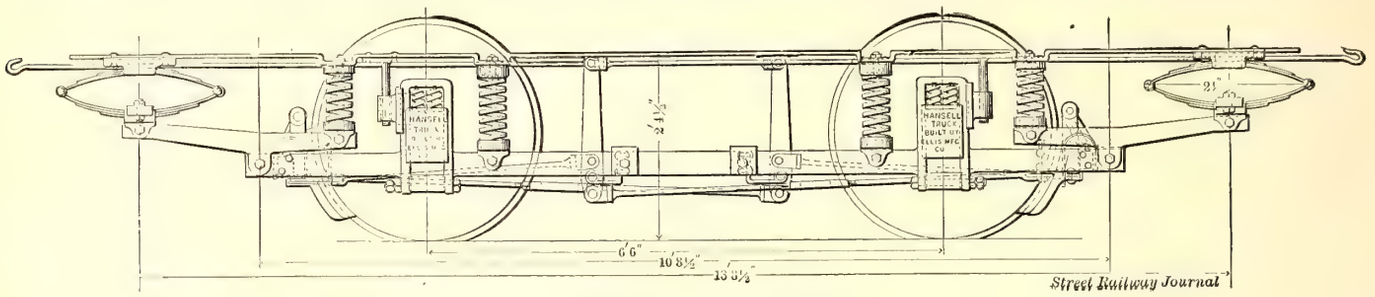
With plenty of capital to back it up, there is no reason why this company should not do an excellent business.



FIG. 2.—INTERIOR OF CONVERTIBLE CAR.

The Hansell Equalizing Trucks.

The Ellis Manufacturing Company of Philadelphia, a company recently organized with Harvey Ellis as president, and J. C. Hancock as secretary and treasurer, has put upon the market a truck, a side view of which is shown in the accompanying engraving. One chief claim made for this truck is that oscillation is eliminated by means of the equalizing beams outside of the journals. These beams are pivoted, as shown, to an extension of the side bar of the truck and carry at their outside extremities twenty-four inch elliptical springs. By extending



THE HANSELL EQUALIZING TRUCK.

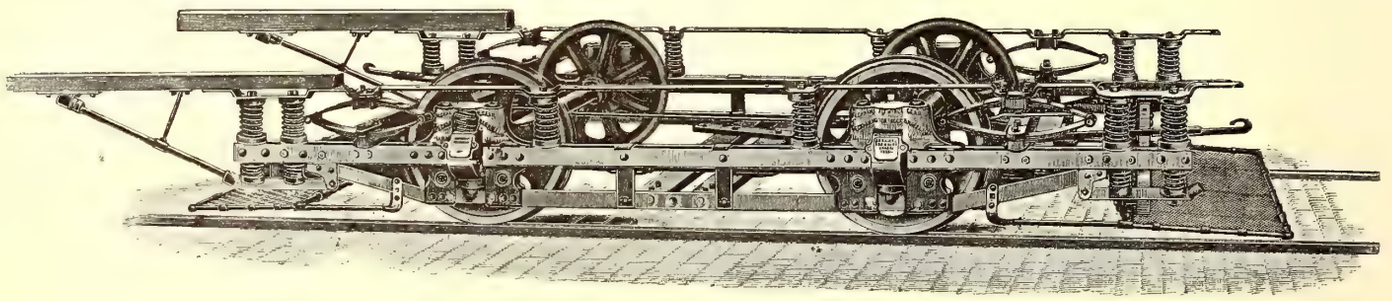
these springs and stiffening the spiral springs accordingly, the spring base is almost illimitable.

Another important feature of the truck is the cushioned journals by which any inequalities of the truck are not communicated to the truck frame. The yoke having a broad guide face gives more positive action of the journal boxes, avoiding a wabbling motion. The journal boxes are built on the M. C. B, standard. The braking apparatus is positive in action, the shoes being operated simultaneously with great leverage. The wheels and axles can be removed quickly and with very little trouble by loosening one bolt under the journals. Any springs can also be replaced without taking off the car body.

Peckham's Improved Extra Long Truck.

This truck is an improvement on the extra long 6 D truck manufactured by the Peckham Motor Truck & Wheel Company, and consists of an increased spring base and a new truss extension for supporting open cars. It is designed expressly for twenty-two foot closed, or thirty-two foot open cars. The spring base of this truck is fourteen feet with a wheel base of six feet six inches. The extreme length of the forged steel top frames is sixteen feet. It is equipped with the Peckham spiral spring cushioned gear, and has the same general arrangement of springs as his standard truck, except that it is provided with an extra spiral spring at each end which increases the spring base and prevents oscillation of cars.

The spring cushioned gear consists of a steel yoke provided with a cylindrical aperture on the upper part into which is inserted the graduated spiral springs. These springs are of different lengths and diameters, insuring flexibility under both light and heavy loads. The side frames are constructed of wrought steel bars secured to steel yokes entirely by rivets driven hot by skilled boiler makers. The general construction of side frames, brakes, etc., is the same as that of their standard truck, which has been described in former numbers of the STREET RAILWAY JOURNAL.



PECKHAM'S IMPROVED EXTRA LONG TRUCK.

The truck is equipped with the Peckham automatic life and wheel guard which was illustrated and described in the June issue of the STREET RAILWAY JOURNAL.

The Composite Brake Shoe Company.

This is the title of a new company which has succeeded to the business and to all the rights, titles, etc., of the Safety Brake Shoe Company, of Boston. The officers of the Composite Brake Shoe Company are Wm. W. Whitcomb, president and general manager; George C. Ewing, superintendent; Charles H. Burrage, secretary and treasurer. The headquarters are at 620 Atlantic Avenue, Boston.

The composite brake shoe is well known and has achieved an excellent reputation for its braking and wearing qualities, and descriptions of the shoe have already been published in these columns. The new company will have larger facilities for business than were enjoyed by the Safety Brake Shoe Company,

Aluminum Bronze for Overhead Railway Material.

The Fiberite Company, of Mechanicville, N. Y., has taken a new departure in the matter of overhead material. Recognizing the importance of having the strongest and most durable metal, this Company has recently adopted aluminum bronze in place of the ordinary red bronze. As is well known, aluminum bronze, like iron, may be forged and welded, and is very strong and firm. The relative tensile strength of ordinary bronze, as compared with aluminum bronze, is as follows: Ordinary bronze tests 36,000 lbs. to the square inch, aluminum bronze 90,000 lbs. to the square inch. One of the important features of aluminum bronze is that it is not in any way subject to oxidation.

This company is constantly adding to its line of specialties, making among other things, frogs, crossovers, section insulators, trolley harps, trolleys, and many other specialties which are useful to street railroads. It is the first company in the country to apply the use of aluminum to street railway apparatus.

The Hazelton or Porcupine Boiler.

The use of the vertical boiler manufactured by the Hazelton Boiler Company, of New York, is so extensive that a few particulars in regard to its main features and advantages will not be without interest.

The boiler consists essentially of a vertical standpipe or cylinder, varying in diameter, height and thickness, according to the power required. From this vertical pipe the water tubes radiate, giving to the boiler before it is enclosed, somewhat the appearance of an enormous porcupine standing erect; hence its name. The standpipe rests upon a circular, cast iron foundation plate, placed upon a supplementary foundation of brick, raised one course above the level of the foundation. That portion of the standpipe below the grate bars forms the mud drum, into which a manhole with a plate is placed, affording ready facility for entering the boiler and examining every portion of its interior surface. Owing to the very rapid and perfect circulation in this boiler, the extraneous matter contained in the water is deposited in the lower end of the standpipe and either blown off or removed through the manhole.

The diameter, length and number of the radial tubes depend upon the size of the boiler. One end of each tube is open, the other is closed upon itself, forming a hemispherical or round end, and in the process of closing, the end is thickened, thereby adding strength and producing a homogeneous tube. The open end of each tube is expanded into the standpipe, the tube extending outward horizontally, its closed end being about one inch distant from the inner surface of the brickwork enclosure of the boiler. Thus the radial tubes, being secured at one end only, and clear of the brickwork at the other end, can expand and contract without strain.

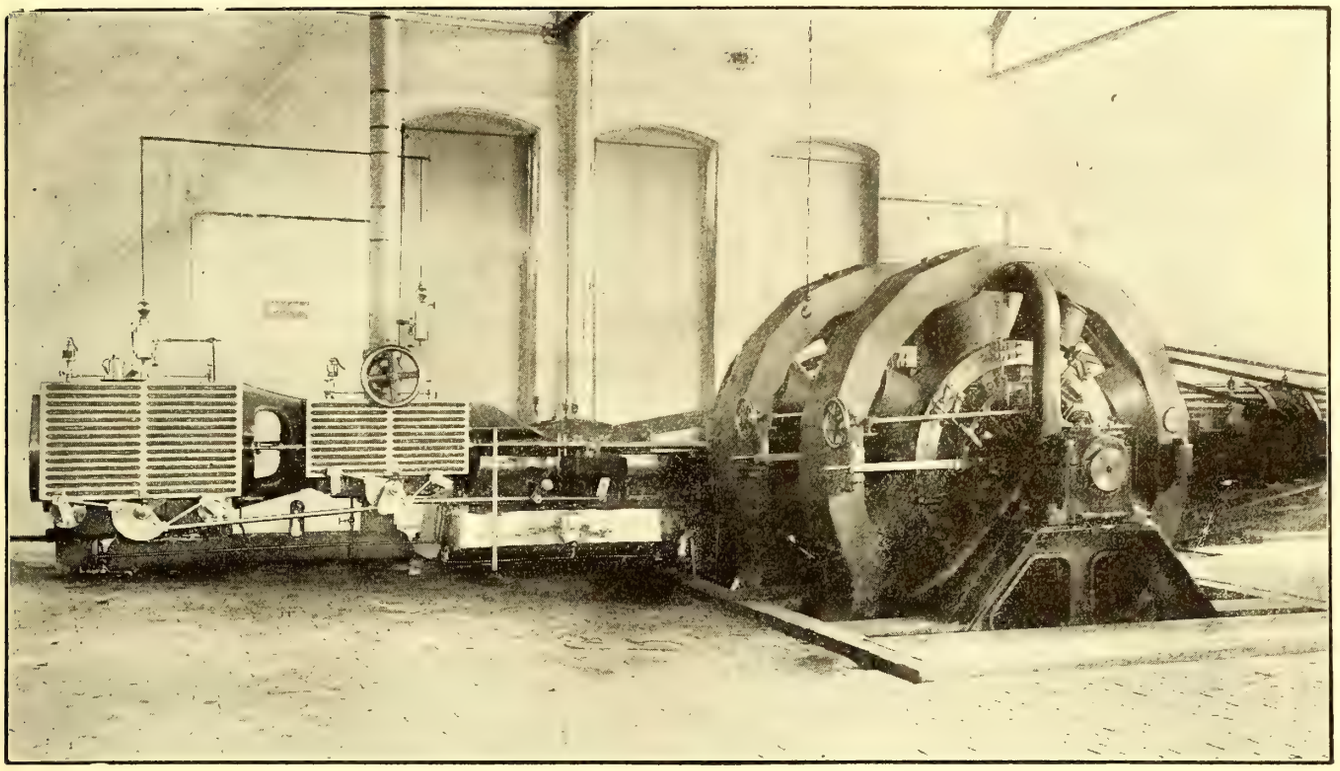
The grate surface is circular in form, and extends entirely around the standpipe. The grate bars, at their inner ends, rest upon a wrought iron ring, supported by wrought iron brackets riveted to the standpipe, and the outer ends are supported by cast iron plates resting upon a projection of brickwork.

THE Jefferson Avenue Railroad, of New Orleans, (La.) is the title of a new corporation, with a capital of $500,000, organized in New Orleans, which will build a street railway to operate in connection with a pleasure resort on what was formerly the Perkins sugar plantation, and which will comprise twenty-five acres. The officers of the company are W. N. Louque, president; Octave Besancon, secretary and treasurer, and Wm. Cummings, superintendent. The company proposes to illuminate the grounds by means of electric light, run a hotel and restaurant, a base ball park and athletic grounds, etc.

Direct Coupled Russell Engine and G. E. Dynamos.

The direct coupled dynamos and engine shown herewith were recently installed in the station of the Edison Electric Light Company, at Grand Rapids, Mich. They present some features of interest, and deserve special notice. The outfit consists of one four valve, compound, condensing engine, 15×24×24, rated at from 300 to 400 H. P., built by Russell & Company, of Massillon, O., and two 100 K. W. generators, made by the General Electric Company, of Schenectady, N. Y.

The bed of the engine, and the fields of the dynamos rest upon a common iron base. The main shaft of the engine, carrying, in addition to the flywheel, the two armatures, is supported in two pillow blocks



DIRECT COUPLED RUSSELL ENGINE AND GENERAL ELECTRIC DYNAMOS.

mounted on detachable iron stands, so that the armatures may be removed without lifting the shaft out of place.

A test conducted by Frank A. Simonds, mechanical engineer, to determine the engine's economy in verification of guarantees, yielded the following results:

RUNNING NON-CONDENSING.

Duration trial, 6 hrs.	
Average steam pressure	139.05
" revolutions per minute	162.00
" I. H. P. developed	307.74
Water per I. H. P.	18.45

RUNNING CONDENSING.

Duration trial 6 hrs.	
Average steam pressure	130.00
" vacuum	25.75
" revolutions	162.00
" I. H. P.	327.75
Water per I. H. P.	15.59

The Hennegin Life Guard.

The accompanying illustration shows a life guard embodying a number of entirely new ideas. It is the invention of H. H. Hennegin, 306 Temple Building, St. Louis. The aim of the guard is not only to save a person from being run over by a car, but also to stop the car in a shorter space than is possible with the ordinary brakes. One of the most important features of the device is that it is not dependent upon the motorman for its efficient working, but is self acting.

Its construction is as follows: Directly under the platform, about a foot from the front of the same, is a triangular steel casting, the apex of one of whose angles hinges to a piece which is attached to the under side of the floor. To the vertical side of the casting is attached the board seen under the front part of the platform, as shown. To another side are connected the rods seen below the platform supports under the car body. When an obstruction strikes the above mentioned board, which is but four inches from the rails, its displacement being brought about by any weight above twenty-five pounds, it causes it to turn on its axis, being attached to the triangular casting. Thus motion is communicated to the rods, and they, in turn, actuate the mechanism of the guard. The engraving shows the apparatus in its normal position ready for operation. The large casting which, together with its mate on the opposite side of the car, supports the framework of the guard, is strongly connected with the car truck. Great strength is here required, for when the steel bar blocks the car wheel there is a severe dragging motion.

The action of the fender has been frequently tested with dummies and other obstructions. An obstacle striking the board beneath the platform causes it, by means of the mechanism explained above, to throw the guard board to the rails, and at the same time block the wheels. Thus the obstacle is caught by the board and carried along, and at the same time the car is being stopped. The revolution of the wheels then ceases, and the wheels are caused to slide, thus bringing the car to a standstill in the minimum time. The guard was tested while the car was running at a rate of twenty miles an hour and fifty feet a minute, and in all cases it worked most satisfactorily. In the tests on car No. 30 of the Cass Avenue line, of the Cass Avenue & Fair Grounds Railway, of St. Louis, several unexpected obstructions were encountered, such as large stones in the street, and in these cases, the



NEW LIFE GUARD—ST. LOUIS.

comparatively easy working of the device at all times was proven. The guard is reset from the platform.

The grate bar guard shown at the front of the car is also the invention of Mr. Hennegin. It is intended for use between motor and trail cars. It is detachable, and can be changed from one end of the car to the other in a moment's time, where such operation is necessary. The method of hanging the guard on the platform can easily be understood on reference to the cut, the vertical portions of its arms fitting in brass sockets at their upper ends, and resting against the platform at their lower ends. The arms are held in the sockets by heavy screws, and are thus supported.

The Works of the Card Electric Motor & Dynamo Company.

This business was established in Cincinnati in 1882 in a modest way, for the purpose of manufacturing generators and stationary motors from designs made by Mr. Card, after whom the company derived its name. Mr. Card, however, has not been connected with the company for about eight years, and the original design and method of construction of the machines have been greatly modified, and have little resemblance to the original dynamos first manufactured, though the name is retained.

From small beginnings the business has grown to large proportions, and the works now occupy the company's own building, a large four story brick structure on the corner of Broadway and Hunt Street, with from fifty to seventy-five employes. Notwithstanding the financial depression, the business of the firm has steadily increased, especially since January 1, so that it has been necessary to run overtime. The ground dimensions of the building are 175×80 ft., with the principal side entrance on Hunt Street. Capacious offices are on the second floor, with entrance on Broadway.

The machine shop is located on the ground floor, and is equipped with a large and fine assortment of lathes, planers and radial drills, of latest designs, for the economical manufacture of dynamos and motors, and each one of which is driven by an independent motor, no shafting being employed. The current for operating the motors has a potential of about 110 volts, which is derived from an eighty horse power generator driven by an engine of 200 H. P. capacity, through the medium of a countershaft, and from which other generators are driven for producing the current employed in the testing new motors.

The motor which operates a lathe is usually placed on the floor under the machine, that for the drills to one side, while the planers are operated by a belt from the motor suspended to the ceiling. The rheostat and switches are attached to the field of the motors, or to the frame of the machines, and the lathes are controlled by a wooden bar which is attached to the side of the frame, and has a motion endways, back and forth, for stopping, starting or reversing, and by which the speed can be controlled, it being of sufficient length to be reached by an attendant from any part of the machine. The switches of the motors for driving the radial drills are operated by hand wheels, through the medium of a shaft which extends across the machine, the wheels being accessible from either side. The operation of the tools by this method has proved very satisfactory, and the workmen take kindly to it. The change of speed, and the starting and stopping take less time than where countershaft and belts are employed, and the danger of adjusting belts to coned pulleys is avoided. The first shop equipment by this method is said to be but little, if any, more than the expense of shafting, and much less power is required to operate the tools.

More recently a motor has been devised for operating lathes in which the armature is wound on a thimble embracing a shaft in line with the spindle of the machine, and the fields form part of the frame-work, making virtually an ironclad motor and a self contained machine, the spindle being driven by differential gears, the same as employed with coned pulleys. The lathe, equipped as illustrated in our May issue, was manufactured by the Lodge & Davis Machine Tool Company, of Cincinnati, which manufactures most of the machines which are equipped in this manner with the Card motors. For extra large lathes a multipolar motor is employed. The plan of thus driving iron working tools,

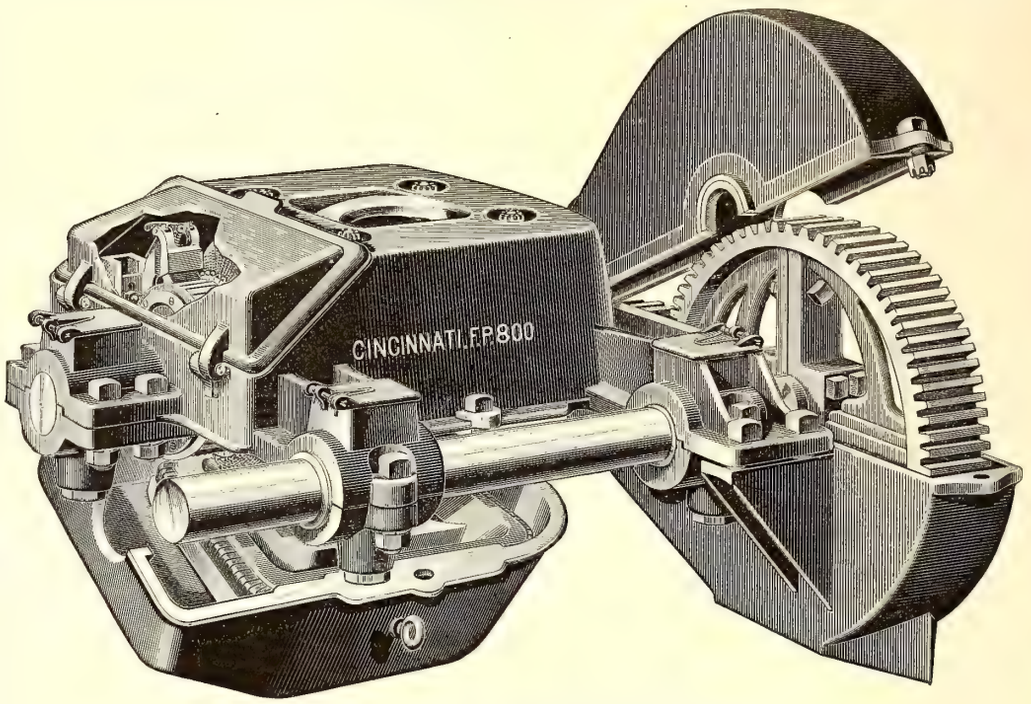


FIG 2.—MOTOR—CARD ELECTRIC MOTOR & DYNAMO CO.



FIG. 1.—WORKS OF THE CARD ELECTRIC MOTOR & DYNAMO CO., CINCINNATI.

it is claimed, was originated by this company. Machines thus driven are particularly adapted to street railway work, for they can be set up at the car barn, power station, in the machine shop, or wherever it is necessary to make repairs, and can be readily moved from one station to another in case it is necessary.

The works turn out generators and stationary and car motors. The stationary motors are manufactured up to eighty horse power, and are adapted for service in all cases where power is required. The shafts of the large motors are supported on long, self adjusting, self oiling journal bearings, and are built and finished in a most thorough manner, evidencing a superior class of workmanship.

Recently the company has brought out a railway motor which is modeled after the design of the General Electric Company's 800 motor, but differs from it in that the lower half of the frame is hinged, and can be swung down when it is necessary to remove the armature. The armature shaft is held in place by a collar which, when unbolted, allows the armature to be let down. This motor is also provided with self oiling bearings which are longer than those employed in the G. E. 800 machine, and the motors are also equipped with a steel shaft, while the cover is of a somewhat different pattern from the original type. Twenty-five equipments of these motors have been recently put in service on the lines of the Cincinnati Street Railway Company, as noted on another page of this issue.

The Card Motor Company has also recently rebuilt or repaired a number of motors, of the waterproof type, which went through the fire in the burning of the car barns of the Cincinnati Street Railway Company last winter.

The winding room of the works is located on the second floor, and the four floors are served by an elevator which is operated by an electric motor. The second floor is occupied by a large drafting and designing room in the front of the building, and a stock room in the rear half of the floor. The fourth floor is used for a pattern shop and storage of patterns and light castings.

The Lodge & Davis Machine Tool Co.'s Works.

The works of this company occupy an entire block, bounded by Sixth, Eggleston Avenue, Culvert and Eighth Streets, Cincinnati. They consist of a collection of well constructed two and three story buildings, having a floor space of over 60,000 sq. ft., and splendidly adapted to the business for which they were designed. The location is near some of the steam lines, from which sidings lead directly into the buildings, facilitating the delivery of supplies and the shipping of material. Among the manufacturing industries of the city, none command a more conspicuous position, either in location or reputation, than the large works of the above company. The works when running full give employment to about 650 men.

The business consists in the manufacture of tools for working iron, steel and brass, and includes lathes, planers, shapers, milling machines radial drills, screw machines, bolt cutters. As these tools enter largely into the manufacture of all classes of traction machinery, including street cars, dynamos and electric motors, and are also employed in the repair of this machinery, their manufacture is of special interest to the street railway fraternity.

The different departments of the works are well lighted, well ventilated and thoroughly furnished in every department with almost every description of iron working tools for the processes required in the different shops and finishing rooms; and also with trolleys and hoists for handling heavy casting and serving the tools with the greatest possible despatch and economy.

The products of the works go all over the world. This company was among the largest exhibitors of iron working tools at the Columbian Exposition, making an exhibit which cost over $25,000, and which has brought in since the close of the exposition a very large increase in foreign orders. Among the tools in process of construction at the recent visit of a representative of the STREET RAILWAY JOURNAL were noted radial drills, planers and shaping machines which are being built for the Government railways of Hungary, and which are to be shipped directly to Buda-Pesth. We also noted a number of orders from South American countries, and an order for a 24 × 12 lathe for a mining camp located in the mountains of Mexico, in the construction of which the specifications required that the shears and all parts should be so joined and broken up that the whole machine could be packed in boxes which should not exceed in weight 250 or 300 lbs., so that they could be carried over the mountain trails on the backs of burros.

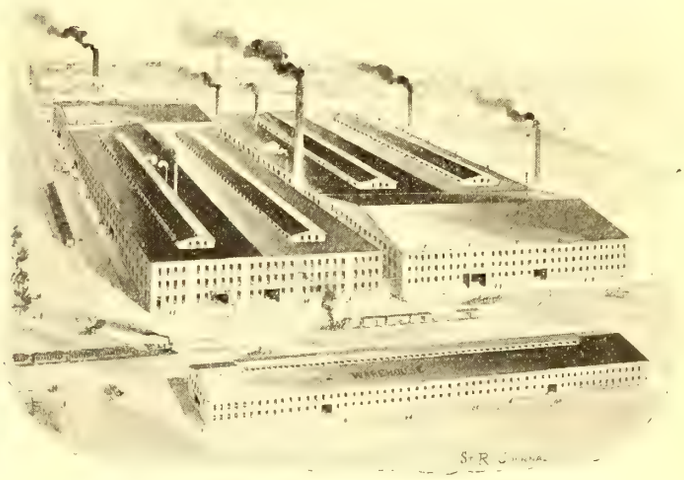
A special feature which commends this company's work, is that all parts of the machines are built on the interchangeable plan. This not only insures accuracy, but enables duplicate parts to be finished at once.

One of the most interesting features of the works is the tool room, in which there are a number of carefully constructed machine tools designed for the manufacture of drills, taps, etc., employed in the shops. The tool room is provided with shelves and cupboards for the storing of the small tools, which are arranged in sections and properly numbered. There is also an electric call board similar to those employed in hotel offices. This is in charge of an attendant who delivers the tools to the various workmen on signal, which each can give by touching a push button near his machine. The tool is delivered and the workman's check taken in receipt, so that a careful check is kept on all the small tools. The oil and other supplies are also issued on check in the same manner, and none of the workmen are allowed to enter the tool room without special permission. The store room for castings is also managed in the same way, only one man being allowed to remove a casting of any kind from its department, when it is delivered and charged up to the individual workman.

The Lodge & Davis Company was among the first, if not the first, to manufacture lathes and other iron working tools with a cabinet in the legs or pedestals of the machine. This company was also the first to place the lead screw of the large lathes inside the bed, giving to the carriages uniform motion, and avoiding the tendency to bind, as is the case where the lead screw is placed on the outside. It was also the first to employ an automatic stop for lathes and drills. By means of this attachment any number of pieces may be bored or turned up on a lathe without resetting or remarking. The drill press spindle will stop automatically when a certain depth is reached after the stop has been properly set. This is a very essential device where a large amount of duplicate work is to be done.

Among some of the improvements recently introduced by the company in the manufacture of large planers is the mounting of the bull wheel under a table having a shaft with its ends supported in bronze bushings in the sides of the frame, so that the bearings can be oiled from the outside. Formerly these wheels were mounted loose on a stationary shaft, and the matter of oiling the bearings was attended with considerable difficulty. A shield of brass is also provided for the friction mechanism, and the reversing mechanism is of the latest improved type.

Among the latest improvements in tool machinery introduced by this company, is the manufacture of lathes and planers and other tools, equipped with an individual electric motor for driving, so that the tools are independent of countershafts and other connections. In these machines a motor of the Card type is chiefly employed. The employment of an individual motor for machines has been practised for some time, but in most cases the motor was placed in position under, above, or near the machines, and the power transmitted by belts. Now, however, for lathes of different sizes the armature is mounted directly on the shaft, and a portion of the framework of the machines becomes the motor field, so that the working tool may be driven at any speed to suit the convenience of the operator. The current is controlled by a switch and rheostat operated by a wooden slide lever attached to the side of the machine in a convenient position to be operated. The works are having a large run on these machines, as they are becoming popular with manufacturing companies.



WORKS OF THE LODGE & DAVIS MACHINE TOOL CO.

The details of the shop practices are also interesting, and account chiefly for the superior workmanship for which the tools of this firm have a wide reputation, and also for the improvements and new devices that are constantly being introduced. The president of the company holds a conference with the heads of all the departments at a certain hour every Saturday morning, in which the details of the business are discussed, the requirements of the supplies in each department presented; and no supplies are ordered except such as are approved of by a unanimous vote of the heads of all the departments. The advantages of improved and new devices of every kind are carefully discussed at these meetings, and are adopted only on the recommendation of the foremen. This practice, it is claimed, sets the foremen to thinking, and makes them take more interest in the affairs of the company than is generally the case. With this practice the heads of the departments, draftsmen, and workmen throughout the shop are encouraged to make suggestions and give the company the benefit of any devices that may be invented that will tend to facilitate the operation of the works. Blue prints for different parts accompany each shop order, and each workman keeps a record of the time he spends in the manufacture of any piece, or appliance, so that the cost of any special part of a tool is readily estimated.

Among the specialties of this shop are iron working tools for the equipment of machine shops in technical schools throughout the country. These machines usually receive an extra finish, and are built with special care and with great accuracy.

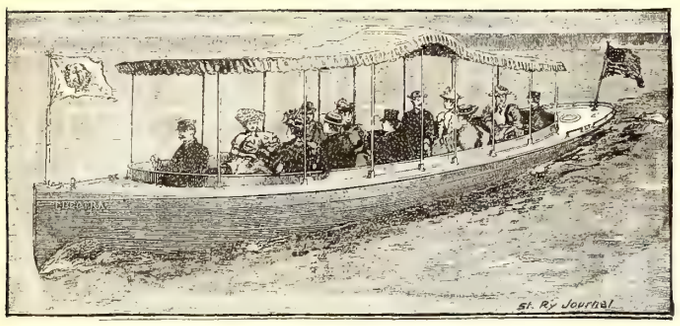
The company employs agents who travel in every civilized country, one of its foreign representatives being able to speak nine different languages. The reciprocal trade relations with the Spanish speaking countries of South America have brought large orders for tools from these countries, and the export trade, as noted above, is constantly on the increase. The company has branch stores in New York, Boston, Chicago, Pittsburgh and St. Louis.

About $500,000 capital is employed in the business, and the officers of the company are as follows: Charles Davis, president; William H. Burtner, vice president and treasurer.

Electric Launches for Street Railway Companies.

Reference was made in our last issue to the use of electric launches by street railway companies, as attractions in pleasure resorts reached by the lines of the company. The General Electric Launch Company, of 44 Broad Street, New York, which operated the electric launches on the lagoons at the World's Fair, Chicago, has been disposing of the launches in use there for $2,000 apiece. A number has been operated profitably for hire since, and among other users, in addition to those mentioned in our last issue, are the Milwaukee Electric Launch Company, of Milwaukee, Wis.; Altoona & Logan Valley Railway Company, of Altoona, Pa.; Hartman General Electric Company, of Duluth, Minn.; Pueblo City Railway Company, of Pueblo, Colo., and Prof. S. H. Short, of Cleveland, O.

It will be found, upon inquiring of those using the launches for hire, that they will go far towards earning their cost in one season.



ELECTRIC LAUNCH "ELECTRA."

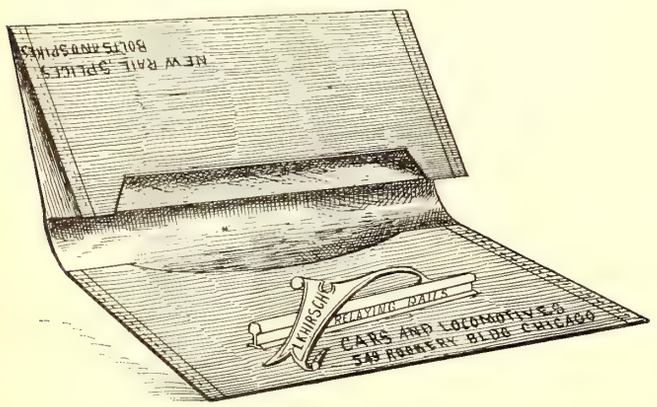
At the World's Fair they earned, at times, as much as $150, each, a day. Assuming that, on the most conservative basis, a launch earns but $20 a day for a season of two months, this will net $960, after deducting $2 a day for captain, $1 a day for current (three cents per horse power hour), and $1 a day for maintenance. Each of the launches seats thirty passengers; at twenty-five cents each per trip (the charge at the World's Fair was fifty cents) it would make $7.50 per trip of, say, one hour's duration.

The $2,000 includes the time, traveling expenses and services of a competent man to start the launch and teach the purchaser all about caring for it and running it. The boats, new, cost nearly double this sum, and at the price and seating capacity are cheaper than steam or naphtha. The boats are over thirty-five feet long, with six feet beam, draft of thirty inches when loaded, and will seat, comfortably, thirty people. They are lighted and propelled by their own electricity. They can be charged from any direct current, trolley, incandescent or arc, and will run from twelve to fourteen hours at their normal rate of speed—six miles an hour—on one charge. They may be charged over night, or at any convenient hour of the day. When fully discharged, it takes about six hours to charge.

A Neat Card Case.

We are in receipt of a neat leather card case from L. K. Hirsch, of Chicago.

The card case is stamped in silver with Mr. Hirsch's trade mark—a



A NEAT CARD CASE.

scroll bearing his name and resting against a section of rail. The card case also gives the information that Mr, Hirsch has in stock rails, splices, bolts and spikes, cars and locomotives, and relaying rails.

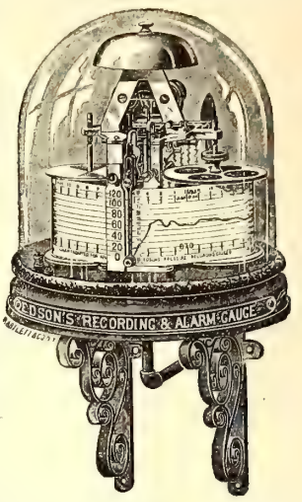
The Philadelphia & Trenton Street Railway Company was incorporated June 13, with a capital of $150,000, to construct and operate an electric street railway in the counties of Philadelphia and Bucks, State of Pennsylvania. L. Calvin Maus, of Philadelphia, is the president of the company; others interested are Theodore F. Hansen, Philadelphia, and J. Uhle Bethell, Lansdowne, Pa.

A Well Known Pressure Recording Gauge.

The pressure recording gauge manufactured by Jarvis B. Edson of New York, was awarded a short time ago the John Scott Legacy Medal by the Committee on Science and the Arts of the Franklin Institute, Philadelphia. The report, which is signed by Joseph M. Wilson, president and Wm, H. Wahl, secretary, and which is countersigned by H. R. Heyl, chairman, reads in part as follows:

"The Edson instrument affords a written tracing or log of every degree of pressure sustained within a steam boiler, tank, pipe or any reservoir, of water, oil, air, steam or other liquid to which it is attached, and of the time when such pressure existed. It gives, if continuously applied, a complete biography of a boiler and a correct exhibit of all the work done. The recorder is a good check on night guards, and if regularly kept will show indisputably whether a boiler has been overstrained. The record can be read at a glance, as the co-ordinates of time and pressure are rectangular and not circular as in most of the other recording gauges.

"The Edson pressure recording gauge has been in service for many years, and a few of the testimonials submitted to the investigating committee clearly show the durability and practical value of the instruments. The gauge is mechanically one of the finest pieces of workmanship of its class now in the market, and the fact that it can be used continuously makes it particularly desirable where it would be inconvenient to change records every twenty-four hours."



EDSON PRESSURE RECORDING GAUGE.

New Roads.

Bradford, Pa.—The Bradford Electric Street Railway Company was incorporated June 7, with a capital stock of $100,000. Lewis Emery, Jr., of Bradford, is the president of the company, and others interested are C. P. Collins, W. R. Weaver and L. E. Hamsher, all of Bradford.

Bridgeport, Ct.—The Bridgeport Traction Co. last month began the excavation for power station. Poles are being located and deliveries of the trolley line insulators furnished by the H. W. Johns Manufacturing Co. will soon begin.

Brooklyn, N. Y.—It is reported that a franchise has been obtained by a company called the Long Island Electric Railway Company. The road is to run parallel with the Long Island Railroad through Suffolk County to Patchogue and all the towns along the line, including Baldwin's, Milburn, Freeport, Merrick, New Bridge and Seaford to Babylon, and also north and south from the mainland and from Rockville Centre to Hempstead village, Garden City and Mineola. The following are the officers of the company: President, A. R. Hart; vice-president, Charles H. Mullin, of Mount Holly Springs, Pa.; treasurer, Clarence Wolf; secretary, J. C. Von Arx.

Cincinnati, O.—The County Commissioners have granted a fifty year franchise to the Hamilton, Le Sourdsville & Middletown Electric Railroad Company for a road between this city and Hamilton. This is to be a branch of the Cincinnati & Dayton Electric Railway.

Cortland, N. Y.—The Cortland & Homer Traction Company has filed a certificate of incorporation, with a capital stock of $300,000. Some of the directors are: P. S. Page, C. D. Simpson, H. E. Hand and I. L. Post. The company will construct an electric railroad, twelve miles in length, from Cortland to Homer, and extend to McGrawville.

Delaware, O.—The County Commissioners have granted a franchise in this county for the Delaware & Centerburg Electric Railway.

Detroit, Mich.—The County Commissioners have granted a twenty-five year franchise for the construction of the Detroit Electric Railroad through Lucas County. The franchise specifies that the motive power shall be electricity. The road is to be completed within eighteen months. The parties who secured the franchise are J. H. Ainsworth, J. Ellery Eaton, W. G. Gardiner, J. N. Bick and Jas. A. Dawson.

Galt, Ont.—It is reported that the contract of the Galt & Preston Street Railway Company, for dynamos, motor cars, overhead work, etc., has been awarded to Ahearn & Soper, of Ottawa, and the contract for engines and boilers to the Goldie & McCulloch Company, of Galt.

Goshen, Ind.—The Indiana Electric Railway Company of Goshen, is the name of a new company which has secured control of the old Goshen Electric Street Railway Company's lines. At the head of the new company are J. J. Burns, J. H. McIlhenney and K. G. Ripley, all of Chicago, who will extend the line to Elkhart, and also to New Paris, there to connect with the Wabash Railway.

Harrisburg, Pa.—The Cumberland Valley Traction Company, of Carlisle, has purchased the franchise of the Harrisburg & Mechan-

icsburg Electric Railway Company, and will build the line this summer. The Cumberland Valley Traction Company has also leased the Cumberland Valley Electric Railway, which is now being constructed between Carlisle and Boiling Springs. The line will be extended to Mt. Holly, the Carlisle Indian training school, and also to Mechanicsburg, where it will connect with the road of the Harrisburg & Mechanicsburg Company.

Hartford, Conn.—Work on the electrical construction of forty-three miles of road is being pushed by the Hartford Street Railway Company. The overhead line is well under way, the Johns-Pratt insulating materials being used.

Lewiston, Ont.—At a recent meeting of the directors of the Lewiston & Youngstown Electric Railroad, a committee was appointed to obtain the right of way for the road building along what is known as the Crick Road, on account of great opposition of property owners on the River Road.

Omaha, Neb.—The Council Bluffs & Lake Manawa Electric Motor Company has received a ten year franchise.

Oneonta, N. Y.—It is said that capitalists in Oneonta and Richfield Springs are actively interested in an effort to build an electric railroad between the two towns.

Pittsburgh, Pa.—A new electric road is to be built from Castle Shannon to this city, to be known as the Knoxville, Fair Haven & Mt. Lebanon Railway. The company is capitalized at $100,000. The Knoxville Land Improvement Company and the Fair Haven Land Company are at the head of the scheme. The president of the new company is J. F. Grimes, of Knoxville, and the treasurer W. W. Murray.

Poughkeepsie, N. Y.—The Poughkeepsie & Wappinger Falls Railway Company, in addition to the orders mentioned in our last issue, has awarded the contract for trolley line insulators to the H. W. Johns Manufacturing Company, and the registers to the Lewis & Fowler Manufacturing Company.

Watertown, Mass.—The Watertown Selectmen have been asked by the Newtonville & Watertown Street Railway Company for an extension of time on its franchise to build an electric road on North Beacon Street as far as the Boston line.

Personal.

Mr. A. H. Lewis, has formed a business connection with the Abendroth & Root Manufacturing Company, of New York. Mr. Lewis will make his headquarters in Cincinnati.

Mr. Arthur S. Beves, formerly treasurer and assistant secretary of the General Electric Company, recently opened an office in the Edison Building, 44 Broad Street, New York, where he deals in investment securities, making a specialty of street railway securities.

Mr. Henry G. Issertel, E. E., has formed a connection with the H. W. Johns Manufacturing Company, of New York. Mr. Issertel was formerly manager of the railway department of Alexander, Barney & Chapin, and has recently been engaged as a consulting electrical engineer.

Mr. A. H. Englund, secretary and manager of the International Register Company, of Chicago, made a trip East last month combining both business and pleasure. Mr. Englund reports a good business in portable registers, and that the International register is maintaining its old popularity.

Mr. Everett K. Day, whose name is familiar to our readers through interesting experiments conducted by him in electric freight transportation at Sanford, Me., called at our office last month. Mr. Day has resigned his position as superintendent of the Mousam River Electric Railway Company at Sanford.

Mr. Philip Dawson, of London, who was engaged with the late Mr. Anthony Reckenzaun in engineering work, and who is now associated with Mr. R. W. Blackwell of that city, in electrical engineering, was in New York the first part of last month. Mr. Dawson is spending some time in this country inspecting the electric railway systems here, and before his return will visit the Pacific slope.

Mr. Wm. W. Nugent, of Chicago, Western manager for C. & G. Cooper & Company, met with an accident May 18, which confined him to his room for several weeks. When about to board a street car he was struck by an express wagon. No bones were broken, but he was severely bruised and remained unconscious for four hours. He was taken to the Alexian Brothers Hospital, but was aftewards removed to his home.

M. Pierre Arbel, managing director of the Société Anonyme Industrielle des Etablissements Arbel, of France, has recently been appointed to the Order of the Legion of Honor. This high honor was conferred as a recompense for two interesting reports on Mines and Metallurgy, which the French Government requested him to prepare, during his stay at Chicago, as delegate to the World's Columbian Exposition. Mr. Arbel, it is interesting to state, is still a young man, being in his thirty-fifth year.

New Publications.

A Catalogue of Rail Sections. Published by the Illinois Steel Company.

The 1894 catalogue of the Illinois Steel Company contains eighty-four sections of types of rails manufactured by it. The dimensions of each section are given, together with the weight per yard, number of tons per mile of track, disposition of metal, and the names of some of the principal companies using that particular section. Also included in the catalogue are a number of tables, useful in railroad construction, giving the number of spikes used per mile of track, crossties required, etc.

The Steam Engine and Other Heat Engines: By J. A. Ewing, M. A. Professor of Mechanism and Applied Mechanics in the University of Cambridge. 400 pages. MacMillan & Company, New York. Price $3.75.

During the last few years there has been published a large number of text books to cover the theory of steam and other heat engines, some of which are important additions to the literature on this subject. One of these is the book which has just been issued by MacMillan & Company, and from the pen of Professor Ewing. The properties of steam and the general theory of the steam engine are taken up in a careful and systematic manner. Special types of engines are not described, but the general characteristics and distinguishing features of general types are given. Altogether we can unqualifiedly recommend this book to students and engineers.

Handbook of Street Railway Track and Trolley Equipment. Published by the Pettingell-Andrews Company, of 72 and 74 Federal Street, Boston, Mass.

That the Pettingell-Andrews Company is fully prepared to supply all equipment useful in electric railway work is shown by the new handbook which has just been issued. The company supplies grooved and T rails of all sizes, from 35 lbs. to 105 lbs. to the yard, spikes, ties and all necessary parts of track construction; insulators, pull-offs and all parts of the overhead equipment, including the well known "West End" and "Emerson" types, trolleys, wire cutters, wrenches, Davis tower wagons, commutators and commutator bars, wires of all kinds, etc. The catalogue contains a number of tables of useful information in the equipment of lines, giving the number of track bolts, spikes, etc., required in street railway construction; definitions of technical terms used, formulæ for estimating sizes of wire, etc. The manager of the railway department is Frank X. Cicott.

Obituary.

John H. Dalzell, one of the best known street railway men of Pittsburgh, died May 27, at his residence, Allegheny City. His death was the result of a complication of diseases superinduced by liver complaint.

Mr. Dalzell was born sixty years ago in Pittsburgh. His early education was received in the public schools of this city, after which he attended the Western University. In the early days of the oil business he was one of the most successful operators, and retired with a large fortune. He early became interested in street railways. He was president of the Pittsburgh, Allegheny & Manchester Traction Company and an official of the Allegheny Traction Company, besides holding stocks of numerous other rapid transit lines. He was also interested in the Standard Underground Cable Company and other prominent corporations of Pittsburgh. A wife and two daughters survive him.

Equipment Notes.

W. D. Hoffman has succeeded Huxley & Hoffman as agent of the Buckeye engine in Boston.

The American Electrical Works, of Providence, R. I., has decided to open a warehouse and sales room in Chicago. Francis E. Donohoe will have charge.

The Fishkill Landing Machine Company, Fishkill-on-the-Hudson N. Y., builder of the Fishkill-Corliss horizontal and vertical engines will shortly issue a new edition of its catalogue.

Charles E. Chapin, of 136 Liberty Street, New York, is doing a large business in general electric railway supplies. Mr. Chapin is a manufacturers' agent and deals in street railway material of all kinds.

Joseph Sachs, an electrical engineer who will make a specialty of assisting inventors in working out their ideas in a practical manner, has recently opened an office in the Mutual Life Building, 32 Nassau Street, this city.

F. A. Scheffler, who has been connected with the Stirling Company for the last year as its sales agent in New York, is now at the Boston office of the company, where he will be associated with J. Bradford Sargent, the New England representative of the Stirling Company.

The Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., writes us that the contract for registers for the cars of the Poughkeepsie (N. Y.) & Wappinger Falls Railroad Company has been awarded to it and not to another company, as mentioned in our last issue. The Lewis & Fowler register maintains its long established popularity, and the company is constantly adding new lines to its extensive list as users of this improved register.

The Lewis Electric Company, of New York, has put upon the market an electric lighting system for cars, which has been in operation with success for a considerable time on one of the cars of the New York & Brooklyn Bridge cable road. The company has recently been reorganized, and a large interest secured by Drexel Morgan & Company. G. W. Moslin has been elected president of the company, with Messrs. E. H. Johnson, E. West, Jr., I. N. Lewis and H. E. Fanshawe as directors.

The Mather Electric Company, of Manchester, Conn., is receiving encouraging orders for its new direct connected and belted generators, both for lighting and railway work. The well known capacity of this company to turn out first class and highly efficient apparatus, gained by fourteen years' experience in the business, suffices to insure a purchaser confidence in these erratic times. J. Holt Gates, 1139-40 Monadnock Building, Chicago, general Western agent, reports a good steady business.

The Gleason & Bailey Manufacturing Company, of New York, the manufacturer of hurry up wagons for street railway service, writes us that its shops are busily employed in the construction of these wagons and modern fire apparatus for which the company has a large reputation. The towns of Plaquemine, La., Gardiner, Me., and West Groton, Mass., were among the company's customers last month. The city of Cleveland, O., has also placed another order for a Gleason & Bailey steel truck.

The Sterling Supply & Manufacturing Company, of New York, is installing its fender on the cars of the Broadway cable railway, New York. This fender is very similar to that used on the Third Avenue cable railway in New York and is carried directly on the truck running close to the ground. It has been very successful on the Third Avenue line, and as it takes up no room in the street, being entirely under the car, seems especially adapted to the requirements of the Broadway service.

The Laconia Car Company, of Laconia, N. H., had a disastrous fire at its works on June 3. It is thought that the conflagration originated from the paint shop. The greater part of the loss was covered by insurance. The company states that it will begin immediately to rebuild and re-equip the destroyed shops, and that the event will not materially affect its business or ability to accept new contracts. The management promises that the new works will be more complete and commodious than the old.

The Phosphor Bronze Smelting Company, of Philadelphia, Pa., manufactures the well known "Elephant" brand alloys. This material has proved its value in the construction of machine castings, pinions, cog wheels, valves, cylinder linings, plungers, etc., where toughness and hardness with ability to resist crystallization and corrosion are desirable. The metal has also been successfully employed for bells, steam whistles, rods and bolts. The company also manufactures the "Elephant" brand of phosphor bronze bearing metal.

The H. W. Johns Manufacturing Company, of New York, has been kept busy in filling the large number of orders received for line appliances, insulators and insulating material. This company is to supply the trolley line appliances for the Nassau Electric Railway Company, of Brooklyn, N. Y. Other roads which will use the John's-Pratt insulators, and whose orders have been received recently, are the Bridgeport Traction Company, of Bridgeport, Conn., the Hartford Street Railway Company, of Hartford, Conn., and the Poughkeepsie & Wappinger Falls Railway Company, of Poughkeepsie, N. Y.

F. W. Darlington, consulting and electrical engineer of Philadelphia, Pa., has moved his office from 4210 Chestnut Street to Room 503 Girard Building, Philadelphia. Mr. Darlington was formerly chief engineer of the Philadelphia Traction Company, and had previously for a long time been connected with the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for whom he supervised the installation of a large number of electric railway, light and power plants. Mr. Darlington is prepared to submit estimates, plans and specifications for electric stations, and give the installation of such stations his personal superintendence.

A. B. Wetmore & Son is the title of the firm which will carry on hereafter the extensive lumber business of A. B. Wetmore of New York, Wm. H. Wetmore, son of A. B. Wetmore having been made a member of the firm June 1. The firm will carry on a wholesale business in hard woods, North Carolina and long leaf yellow pine by carload and cargo, and will make a specialty of ties and poles for street railway companies. Wm. H. Wetmore has been connected with the business in New York and the South since June, 1884. The firm enjoys an excellent reputation among street railway companies and has done a large business in this line.

The Berlin Iron Bridge Company, of East Berlin, Co., is building a new boiler house for the Coe Brass Manufacturing Company, at Torrington, Conn., and has also received the contract for the roof of the new electric light station belonging to the Flatbush Gas Company, at Flatbush, N. Y. This building will be sixty feet wide and seventy-three feet long, divided into a dynamo room and boiler house, and the roof of the building will be covered with that company's patent anti-condensation, corrugated iron roof covering. The Berlin Iron Bridge Company has appointed W. E. Sterns its purchasing agent, to fill the vacancy caused by the death of Wm. H. Riley.

The Clonbrock Steam Boiler Works, the sole manufacturer of the Morrin Climax Steam Generator, of Brooklyn, N. Y., informs us of the following contracts for Climax boilers during one week of last month: The United Electric Light & Power Company, East 29th Street, New York City, 10,000 H. P.; Thomson-Houston Electric Company, East 24th Street, New York City, 1,000 H. P.; Newark Electric Light & Power Company, Newark, N. J., 2,000 H. P.; Central Railway & Electric Company, New Britain, Conn., 1,000 H. P.; Edison Electric Illuminating Company, of Brooklyn, N. Y., 4,000 H. P., for the first district station of this company on Pearl Street.

George Cradock & Company, of Wakefield, England, write us that their last rope to be removed from the North Chicago tunnel worked eighty-eight days and was at last taken out on account of its being worn too small for the grippers to take hold of it. This cable as mentioned in our last issue, was installed February 11, and removed May 7. Although having made this excellent record, it is still good enough for use and will be employed on the South Clark Street cable line. The previous tunnel rope supplied by George Cradock & Company was taken out December 2, after running ninety-eight days, and was put to work again on the South Clark Street line on May 12.

The Central Electric Heating Company, of New York, has been carrying on a series of tests to determine the amount of current required in heating electric cars with heaters of its make. The company has sent us a number of reports of tests made on the line of the Atlantic Avenue Railway Company of Brooklyn, giving the amperage with different cars and under different conditions of weather. In most of these tests five thermometers were carried on each car, three of these usually being located at different points inside the car and two on the outside. The records show that a comparatively small amount of current is required to properly heat the cars, even under the most adverse conditions of weather.

Chas. A. Schieren & Company, of New York, write us that last fall the Bangkok Tramway Company, Limited, Bangkok, Siam, received two of their fourteen inch perforated electric leather belts. Upon the arrival of the belts at their destination they were immediately put into use on Brush generators for the electric railway, on the Short system in operation there. In a letter written to the Brush Electric Company, January 16, 1894, Mr. Aage Westenholz, among other items of interest, states regarding the belting as follows: "The belting is also running, and has so far given us extreme satisfaction; our chief engineer can in fact scarcely find terms to express his admiration for its fine appearance and smooth running."

The Pettingell Andrews Company, of Boston, Mass., is making large sales of commutator bars for the Billings & Spencer Company, as well as a large number of other electric railway specialties. The company has issued a large number of cards upon which is mounted a sample of the Billings' patent commutator bars. These bars are drop forged and are particularly guaranteed to be free from blow holes, porosity and all imperfections. The sample shown on the card gives an excellent idea of the finished product. The company is also sending out in the same way a sample of the Billings & Spencer No. 262 wrench, unfinished. The company reports having closed a large number of contracts for overhead line material.

The Mica Insulator Company, of New York, sole manufacturer of micanite plates, commutator segments, rings, washers, cloth, paint, etc., for electrical insulation, has recently published a new catalogue devoted to the subject of micanite. This company's line of micanite insulators is being increased constantly, and the catalogue embraces a number of new features, and is complete as far as it goes. The company has met with deserved success in its introduction of micanite as an insulator. This material has given universal satisfaction, and the managers of the company tell us that their sales have steadily increased, the month of May being the largest in spite of the dull times. They have also introduced micanite in Europe, and the demand has steadily increased from that section.

The Ellis Manufacturing Company, of 218 S. 4th Street, Philadelphia, Pa., is the title of a corporation which is now manufacturing the Hansell electric equalizing truck. The officers of the company are Harvey Ellis, president, and Joel C. Hancock, secretary and treasurer. Both of these gentlemen are well known in the steel and street railway trades, having been for about eighteen years connected with the Cambria Iron Company. The truck of this company is a novelty from the fact that the equalizing bar is outside of the journals, giving easy riding and preventing oscillation. It is constructed on pure mechanical principles, and has received the most flattering criticisms from the railway and mechanical engineers throughout the country who have inspected it. While the truck is in no respect a cheap one, the manufacturers believe that they will be able to meet the market.

The Foster Automatic Safety Guard Company, of New York, whose orders for fenders in Paterson and Hoboken were mentioned in our last issue, has received the following letter from M. R. McAdoo, manager of the Paterson Railway Company. "The Paterson Railway Company have decided, after making trials and tests of several safety guards on our cars, to adopt your form, and we desire you to make immediate arrangements to place them on all our cars. I am personally very much pleased with the simplicity and automatic action of the cradle, and after making thorough tests of all best known guards on the market have recommended its adoption by our company." This company has recently established a factory at Paterson, N. J., and is now able to turn out fenders rapidly. The work of equipment of the cars of the Paterson Railway Company is going on rapidly.

The Ball & Wood Company, of New York, mentions to us, among recent contracts, that of the Poughkeepsie & Wappinger Falls Electric Railway Company which has given an order for two Ball & Wood 300 H. P., cross compound engines. The Ball & Wood engines will also be furnished to the Manayunk & Roxborough Incline Plane Railway, Yonkers Railway Company, Athol Gas & Electric Company, of Athol, Mass., and for the Geneva Brush Light & Power Company, of Geneva, N. Y., all for railroad purposes. The Ball & Wood Company has received so many orders recently that the managers have found it necessary to increase their factory force by the addition of a night gang. Beginning May 28, the company's works have been run to their full capacity twenty-four hours a day, which speaks well for the reputation of the company's engines, and the excellent service which they are giving on many roads.

The Ball & Wood Company, of New York, has again been successful in securing through its secretary and treasurer, Mr. Vincent, one of the largest power contracts which has recently been placed.

The order comprises six Ball & Wood improved, cross compound, condensing engines, of 300 H. P. each, for the Hartford Street Railway Company, of Hartford, Conn. It is this type and make of engine which has proved so economical and efficient at the Grand Street station of the Consolidated Traction Company in Jersey City, where the duty has been most severe and the engines subjected to almost constant overloads of from 20 to 50 per cent., pending the increase of the power plant. The factory of the Ball & Wood Company has been running twenty-four hours per day since about June 1, and this Hartford contract will permit no diminution of its forces for some weeks. In times like these such activity is unusual, and it reflects the popularity of these engines, which are indeed remarkable for their reliability.

Stern & Silverman, of Philadelphia, report business as very active. In the railway department they have contracts for the reconstruction of the Brigantine Transit Company's road at Brigantine, N. J., seven miles in length on trestle construction; at Altoona the Bellwood extension of the Logan Valley road for the Pennsylvania Railroad, eight miles in length; also the Roxborough Incline Plane & Railway, six miles long, running from Philadelphia to Barren Hill. In the steam department they report 600 H. P. boiler plant for the Roxborough road, and two 300 H. P., Ball & Wood compound condensing engines; one 10 × 11 in., direct connected Ball & Wood engine for Dooner's Hotel, Philadelphia; one 10 × 11 in., direct connected, Ball & Wood engine for the Mann Building, Philadelphia, and one 8 × 10 in. engine for the boat "Havana." In the lighting department they have contracts under way for a central station at Overbrook, N. J.; the lighting of the Episcopal Hospital, Philadelphia; electrical equipment of the river boat "Havana;" and an arc plant for the pleasure pavilions at Brigantine Beach, N. J.

The American Tool & Machine Company, of Boston, whose factories are located at Hyde Park, Mass , and whose main office is at 84 Kingston Street, and which has been prominent in its special line for over thirty years, has just announced an important change in its officials. E. C. Huxley, who is well known in Boston's business circles, and who has earned for himself especial distinction in the line of mill construction work, becomes its president and general manager, and W. H. Hoffman, who has for a number of years been more or less associated with Mr. Huxley in his labors, and who was for a long period general superintendent of the Eastern works, at Hartford, Conn., of the Buckeye Engine Company, has been appointed the general superintendent of the company. The other officials of the company are M. H. Barker, chief engineer, W. O. Lincoln, treasurer, and M. M. Whipple, superintendent of the sales department. These gentlemen have been connected with the company for a long time, and are favorably known to the trade. It can be confidently stated that the future of this company promises to be unusually successful.

The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., reports through its St. Louis representative, Guido Pantaleoni, 608 American Central Building, that city, the sale of forty twenty-five horse power, single reduction motors to the Lindell Railway Company, of St. Louis. There are now 240 Westinghouse single reduction motors in use on this company's lines and those of the Compton Heights, Union Depot & Merchants' Terminal Railway and Taylor Avenue Railway Companies. The Westinghouse Company has gained the best possible reputation in St. Louis as elsewhere for the superiority of its motors, dynamos and everything else in the line of street railway equipments. It is also receiving its share of the electric lighting business. The Missouri Electric Light & Power Company, of St. Louis, has recently installed a large, direct coupled Westinghouse engine and generator in this plant. This is the largest incandescent lighting station in St. Louis, and its entire equipment of over 3,000 H. P. consists of Westinghouse apparatus only. The Southern Railway Company, of St. Louis, reports that it is highly pleased with the Westinghouse twenty horse power, single reduction motors, which were sold to it some time ago, and that its repair account has been greatly reduced as far as the Westinghouse motors are concerned.

The Gilbert & Barker Manufacturing Company, of New York, and Springfield, Mass., has issued a circular descriptive of the aerated fuel process of the company. By the system of this company oil is used as fuel, and at the burner is atomized and mixed with air. The flame, as a result, is clean, dry and smokeless, and it is claimed, in every particular similar to that furnished by the purest of coal or natural gas. The company has found that by its system the amount of oil required to equal a ton of anthracite coal, is from 60 to 120 gals. Aside from the saving in first cost of fuel, the oil of course presents a great many advantages over coal. The number of users of this fuel is large, as will be seen at a glance over the testimonials received by the company. Among those manufacturers and corporations whose names are most familiar to street railway managers and who are using the system may be mentioned the following: Boston & Albany Railroad; Brooks Locomotive Works, Dunkirk, N. Y.; Chapman Valve Company, Indian Orchard, Mass.; Hall Steam Pump Company, Allegheny, Pa.; The Scovill Manufacturing Company, Waterbury, Conn.; Fibre Conduit Company, Orangeburgh, N. Y.; Berlin Iron Bridge Company, East Berlin Conn.; The Brownell & Company, Dayton, O.; Harlan & Hollingsworth, Wilmington, Del.; Rhode Island Locomotive Works, Providence R. I.; Libbey Glass Company, Toledo, O.; American Wire Glass Manfacturing Company, Philadelphia, Pa.; Okonite Company, Passaic, N. J.

The Consolidated Car Heating Company, of Albany, N. Y., whose electric heating system is well known, has decided to put on the American market an improved lighting system. As the result of most close and careful investigation the company has decided to adopt the Pope system, which is so widely used in Great Britain, and has acquired the ownership for, and sole right of introducing this system into the United States. In order that it may be thoroughly understood that the Pope system is in no way experimental, we may mention that it has been in operation on most of the large English railways since the year 1886, and that up to the present time over 14,000 cars have been equipped therewith by English railway companies, among them the following: London & Northwestern Railway Company, 3,693 cars; Lancashire & Yorkshire Railway Company, 2,942 cars; Great Northern Railway Company, 2,057 cars, and the North Eastern Railway Company, 835 cars. The company has already entered into contracts for equipping a considerable number of cars in the United States, and has begun or completed arrangements for the erection of gas plants at the principal railroad centers. The system is said to be interchangeable with the "Pintsch" system, and precisely the same gas may be used in both. The Consolidated Car Heating Company made an exhibit of the Pope system at the Master Car Builders' and Master Mechanics' conventions at Saratoga, and attracted considerable attention by the quality of material, excellent workmanship, and neatness of design of the apparatus exhibited there.

The Electrical & Mechanical Engineering & Trading Company, of New York, which was organized only a little more than a year ago, has already been awarded a large number of contracts. Among others may be mentioned the following: Contract for car house, cars, motors, trucks and generators for Hoosick Railway Company, Hoosick Falls, N. Y. Contract for an electric light station and complete equipment at Rumsen Neck, N. J., for Rumsen Improvement Company. Contract for electric lighting in new addition to Buckingham Hotel, New York City. Contract for underground conduit system, telephone system and electrical conductors for J. C. Hoagland and Raymond Hoagland, Rumsen Neck, N. J. Consulting engineers for Trinidad Electric Light & Power Company, Port of Spain, Trinidad. Contract for electric lighting system, underground conduits, pole line, etc., for Edward Kemp, Esq., Rumsen Neck, N. J. Supervising and consulting engineers for Poughkeepsie City & Wappinger Falls Electric Railway Company. This railway system will involve a 600 H. P. steam plant, compound, condensing engines and direct driven generators; there will be some fine long distance work, as one section of the road extends ten miles to the towns of Wappinger Falls and New Hamburg, operating cars in and between both towns. The plant will incorporate the use of Stirling boilers, compound, condensing Ball & Wood engines, direct driven General Electric generators and General Electric 800 motors. Mr. Vail gives all the business of his company his personal attention, and turns out none but the best of engineering and construction. The company has pleasant and commodious offices at 39 Cortlandt Street, and here may be found some of the most experienced engineers engaged in the business.

The United States Headlight Company, of Utica, N. Y., is the title of a new corporation organized with a capital of $1,500,000 to manufacture locomotive, electric, cable, motor car and other headlights. The company is well equipped for the manufacture of headlights, having purchased all the machinery, tools, patterns, etc., of the following well known companies: M. M. Buck & Company, The Dayton Manufacturing Company, Kelly Lamp Company, Steam Gauge & Lantern Company, I. A. Williams & Company, and The Adams & Westlake Company, together with thirty-two letters patent and a number of applications for patents, covering, it is claimed, all of the standard devices for illuminated numbers and signals in headlights and other desirable improvements therein. It is the intention of the United States Headlight Company to unite with the patents and facilities thus acquired, the result of over forty years' experience in manufacturing headlights, for the purpose of embodying in them the latest improved devices which will add to the design, convenience and durability; furnishing headlights for all purposes superior to any heretofore supplied, at the lowest possible price consistent with first class material and workmanship. Selling agents for this company will be conveniently located in the best distributing points of the country, who will carry in stock a full line of standard headlights and parts thereof, for the purpose of filling all orders promptly. This company having secured these valuable patents and assumed the litigation now in progress, railroads and others purchasing its goods will thereby protect themselves from action for infringement. The co-operation of buyers is earnestly solicited in recognizing the object in view and the patented rights it has acquired. While it is desirous to avoid controversy, it will, whenever necessary, ask the courts to sustain the validity of its patents.

WESTERN NOTES.

The Barney & Smith Car Company, of Dayton, O., has been awarded the contract for fifty-six of the 110 new cars recently ordered by the Cincinnati Street Railway Company.

James H. Harris, Chicago agent of the Heine Safety Boiler Company has removed his office from No, 28 McVicker's Theatre, where he has been located for seven years, to 1521 Monadnock Building.

The Lodge & Davis Machine Tool Company, of Cincinnati, O., has just shipped two carloads of machinery to be forwarded to its various customers in England, Germany, Austria and South America. This company's export business has increased fully 50 per cent. since the first of this year, which it attributes directly to its recent exhibit at the World's Fair.

The McGuire Manufacturing Company, of Chicago, writes us that it has purchased the Christensen air brake which has shown excellent results on a number of electric railways already. The McGuire Manufacturing Company is preparing to manufacture this air brake on a large scale and expects to offer it to street railway companies at a satisfactory price and with an absolute guarantee that the brake will do its work perfectly.

The Simplex Electrical Company, of Chicago, writes us that the relations heretofore existing, by which George Cutter has been acting as the company's Western selling agent, have been dissolved. The company's Chicago office will hereafter be located at 1137 and 1138 Monadnock Block, and H. R. Hixson, who has for some time been identified with the company's interests in Chicago, will be in charge. A stock of Simplex wire will be kept on hand, from which prompt shipments can be made.

The "Western Electrician," of Chicago, has published a circular entitled "Facts and Fancies." This contains a comparison of the advantages of an Eastern and a Western paper as an advertising medium, and is written in a bright and pithy style. Also included is an article on the publication offices of the "*Western Electrician*" accompanied by handsome engravings. We congratulate our Western contemporary on the success which it has made.

Philip G. Roeder, of Cleveland, O., has recently published an "Exporters' Handbook of Mexico" comprising a carefully revised list of bankers, merchants, professional men, etc., in the different cities of the republic of Mexico. The object of the book is to enable manufacturers to increase their trade in these cities by direct correspondence. The work includes the names of the steam railroads in the different cities, but not the street railway companies. The price of the book is $2.

The Partridge Carbon Company, of Sandusky, O., is the manufacturer of the Partridge self lubricating motor brush, which is giving good satisfaction on a number of leading railways. The company claims that dynamo users need have no more trouble with their commutators if they adopt these goods. The special points claimed for these brushes are that they will wear one-fourth longer, keep the commutator in perfect condition, and need no oil or grease of any kind. The company numbers among its customers a number of leading street railway companies.

The Ohio Brass Company, of Mansfield, O., as will be seen from the illustrated article in our reading columns has recently added a new device for a trolley wire support to its already complete line of construction material. The company is always on the lookout for new articles of merit which will interest the trade, and fill any wants. The company reports the manufacture of many special devices embodying the ideas of the operators of the local roads as the company's facilities for turning out this class of work are unsurpassed. Large orders and numerous inquiries are received with a regularity that cannot fail to be gratifying.

The Mason Electric Company, Chicago, finding its office and storeroom too small for its growing business, has secured a lease of the store, 7 Adams Street, directly opposite the Pullman Building. This location is one of the best in the city, and the store is well fitted for the purposes intended. The original company started by Mr. Mason was for several years at 11 Adams Street, where a large business was built up, which is being continued by the present company. The company confines itself to the manufacture and sale of electric railway supplies only and is a recognized authority in this particular line of business.

The Shultz Belting Company, of Broadway and Barton Street, St. Louis, controls a large portion of the leather belt trade between the United States and foreign countries. The company's agents in the principal cities of the world keep the home office constantly posted as to the wants of foreigners in the belt line, and many orders of this kind are the result. The Shultz Company recently received large orders from Russia and India. There is no reason for the company's large foreign trade, other than the unexampled superiority of its product and its correct method of doing business. The company's orders from various points in this country are very large, and its extensive works are in constant operation as a consequence of these and its foreign trade.

The Dodge Manufacturing Company, of Mishawaka, Ind., manufacturer of wood split pulleys and power transmitting machinery, has established a New York branch at 43 and 45 Dey Street, under the charge of S. W. Schuyler. The company will keep in stock here wooden pulleys of all sizes, shafting, hangers, rope transmission apparatus and, in fact, all machinery which enters into the power transmission line. The company will also have a small fitting machine shop at this place, where there will be facilities for the cutting of shafts, boring boxes, etc. Mr. Schuyler reports that the rope transmission business is growing, and that the company has taken a large number of contracts for its well known apparatus, including a number of orders for cast iron center, wood rim flywheels. The company has just opened a Boston office at 137 Purchase Street, in charge of F. W. Underwood.

The Buckeye Engine Company, of Salem, O., wishes to inform its customers and friends, through the STREET RAILWAY JOURNAL, that in the June issue of that paper it was incorrectly stated that the Buckeye Company had just established a St. Louis office. This company has had an office in St. Louis for several years past. The office is not in the Security Building, that city, as stated in the item referred to, but at 511 Commercial Building. The company's St. Louis agent is A. M. Morse. This gentleman informs us that he has recently received an order for a 150 H. P. Buckeye engine from the Bloomington (Ill.) Electric Railway. This is the third Buckeye engine which has been purchased by that company. The vertical, cross compound Buckeye engine, which is being built in sizes from 150 to 1,000 H. P., is meeting with great favor for electric railway service, and the company reports a large number of new orders.

The Card Electric Company, of Mansfield, O., whose motor equipment was described in our last issue, is creating quite a stir among street railway men. The controlling stand has made quite a hit on account of its simplicity. On a central shaft are placed eight cams, insulated by hard rubber tubing, and held in place by hard rubber pins. Opposite each cam is a switch fastened by a bracket to the back, near the shaft. Each switch is provided with contact pieces to engage with clips on binding blocks fastened to the back. It is easy to see that the controller consists simply of a series of break switches, doing entirely away with all the inefficient sliding contacts, etc., so noticeably bothersome in other controllers. J. Holt Gates, 1139 40 Monadnock Building, Chicago, Western agent, reports many inquiries and an encouraging amount of work on hand. A recent catalogue gotten out by this company is very tasteful and carefully prepared to give full details on both motor and necessary apparatus. Card motors have been in operation for some months in Fremont and Mansfield, O., where they have given entire satisfaction.

The Independent Electric Traction Company, of the old Colony Building, Chicago, has secured the right to manufacture the Patton motors, the invention of W. H. Patton, of Chicago. The principle of this motor, which has been described in former issues, it will be remembered, consists of the combination of a gas engine, electric generator, storage battery and electric railway motor. The generator is driven by a gas motor and is used to start the battery which delivers the current to the motor as required. In this way a constant load is kept on the generator, which is of the shunt wound type. A car equipped with this system is now in operation on the Calumet Electric Railway line at 67th Street, Chicago, where it is running on an 8 per cent grade, and drawing a standard size trailer. The motor car seats comfortably thirty-six persons, although it is but sixteen feet long. The power required when pulling the trailer is not great, as the engine consumes but twenty gallons of gasoline during twelve hours' run. The expense of operation is said to be about $1 a day, and the car weighs 15,000 lbs., as against 12,000 lbs., the weight of a similar sized trolley car.

The Laclede Car Company, of 4500 North Second Street, St. Louis, informs us that its shops are full of work, that they have been so throughout the winter, and that from present prospects they will continue to be so during the summer. Most of the cars now building are for Philadelphia, Pa., and a number of other Eastern cities. The car company recently received an order from the Consolidated Traction Company, of Newark, N. J., for fifty open motor cars to be operated on the Jersey City, N. J., lines. These will be very similar to the open cars being sent by the car company to Philadelphia, Pa., being each equipped with two twenty-five horse power Westinghouse single reduction motors, extraordinarily large buffers, but with nine benches instead of eight. The Laclede Company also sent some very handsome motor cars to Washington, D. C., for the Brightwood Railway Company of that city. General Manager Robinson of the Laclede Company has recently put an electric motor car truck on the market with solid frame and embodying a number of new features. The truck was illustrated and its good points explained in the new catalogue recently issued from the company's offices. Mr. Robinson's patent sand box is now in use on the cars of some of the principal street railway companies of the United States.

The American Car Company, of St. Louis, reports business as very brisk with it at the present time. The company's paint shop, which will accommodate 160 cars at one time is now full. The other departments of the extensive works are also filled, in fact a great deal of work during the summer months is assured, and the management is very much encouraged at the prospects. Among the largest orders is a very large equipment of open cars for the lines of the Electric Traction Company, of Philadelphia, Pa., also various sized orders for the Union Railway Company, of New York City; the West Chicago Street Railroad Company, of Chicago, Ill.; the Missouri Railroad Company's electric lines, St. Louis; and for a number of other points in the country, chiefly in the East. The Philadelphia cars are to be mounted on Bemis and McGuire trucks. Mr. Sutton, president of the car company and inventor of the "anti-concussion electric motor truck" reports that the latter is having a most successful trial on the Market Street electric line of the Missouri Railroad Company of St. Louis, and that the many advantages that were anticipated in this truck over others in the market have been fully realized. The patent street car door, also invented by Mr. Sutton, has already been placed on many cars turned out of the company's shops recently, among them a number to a point in Iowa, which have brought forth flattering testimonials as to the merits of the new door. The improved combined platform dash grab handle and bonnet support recently patented by the same gentleman and illustrated and described in this paper some time ago have also called forth many approvals from superintendents and managers of the street railway companies whose cars have been equipped with the same. The car company has been contemplating some large additions to its already extensive works, and if business continues as at present, it is the intention of the management to carry out the plans.

A Novel Advertisement.

A novel and striking advertising sign has recently been erected in front of the ticket office of the Big Four Route in Cincinnati. It is in the shape of a Maltese cross outlined by a large number of incandescent lights, and is fifteen feet in circumference. The lights are operated by a drum driven by a motor and carrying a large number of connections. In the daytime the sign attracts much attention from its remarkable appearance, but at night it can be seen for a long distance, and the effect is to be imagined rather than described. The current is switched through different sections, and finally the entire sign is illuminated, showing the names of the four cities, Cleveland, Cincinnati, Chicago and St. Louis, from which the road takes its name, as well as the words "Big Four Route." The sign was built from designs submitted by E. O. McCormick, passenger traffic manager of the road.

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., June 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.	100	750,000	Q Feb.	1½	1890	115	116
Watervliet Turnpike & R. R. Co.	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort.	1865	40,000	J. & J.	5	1905	101½	.....
" " " 2d Mort.	1873	20,000	M. & N.	7	1893	101½	.....
" " " 3d Mort.	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort.	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort.	1888	50,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102½	.....
" " " Debenture.	1891	200,000	M. & N.	6	1901	111	.....
Watervliet Turnpike & R. R., 1st Mort.	1889	350,000	M. & N.	6	1919	111	112
Watervliet Turnpike & R. R., 2d Mort.	1889	150,000	M. & N.	6	1919	110	113

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co. Bankers, 9 South Street, Baltimore, Md., June 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	2,500,000	Sem-an	4	.....	51	52
City & Suburban Ry. Co.	50	3,000,000	.....	1	.....	33	35
Central Pass. Ry. Co.	50	300,000	.....	...	.....	60	65
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	14¾	15

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort.	1892	500,000	.....	5	.....	108½	109
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	104¾	105
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	105½	106
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	98	99
" " "	1891	1,250,000	M. & S.	6	1901	100	101
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	112	112½

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange, June 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.	50	$6,400,000	J. & J.	4	1887	76	77
West End Com'n	50	9,085,000	J. & J.	3	1890–1892	46	46¼

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, June 23. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	173	175
Brooklyn Traction Co., pref.	100	3,000,000	.....	...	1893	67	.....
" " common.	100	6,000,000	.....	...	1893	15	.....
Coney Island & Brooklyn R. R. Co.	100	500,000	Oct. 1.	4	.....	.....	144
Long Island Traction Co.	100	30,000,000			1893	15	15¼

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co.	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	102	.....
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	.....	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	104	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st	.....	3,000,000	J. & J.	5	July, 1916	112	115

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., June 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.	50	$100,000	J. & J.	0	.....	.....	65
Enterprise Ry. Co.	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co.	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 108 LaSalle Street, Chicago, Ill., June 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	305	.....
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	100	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	241	242
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	137	137½

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	101¾	102
Chicago Passenger	1883	400,000	F. & A.	6	1903	105	110
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	....	100
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	.....	103½
West Chicago Street	.....	4,100,000	M. & N.	5	.....	103	103½
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	100	101½
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	103¼	103½

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, June 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$7,500,000	Q.—J.	5	.....	105	105¼
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	106¾	107¼
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry.	100	500,000	.....	...	.....	59½	60½
" " " Pref.	100	100,000	.....	6	.....	97	98½
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....		.....	20½	22

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street	.....	50,000	J. & J.	7	July, 1894	100	.....
" "	.....	50,000	J. & J.	7	July, 1895	101½	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	98	99½
	.....	150,000	J. & J.	5	.....	100½	101½
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	110½	111½
" " 10-20's	.....	200,000	J. & D	6	De. '94-1924	102½	.....
" " Cable	.....	250,000	M. & S.	5	Mar. 1906	104¾	105¼
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	107	08
" " " "	.....	300,000	J. & J.	6	Jan. 1914	105	106
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	.....
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	114	115
S. Cov. & Cin. 2d Mort. gold 6's	.....	250,000	J. & J	...	1932	113½	114½

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., June 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co	100	12,000,000	.....	....	1893	48	49
The Cleveland City Ry. Co.	100	8,000,000	.....	....	1893	57	60

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	101	102½
" " City " "	1893	2,349,000	.....			95	96

DETROIT STOCKS.—Corrected by CAMERON CURRIE & Co., Bankers and Brokers, 82 Griswold Street, Detroit, June 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass., June 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	210	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	125	150

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., June 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	87	88
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	37	38

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	100	101
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	115	116
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	115	116
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. June 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$600,000	J. & J.	4	.....	45	47
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R.R.Co	25	.....	.....	...	.....	.....	.....
New Haven & Centville H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Aug.1,1894	104	.....
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Horse R. R. Co.....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 188 Common Street, New Orleans, La., June 22. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.	100	1,200,000	Quart.	1½	1867	124¾	128
Crescent City R. Co.....	100	1,150,000	"	3	1866	80	89
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	38	40
New Orleans City & Lake Co.	100	1,500,000	Quart.	2⅛	1860	107⅛	112
Orleans R. R. Co.....	50	185,000	"	2	1868	32	.....
St. Charles Street R. R. Co..	50	600,000	"	2½	1866	55	58

Bonds.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	.....	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	.....	.....
do do new	1886	40,000	M & N	6	1896	.....	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	113½	116
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	.....	100
St. Charles Street R. R. Co...	1881	120,000	J & D	6	'93-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, June 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (old stock)	50	$2,000,000	M. & N.	4	May, '91.	148¾	149
" " (new stock)	50	2,000,000	.....	...	May, '94.	144	144½

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by JAMES MCGOVERN & Co., 6 Wall St., New York, June 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	25	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2¾	.....	185	188
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	1 0	155
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	140	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	132	135
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4	.....	300	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	50	55
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q.—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	132	135
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	198	.....
Third Avenue.....	100	5,000,000	Q.—M.	4	.....	182	184
23d St.....	100	600,000	Q.—F.	2½	.....	290	.....
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	139	.....
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	108	111
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	106	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	106	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	106	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	103	.....
Broadway Consolidated.....	.....	7,650,000	J. & J.	5	 1943	108	109
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	115	120
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	105	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	99	100
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	55	.....
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	118½	120
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	.....

PHILADELPHIA SECURITIES.—Corrected by HUHN & GLENDINNING, 143 South Fourth st. (Bullitt Building), Philadelphia, June 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	260	265
Continental.....	50	1,000,000	J.—J.	6	1873	124½	126
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	307½	310
Germantown.....	50	1,500,000	Q.—J.	2¼	1858	111	112
Green & Coates...	50	500,000	Q.—J.	3	1858	123	125
Hestonville.....	50	2,050,000	.....	...	1859	35	40
Lombard & South.....	25	500,000	A.—O.	8	1861	90	90
People's Traction Co.....	50	10,000,000	.....	...	.....	34½	35
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	155	160
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	80	85
Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	105	106
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	227	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	207	210
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	232	240
Union.....	50	1,250,000	J.—J.	9½	1864	199	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	200	210
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	114	114½
Baltimore Traction.....	25	5,000,000	.....	1	1889	16	16¼
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	12⅛	12¾

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort.	1889	1,500,000	M.—N.	5	1929	107¾	108¾
" " Imp.	1892	1,250,000	M.—S.	6	1901	101	102
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100¾	102
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	103½	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., June 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 306 Times Bldg., Pittsburgh, Pa., June 22. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	..	.....	19¼	20
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	61	62
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	12⅜	12⅝
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	...	65
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	3	.....	19½	20¼
Pittsburgh, Allegheny & Man	50	3,000,000	.....	1¼	.....	39	40
West End R. R. Co.	50	200,000	J. & J.	...	.....	...	21
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	...	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	150.000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	26½	26¾
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O	5	1927	107	110
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	106	110
Pitts. & Birmingham Traction Co.	1892	.....	.....	5	.....	.....	.....
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500 000	J. & J.	5	1931	103¾	104
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	103	103¾
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1922	101	102
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	.....
Suburban Rapid Transit.	.....	.....	.....	6	.....	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44.500	M. & N.	6	1901	.....	.....
Penn Incl'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....
Manchester	.....	.....	.....	...	.....	103	103½

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS Bankers, Providence, June 19.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	..	.....
BONDS.	Date of Issue	Amo'nt Out-stand'g	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	97½	100
Newport St. Ry. Co.	.....	50.000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, June 19.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	30	35
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	60	61
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	13	20
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	39	40
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	60	80
do do Common.	100	4,000,000	.....	...	1892	18	20
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	68	80
do do Common.	100	3,000,000	.....	...	1892	15	20
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	35	38
BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	93	95
Buffalo (N.Y.) Ry.	1891	5,000 000	F & A	5	1931	99	99⅛
Paterson (N. J.) Ry.	1891	850.000	J & D	6	1931	85	95
Newark (N. J.) Pass. Ry.	1890	6,000 000	J & J	5	1930	98	100
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	90	95
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	86	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., June 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	...	.....	.....	100
Geary St., Park & Ocean R.R.Co	100	1,000,000	Monthly	...	.....	.....	102
Market Street Cable Co.	.....	18,750,000	.....	...	.....	37½	38
Metropolitan Electric	.....	1,000,000	Monthly	...	.....	.....	35
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	15	20
Sutter St. R. R. Co.	.....	2,000,000	Quart'ly	...	.....	90	.....
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	J. & J.	5	.....	.....	106¼
Ferries & Cliff House	.....	650,000	M. & S.	6	1914	107	.....
Geary St., Park & Ocean	.....	671,000	A. & O.	5	.....	102½	.....
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	120¼	.....
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	114	.....
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	.....	116¾
Park & Cliff House R. R.	.....	350.000	J. & J.	6	.....	.....	106
Powell Street R. R.	.....	700.000	M. & S.	6	1912	111½	112
Sutter St. Cable Co.	.....	900,000	M. & N.	5	.....	107⅞	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., May 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	50	65
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue	100	112,000	Dec. '88	2	1885	125	150
Lindell	100	2,500,000	.....	...	1890	85	86
Missouri.	100	2,000,000	Q.—J.	2	1891	190	210
People's.	50	1,000,000	Dec. '89	50c	1899	20	25
St. Louis.	100	2,000,000	J. & J.	3½	1890	145	150
Fourth Street & Arsenal.	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban.	100	2,500,000	.....	...	1891	10	20
Southern, Pfd.	.....	800 000	Jan. '94	3	.....	80	85
" Com.	.....	700,000	.....	...	.....	15	25
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	98½	100
Citizens' Cable	1887	1,500.000	J. & J.	6	1907	104	106
Fourth St. & Arsenal	1888	50.000	J. & J	6	1898-1903	98	100
Lindell	1890	1,500.000	J. & J.	5	1895-1910	102	103
Missouri Cable	1887	500.000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	99	100
" 2d mort.	1886	75,000	M.& N.	7	1902	100	102
People's Cable	1889	800.000	J. & J.	6	1889-1914	90	95
St. Louis Cable	1890	1,500,000	M.& N.	5	1900-1910	100	102
Union Depot	1890	4,000.000	A & O.	6	1900-1910	104	105
Southern	1884	200.000	M. & N.	6	1904	103	105
Southern	1889	300.000	M. & N.	6	1909	100	104
St. Louis & Suburban.	1891	1,400,000	F. & A.	5	1921	84	86
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	70	80

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co, Bankers, 1344 F Street, N.W., Washington, D. C., June 21. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	285	310
Metropolitan R. R.	50	750,000	Q. J.	2	1864	92	95
Columbia R. R.	50	400,000	Q. M.	1	1870	60	65
Belt R.R.	50	500,000	Q. J.	...	1875	39	.....
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	32	.....
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	.....
Rock Creek R. R.	100	401,700	.....	...	.....	.....	.....
Glen Echo R. R.	50	100,000	.....	...	.....	.....	.....
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'tn & Geo'tn conv't. 1st.	'83-'99	3.000,000	J. & J.	6	1899-1929	.....	.....
" " " 2d.	.....	500,000	J. & J.	6	1903-1943	.....	.....
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	.....	.....
Belt.	1921	240,000	J. & J.	6	1921	.....	.....
Metropolitan R. R. convert.	1901	200,000	J. & J	5	1901	.....	.....
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

New York Street Railway Stock Market.

JUNE 26, 1894.

Despite the lack of activity attending all speculative markets, the street railway stock and bond market during the month now drawing to a close has not been unattended with developments of a character to lend individuality to the trading line. There has been a decided falling off in the last few weeks from the spirited demand from investment sources for street railway securities, at one time so marked a feature of the financial situation, but, when it is remembered that prices for this class of securities have, by reason of the discrimination made in

their favor as against steam railroad mortgages, been brought to a point where the returns on the capital invested are on the lowest basis known in years, it is not remarkable that the demand should evidence some slackening. The chief reason for the existing high prices for street railway securities—*vide* Third Avenue Railroad 5 per cent. bonds selling as high as 119—has been the easy money market. With call loan rates ruling at 1 per cent., the moneyed people have been seeking other safe fields for making their capital profitable, and a good deal of the idle money has been turned into the street railway field. Should money, however, become more active and rates consequently advance, banks and other money lenders will return to their ordinary business, and prices for street railway bonds, as for municipal bonds and other purely investment issues, must go lower. But it seems as if easy money must continue to rule for some time. The first of July is now on hand and it is figured that about $75 000,000 cash is needed for dividend and interest disbursements on that day, yet the holding back by banks of this enormous sum to meet these payments has not had the slightest effect. There is so much money that the hoarding of $75,000,000 for a few weeks plays no part at all. It is argued, moreover, that within a week all this money will be in circulation again and will itself be seeking investment. Hence, present prices for good local street railway shares and mortgages may be expected to rule for some time.

Third Avenue shares have been the chief source of attraction. In the first place Wall Street continues to be regaled with stories of big earnings. It is undoubtedly true that the introduction of the cable has been a source of tremendous profit and, now that the excursion business has set in with the advent of hot weather, the road must coin money. Indeed, the payment of quarterly 4 per cent. dividends on the increased capital stock—and with something to spare—is ample substantiation of the management's claims. The large system of transfers inaugurated during the past six months is of the greatest value to the road, in that it has aroused the popular favor, and that means big business.

But the most interesting development of the month is the fight begun between the Third Avenue Railroad people and the big Metropolitan Traction Company for the acquisition of a franchise to operate a cable or underground trolley road on St. Nicholas and Manhattan Avenues between 125th Street and Kingsbridge. The Third Avenue made application to the Board of Aldermen for this franchise nearly a year ago and has secured the consent of a large number of property owners to the project. Counsel and the management of the road insist that they have the best claim and that they will win. On the other hand the Metropolitan Traction Company is just as confident of securing possession of this valuable territory, and, when it is remembered how the tremendous political "pull" which the big combine has with Tammany Hall has secured for it at other times, permission to lay tracks in the city when and where it lists, its boast of final victory in this fight must not be considered mere talk. The matter will not be definitely decided for some time yet, but the varying chances of success are in the meantime lending some zest to the speculation in either stock. Should the Third Avenue win it will be obliged to issue a few millions more stock or bonds to provide funds for the extension, but all necessary arrangements have already been completed to secure the capital needed.

It must not be thought that the dealings in the Third Avenue and Metropolitan Traction have overshadowed all the other street railway shares. Second Avenue still is traded in with "mystery on," as the Wall Street phrase has it. No one can accurately trace the source of the continued buying orders and the belief that some big syndicate—Metropolitan or a new one is hinted at—is quietly picking up a controlling interest meets with a deal of belief, and not without cause. Be this as it may, there is sufficient demand for the stock to keep it steady around 134. Then several of the crosstown stocks have been freely traded in. The air this month has been full of new consolidations and extensions, and, while no definite facts have developed, the very uncertainty has made the trading a trifle more exciting than is wont to be noticed. 42nd Street shares and the stock of the Dry Dock, East Broadway & Battery have been much sought after and quotations are all higher. Sixth & Ninth Avenue shares do not move much. They are now held so closely that very little of the stock comes to market, and, as their dividends are guaranteed, the facts concerning them are too settled to warrant of any speculation on future happenings. The same comment may be made as to the old Broadway stock.

Brooklyn and Long Island street railway shares have furnished more activity. The Brooklyn Traction and the Long Island Traction Companies practically divide the field across the river, and so all trading is practically confined to the dealings in these shares Long Island Traction, which is dealt in on the New York Stock Exchange, was rather weak at one time on free and easy sales by insiders, on the announcement that the old Flynn suit to break the lease of the Brooklyn City and other roads was to be pushed to an end, but nothing has come of this and the big earnings reported by the Brooklyn City Railroad, the Brooklyn Heights road and other branches have brought about a recovery from the low price scored in the beginning of the month. Brooklyn Traction quotations have not changed much and the dealings have been without significance.

With the hot weather now at hand, and with speculation in all directions devoid of public interest, the outlook for activity in the street railway stock and bond market is hardly satisfactory, but the easy money market assures the continuance of existing good prices.

Financial.

$500,000 first mortgage 5 per cent. gold bonds have been issued by the Westchester (N. Y.) Electric Railroad Company. The bonds are due 1943, and are guaranteed by the Union Railway Company of New York. The Mercantile Trust Company, of New York, is trustee of the mortgage.

$ $ $

A RECEIVER for the Steubenville (O.) Street Railway Company has been asked by the Sprague Electric Railway & Motor Company and others.

$ $ $

JUSTICE VANN has appointed Edward F. Rice as a second receiver for the Syracuse (N. Y.) Consolidated Street Railway Company. Ald. P. J. Much is the first receiver.

$ $ $

THE stockholders of the Pasadena (Cal.) & Los Angeles Electric Railway Company, of Pasadena, Cal., were to vote July 2 on the proposition to issue $350,000 in bonds.

$ $ $

The following is a comparative statement of the operations of the Columbus (O.) Street Railway Company for the month of May: Gross earnings, 1894, $59 367.36; 1893, $47,546 79; increase, $1,820.57. Operating expenses, 1894, $23,055.81; 1893, $28,954 20; decrease $5 898.39. Net earnings, 1894, $26,311.55; 1893, $18,592.59; increase, $7,718.96.

$ $ $

THE entire plant of the Tampa (Fla.) Street Railway & Power Company, it is reported, was sold June 4, at 1:45 o'clock, in front of the court house by T. C. Taliaferro, the receiver. It was purchased by J. Rush Ritter, a capitalist of Philadelphia, and a large stockholder in the company, for $70,055. There was but one other bidder, Edward Manrara.

$ $ $

THE following is a comparative statement of the operations of the North Shore Traction Company for the month of April: Gross earnings, 1894, $88,421.21; 1893, $85,163; increase, $3,258 21. Operating expenses, 1894, $52,980.14; 1893, $63,137.58; decrease, $10,157,-44. Net earnings, 1894, $35,441.07; 1893, $22,025.42; increase, $13.-415.65.

$ $ $

THE following is a comparative statement of the operations of the Brooklyn (N. Y.) Traction Company for the month of May: Gross earnings, 1894, $80,466.86; 1893, $74,196.55; increase, $6,270.31. Operating expenses, 1894, $50,880.47. From operation, 1894, $29,586,39. Miscellaneous receipts, 1894, $1,488.40. Net earnings, 1894, $31,074.79. We have no data showing the operating expenses and net earnings for the corresponding month of 1893.

$ $ $

THE report of the Buffalo (N. Y.) Railway Company for May shows a gratifying increase in gross earnings of $5,250.43 over those of the preceding year. This increase is larger, by $1,740.79, than that shown for April. The report for May in full is as follows: Gross earnings, 1894, $132 654.04; 1893, $127,403.61; increase, $5,250.43. Operating expenses, 1894, $72,924.39; 1893, $76,744.05. decrease, $3,819.66. Net earnings, 1894, $59.729.65; 1893, $50,659.56; increase, $9,070.09.

$ $ $

THE Worcester (Mass.) Traction Co. reports a gratifying increase in gross earnings for May. Through careful management the operating expenses were kept more than $8,000 less than last year, making a handsome showing in net earnings. The report in detail is given below:

	1894.	1893.		
Gross earnings.....	$32.927.45	$31,836.00	Increase,	$1,091.45
Operating expenses	14,467.22	22,758.90	Decrease,	8,291.68
Net earnings.....	$18,460.23	$9,077.10	Increase,	$9,383.13

$ $ $

THE Governing Committee of the Baltimore Stock Exchange, upon application of the City Passenger Railway Company, of that city, has decided to list 100,000 shares, $25 each, or $2,500,000 City Passenger stock. The company, in its application, makes the following statement.

The earnings of the company have been as follows:

	GROSS.	NET.
1891.	$835,400.43	$86,233.40
1892.	780 388.29	85,712.54
1893.	794,450.24	128,102.89

There are 45 miles of completed road—21.6 cable, and 23.4 electric.

The equipment consists of 194 cars, used on cable and electric roads.

STATEMENT, MAY 25, 1894.

Assets.

Cash.....		$ 272,509.03
Property account.....		4,347,342 49
Circuit Railway Co.....		5,000.00
Consolidated Gas Bonds.....		7,000.00
Bills receivable.....		256.00
		$4,632,107.52

Liabilities.

Capital stock paid.....	$2,494,610	
Installments unpaid.....	5,390	
		$2,500,000.00
Bonds.....		2,000,000.00
Surplus.....		132,107 52
		$4,632,107.52

THE directors of the Brooklyn Heights Railroad Company decided at a meeting June 29 to default upon the payment of the quarterly dividend of 2½ per cent. to the stockholders of the Brooklyn City Railroad Company. President Lewis said that the default in payment would not affect the stockholders of the Brooklyn City Company, as they will receive their dividends as usual, there being a guarantee fund which can be used. The Heights Company deposited $4,000,000 as a guarantee of the payment of $1,200,000 rental, and $250,000 of this can be used to meet the default. The Heights Company has decided to avail itself of this. Owing to the reports of the default, the price of Long Island Traction stock went down from 14 to 12½, but it went up again to 13½.

$ $ $

THE Kansas City Railway Company, which was formed last month in Kansas City, Mo., by the consolidation of the Kansas City Cable Railway Company, the Grand Avenue Railway Company, and the Kansas City & Independence Rapid Transit Company, has elected the following officers: Pres. Walter H. Holmes, V. Pres. Victor B. Buck (Boston), Treas. Wm. B. Clarke, Sec. D. B. Holmes, Gen. Man. Conway F. Holmes.

By the consolidation agreement the stockholders of the Kansas City Cable Railway Company are entitled to receive, for every $100 of their present holdings $90 in the company's consolidated mortgage bonds and $10 in its preferred stock. Stockholders of the Grand Avenue Railway Company are entitled to $100 in preferred stock for each $100 of their present holdings. Stockholders of the Kansas City and Independence Rapid Transit Company are entitled to $50 of the company's common stock for each $100 of their present holdings. The company is capitalized as follows:

CAPITAL STOCK.—Common stock, authorized, $2,700,000, issued, $2,000,000; in treasury, $700,000; par value $100 per share. Preferred stock, authorized and issued, $2,300,000.

FUNDED DEBT.—Consolidated mortgage gold bonds, authorized, $5,000,000, now in progress of exchange; coupon, but may be registered; dated May 1, 1894, due 1909; denom. $1,000; int. 5 p. c., payable May and November, at office of Central Trust Company, of New York, trustee of mortgage.

The company has also assumed the principal and interest of the following bond issues of constituent corporations:

Kansas City Cable Railway Company's first mortgage coupon bonds, authorized and issued, $1,350,000; dated April, 1887, due 1897; denom. $1,000; int. 5 p. c., payable April and October, at office of New England Trust Company, of Boston, trustee of mortgage.

Grand Avenue Railway Company's first mortgage bonds, authorized and issued, $1,200 000; coupon, but may be registered; dated July 10, 1888, due July 10, 1908; denom. $1,000; int. 5 p. c., payable January 10 and July 10, at office of Central Trust Company, of New York, trustee of mortgage.

Kansas City & Independence Rapid Transit Company's first mortgage bonds, authorized, $1,000,000, issued, $800,000; coupon, but may be registered; dated March 1, 1889. These bonds have been exchanged for the company's consolidated mortgage bonds in the rates of $60 to $100 of consols.

The J. G. White Prize Competition.

The offer of $400 in prizes made, in our May issue, by J. G. White of New York, the well known electrical engineer, for the best essays on the construction of an inexpensive car house, and for the best method of operating a park in connection with a street railway system, has brought out, we understand, a large number of replies. The judges inform us that they have not yet been able to pass finally upon the relative merits of the papers submitted, but hope to be able to do so during the coming month. The result of the competition will be published in our August number if a decision is reached before the time of going to press with that issue.

"The Financial and Commercial Chronicle" to be Published by a Company.

The William B. Dana Company, publishers of the *Commercial and Financial Chronicle*, has been incorporated at Albany with a capital of $500 000. The incorporators are William B. Dana, Arnold G. Dana and Frederick R. Shepherd. William B. Dana is president, Arnold G. Dana treasurer and Frederick R. Shepherd secretary.

Arnold G. Dana is a son of Professor James D. Dana, of Yale College (brother of Wm. B. Dana), and has been connected for a number of years with the *Chronicle*, having in charge the quarterly "Investors' Supplement," published by the *Chronicle*. He has recently been associated with Redmond, Kerr & Company, bankers, of New York, but will, resume his former position in the fall. Mr. Shepherd is in charge of the City and County department of the *Financial Chronicle*. The first issue under the newly organized company was made June 23.

EDWARD E. HIGGINS,
Expert in Street Railway Values and Economies.
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The Lake Shore Route.

The Lake Shore Route, between Buffalo and Chicago, is celebrated all over the world as affording the embodiment of luxury in travel. Its new Day Coaches are sixty feet in length, and will seat fifty-eight people, comfortably. They are fitted with the Gould platform and automatic coupler, Westinghouse air brakes and signal, heated with steam taken from the locomotive, and at night are brilliantly lighted with Pintsch gas, for which purpose five elegant bronze chandeliers depend from the roof of the car.

The interior of the coaches is finished in mahogany, highly polished and paneled. Each coach has a nice lavatory and toilet. The latest models contain separate toilet rooms—one for ladies and one for gentlemen. The car seats are of the style known as the Mason tilting, with high spring backs and broad seats. They are richly upholstered in crimson plush. The windows, which are of plate glass, are large, and each is fitted with a spring-roller curtain, in shade to blend with the interior finish, and every feature is of the best.

The dining cars in service on the trains of the Lake Shore & Michigan Southern Railway are operated by the company. The cars are neat and tasty in all their appointments. Great care is exercised to provide the patrons of the Lake Shore Route with a service which shall prove satisfactory. As a result, dining on the trains of the road is accomplished in a very satisfactory and comfortable way.

The sleeping cars in service on the Lake Shore Route are of Wagner build. Ordinarily, they contain twelve sections a state-room, a smoking apartment, and toilets for ladies and gentlemen. In some instances, however, there are cars containing sixteen sections, the state-room being omitted. Every valuable device is embodied in their construction.

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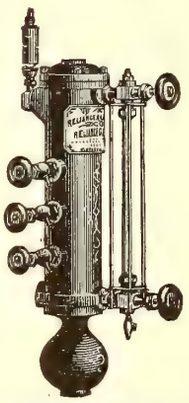
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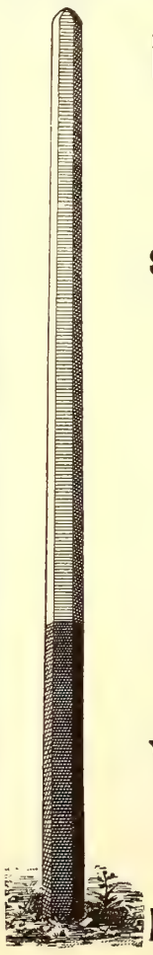
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THE STREET RAILWAY JOURNAL

Vol. X. *NEW YORK & CHICAGO, AUGUST.* *No. 8.*

AUG 6 1894 PATENT OFFICE

A Model Car House.

In the engraving on this page is presented a view of the capacious car house recently completed by the Union Railway Company, of New York. The engravings on the following page are from photographs of the first and second floors.

The house is located at the junction of Boston and Woodruff Avenues, and has a frontage of about 150 ft. on Boston Avenue, and extends back on Woodruff Avenue a distance of about 260 ft. As shown in the exterior view, the building is of brick with stone trimmings, and presents a very handsome appearance. The architectural feature of the structure is the square tower of attractive design eighty-two feet in height and twenty-five feet square, located over the central doorway.



FIG. 1—EXTERIOR OF CAR HOUSE—UNION RAILWAY COMPANY, NEW YORK CITY.

Woodruff Avenue descends gradually from Boston Avenue, so that the building is one story higher in the rear than in the front.

On the ground floor are fourteen tracks, each with a storage capacity of nine closed or seven open cars. All tracks are provided with pits for the inspection of motors, running gear, etc. The trolley wires which lead into the building are carried under wooden troughs, which are attached to the floor beams. The floors here are laid with cement. An electric elevator carrying a platform, 11 × 35 ft., and operated by the railway current, is provided for quickly transferring cars to the basement or the upper floor. This elevator is shown at the left of Fig. 3.

On the second floor, shown in Fig. 2, there are thirteen tracks with a total storage capacity of seventy-five cars. An especially interesting feature of this floor is a flush transfer table of special design which was built for the Union Railway Company by the White Manufacturing Company, of New York. With it the cars can be quickly and easily moved to any part of the room by one man.

This transfer table, which is shown in the engraving and which was fully described in the May, 1894, number of the STREET RAILWAY JOURNAL, runs on rails laid on the floor itself, and avoids the necessity of cutting the floor. The transverse rails upon which the car rests when on the table are slightly bent down at the ends, so as to make connection with the floor rails.

The company will perform its own armature winding, and a space of about 40 × 50 ft. in the Boston Avenue end of the second story is set apart for this purpose. Twelve large windows furnish abundant light for this work.

Adjoining the armature room, directly in the center of the front of the house and within easy call of the dispatcher's office, is a large room for the use of conductors and motormen. It is well lighted and heated, and furnished with an ample number of comfortable seats.

The machine and blacksmith shops are located in the basement in the rear end of the building, and will be fully equipped with the most approved machinery for making all necessary repairs. Power will be supplied entirely by electric motors operated by the railway current. The paint shop of the company is also located in the basement.

The tracks are so arranged that a car can be taken

from the street or any part of the building to the elevator, lowered to the basement and run directly to the repair shop, facilitating the work of repairs. A large stock room adjoins the machine and blacksmith shops.

The house is well lighted by large windows on all sides.

The Indianapolis Franchise Case.

An interesting case involving the right of a city to transfer certain franchises, claimed to have expired, from one corporation to another, was argued last month in Indianapolis in the case of "The Citizens' Street Railroad Company *vs.* The City Railway Company." The final arguments for the former, the one now in the field, was presented by Hon. Benjamin Harrison who claimed, among other points, that an extension of an existing franchise did not require any special consideration, the consideration for the original grant being sufficient to cover the extension, also that the termination of the right to operate cars over certain streets was tantamount to a confiscation of the tracks of the company in those streets when no provision had been made originally to cover this point. Also that a grant from the legislature could not be terminated by a city, even though it had been provided in the act of the legislature that it should not take away the "exclusive power exercised by the city over the streets," the term "exclusive power" merely identifying the powers then exercised over location, survey and construction. Mr. Harrison claimed that under the State charter the franchises were perpetual. The case was presented before Judges Woods and Baker of the United States Circuit Court. No decision will probably be given for some time.

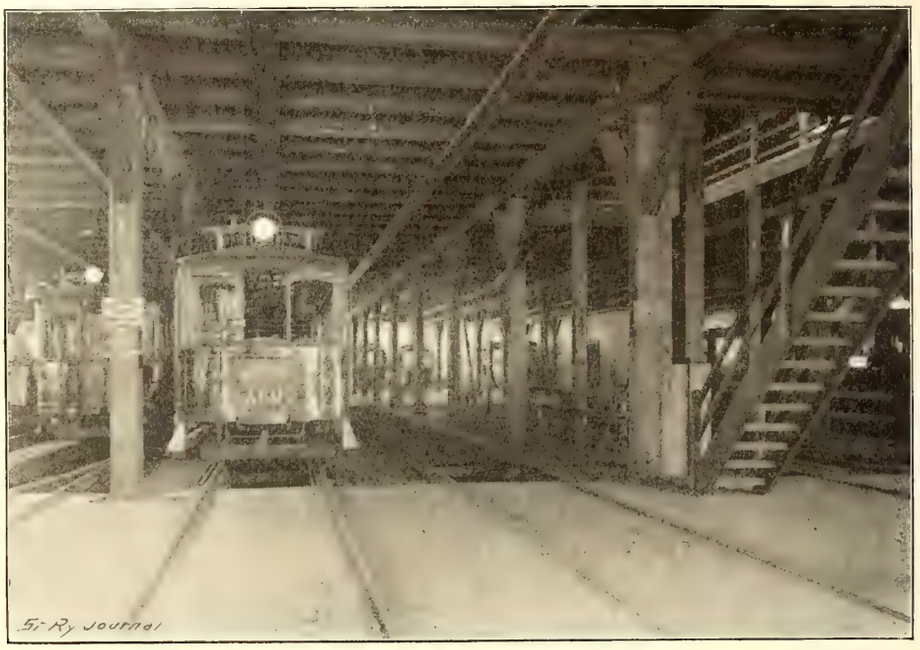


FIG. 3.—VIEW OF GROUND FLOOR OF CAR HOUSE—UNION RAILWAY COMPANY, NEW YORK CITY.

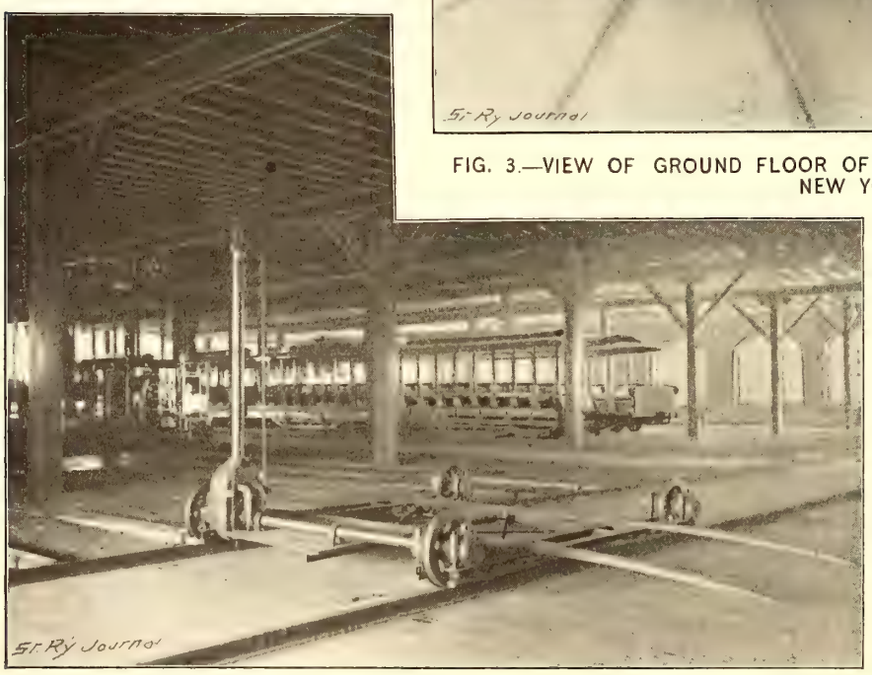


FIG. 2.—VIEW OF SECOND FLOOR OF CAR HOUSE—UNION RAILWAY COMPANY, NEW YORK CITY.

Fenders in Washington.

A bill has been introduced in Congress to compel all the street railway companies in the District of Columbia to equip all electric and cable cars with fenders. The District Commissioners are examining different types.

Railway Lines in Detroit Sold.

Thomas Nevins, of Orange, N. J., the contractor who has been mentioned on several previous occasions as the purchaser of the Detroit Street Railway lines, concluded the purchase July 3. It is said Mr. Nevins had an option on this scheme, which expired on July 9. It was coupled with a condition that the franchise be obtained from the Common Council of Detroit. A company of capitalists, anxious to secure the roads, succeeded in delaying the granting of the franchise beyond the time named in the option, with the hope of defeating Mr. Nevins. The latter went to Detroit, however, and closed the deal, paying, it is said, par for the $1,250,000 of stock and $3,000,000 bonds.

Mr. Nevins will at once go to work and organize a stock company, in which he will hold a controlling interest, and equip the remaining fifty miles of trackage with the trolley system. He will take possession of the newly acquired property in a few weeks.

Mr. Nevins in a recent interview said: "I was treated in a very fair manner by the municipal authorities of Detroit. My company will be exempt from taxes, and free from any expense for street paving or improvements of any kind. For these considerations I agreed to give the city a workingman's rate of fare, which is three cents, between the hours of 5:30 and 7 A. M., and 5:15 and 6:15 P. M."

An Electric Railway Between Columbus and Cincinnati.

The prediction that Cincinnati and Columbus are to be connected by an electric railroad has become a very strong probability. Application has been made to the Franklin County Commissioners for a right of way for an electric railway on the national pike from Columbus to the Madison County line, and a franchise has been granted on condition that the road is begun by September 1, 1895, and completed by September 1, 1896. The applicants are L. D. Hagerty, H. B. Morehead, Dennis Dwyer, of Dayton, and Orin Brown.

The Hobart Electric Street Railway.

The second electrical street railway in Australasia, and, perhaps, the finest in the Southern Hemisphere, is that opened for traffic September 1, 1893, at Hobart, the chief city of Tasmania, that island which lies due south of the great continent of Australia, and which is looked upon by its inhabitants as the gem of the Southern seas. A feeling of discontent with antiquated methods of traction had been rising ever since the success of electric traction in America had been reported there. And this feeling speedily impelled them to investigate and be more forward with the times. From the beginning the cars have been great favorites, and not a stop or a hitch has occurred since the line was opened. The system adopted is the overhead, and is similar in most respects to those installed here and in Europe.

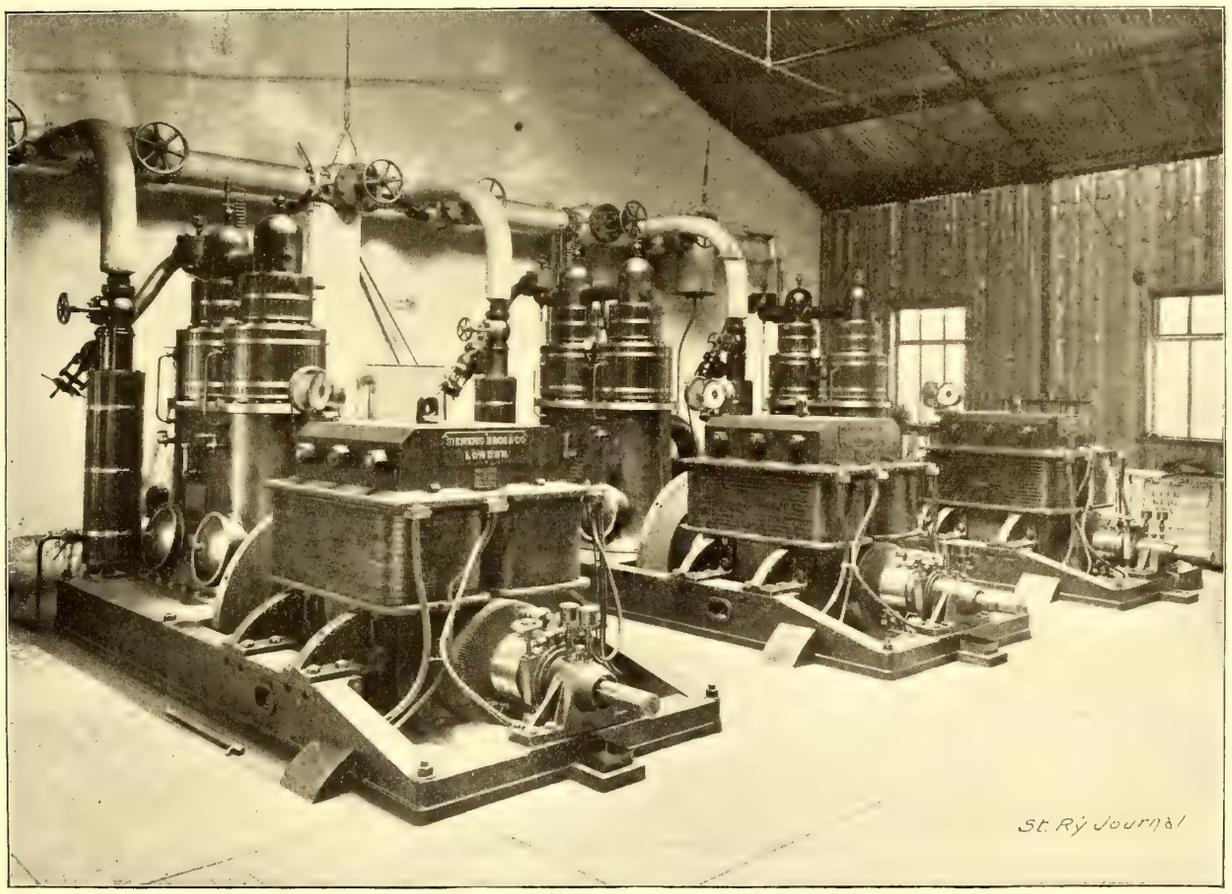


FIG. 1.—INTERIOR OF POWER STATION—HOBART ELECTRIC STREET RAILWAY, TASMANIA.

Some years ago a body of local capitalists secured a concession from the city, granting them a perpetual lease of all the roadways necessary to the operation of a car service. A horse car service was effected for some time, but the claims of improved traction became urgent, and a more utilitarian and satisfactory method was contemplated. An offer being made to the syndicate by the Hobart Electrical Tramway Company to take over the concession and build an electrical road, it was accepted at once. A contract was made shortly afterwards with Siemens Brothers & Company, of London, to undertake the entire equipment of the line from the foundations of the power house to the last fuse on the last car, that is, the steam and electrical plant, track, line and rolling stock.

The total length of the tracks is ten miles, the system being divided into three sections, each about three miles long, running to the suburbs of New Town, Sandy Bay and Cascades. The first two start from the telegraph office at the corner of Macquarie and Elizabeth Streets, while that running to the Cascades starts from the railway station in Lower Park Street, and continues along Macquarie Street to its terminus at the Cascades.

The power station and car house have been erected at the lower end of Macquarie Street, near the Hobart rivulet, and so much difficulty was experienced in finding suitable foundations for the house itself and the engines, boilers, stack, etc., that piles were driven and a firm concrete foundation laid upon them. Upon this structure the house was erected. It was designed in England, and sent out all ready to be set up. It consists of a galvanized iron shell with wrought iron principals and girders, the various portions being separated by wooden and brick partitions.

The boilers (Fig. 2) are four in number, and are of the Marshall locomotive, multitubular type. They have a capacity of sixty horse power each, and generate steam at a working pressure of 160 lbs to the square inch. The mountings are complete and include double gauge glasses, steam gauge, patent draughts, etc. The boilers are covered with Bell's asbestos composition, as are the steam pipes, to lessen the waste of heat. The ash pits are built beneath the surface of the boiler room floor. The flues are connected with the stack, which rises ninety feet skyward. This is of wrought iron riveted throughout, is five feet in diameter and securely anchored with stranded steel stays. A water tank is provided for the feedwater, which is pumped by two No. 5 Worthington steam pumps through two Marshall 100 H. P. water heaters into the boilers. The steam passes from the boilers through a ring main so arranged that any engine or any boiler may be worked separately or together.

Passing from the boiler house into the engine and dynamo room, the visitor sees an installation which for neatness and compactness need fear no rival anywhere. The engines are three in number and are of the Willans & Robinson well known vertical, patent central valve, high speed, compound type. They are provided with steam separator and fitted with sensitive governors of special design. They operate at a speed of 350 revolutions per minute, and are directly connected to three generators—engine and dynamo being fitted to one bed plate. The rate of speed is shown on a tachometer.

The three generators are of the Siemens H. B. $\frac{36}{21}$,

bipolar, compound wound type, the armatures being set near the floor and making the same number of revolutions as the engine. The capacity of each dynamo is 250 amperes at 500 volts. The engine shaft, directly coupled to the armature shaft, carries a flywheel of massive construction four feet two inches in diameter, weighing with the shaft about two tons. The working parts of the engines run in oil baths carefully covered in, and each engine will work up to 200 H. P.

The generated current is led from the dynamo terminals to a switchboard arranged on the wall of the room. Upon this are mounted the necessary switches, cutouts, resistances and measuring instruments. The engine room, boiler house, car barn, offices, etc., are all lighted by sixteen candle power incandescent lamps arranged five in series between the lines.

The construction of the overhead line is extremely substantial. The poles are erected along the edge of the sidewalk, some being of wood and some of iron. Owing to the position of the poles and wires of the telegraph and telephone departments, which follow the route taken by the cars along almost the entire length of the line, it was found necessary to crank the poles of the street railway, to throw the top some three feet from the line of the base, in order that they should not run into contact with the other wires. The interruption to the telephone service has been so slight as to have evoked no complaint.

The feeders, of which there are fifteen miles, are of nineteen strand copper wire. The trolley conductors, of which there are ten miles, are of seven M. M. diameter, galvanized steel wire. These are suspended from span wires of galvanized iron, there being eight miles of this, stretched between 800 side poles carrying 1,000 insulators.

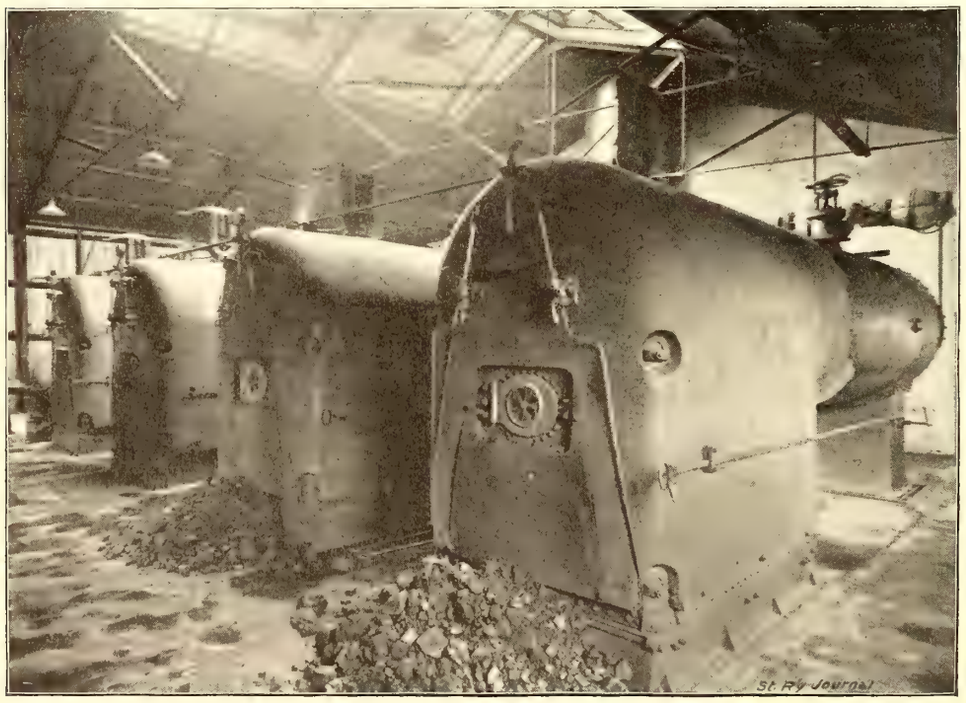


FIG. 2—BOILER ROOM—HOBART ELECTRIC RAILWAY, TASMANIA.

The track is constructed of forty pound T, or Vignole, steel rails spiked to wooden ties, and guard rails are used along the whole length of service track. The rails are bonded with solid copper strips securely riveted. There are fourteen turnouts arranged for a fifteen minute service along the lines. In some places the curves and gradients are rather severe, the steepest grade being on the New Town line, where for about fifteen chains the rise is about 6 per cent.

The cars are twenty in number, and are neat examples of the car building art, built for Siemens Brothers & Company by the Lancaster Waggon Company. They are



FIG. 3.—DOUBLE DECKED CAR—HOBART ELECTRIC RAILWAY, TASMANIA.

principally of teak and ash, the window frames being of mahogany, and are double decked, the upper deck being roofed over, but not closed in, and the seats arranged across the top of the car. There is room for twenty-four passengers inside and twenty-four on the upper deck, which is reached by a winding staircase at each end of the car. While they are constructed to carry only forty-eight passengers, rush of traffic has frequently loaded them with as many as 106. This speaks well for both motors and cars. The cars are supported on the trucks by spiral springs, and each car and truck complete weighs about six tons.

Each car is provided with two motors of twelve and a half horse power each, geared to the axles through single reduction gears working in oil. The motors and gearing are enclosed in suitable casings which render them both water and dust proof. One motor has been found sufficient to operate a car in case of breakdown of the other. Current is taken from the overhead wire by Siemens friction contact arrangements, two of which are mounted upon supports running up from the roof proper of the car. They are light steel frames of rectangular shape, pivoted at the lower part of each side and kept in contact with the trolley wire by means of two strong spiral springs. While this system may seem to American eyes inferior to the trolley pole with its revolving contact, it is said to be very efficient and less liable to break down, while the wear on the overhead conductor is very slightly, if at all, in excess. The controlling switches are placed one on each platform, and are of the well known Siemens type. The resistance, consisting of a

series of coils, is set beneath the platform. The maximum speed allowed is twelve miles per hour, but this is exceeded on down grades and in the less frequented neighborhoods.

The cost of the installation complete amounted to about £34,000 or $170,000. The cars began to run on September 21, and up to October 20 had covered 25,000 miles, and carried 115,000 passengers, the highest number in one day being 7,500 with fifteen cars. The population of Tasmania in 1891, when the last census was taken, was 146,667, and that of Hobart and its suburbs 29,593. Since the road was opened, up to June 1, date of our latest advices, the cars had carried 1,092,491 passengers, the number of car miles run being 243,165. The ordinary service consists of twelve cars, but eighteen have been used on certain occasions, and even twenty, without any special effort on the part of the steam or electric plant.

The fares are fixed at four cents for travel within the city limits, while another two cents procures a further ride for three miles in any one of the three directions in which the cars run. Numbered tickets are given to the passengers, and these must run consecutively and correspond to the conductor's series. The passengers are requested to destroy their tickets on leaving the cars, a request pretty generally complied with, as they are made aware that responsibility for mistakes falls upon the conductor. The cars run every quarter of an hour, or, as a taciturn London 'bus driver once replied to an enquiring passenger: "They leaves at quarter past, half past, quarter to and at!" Passengers are transferred from any one line to any other without increase of fare.

The cars have been an unqualified success in Hobart, and the road stands at present as an object lesson to the other Australian colonies. It has attracted considerable attention, and has been visited by the engineers of most of the street railways in the Australian colonies, not to speak of the big political magnates.

The question of lighting business premises in the city from the station has also been mooted, and as by Act the Tramway Company's charter allows it to do anything in that way, it is probable that it may also undertake the city lighting.

To A. C. Parker, engineer in charge, under whose expert supervision the entire installation of this model road was effected, we desire to acknowledge our indebtedness, for his kindness in providing us with the facts upon which the foregoing article was based, as well as the interesting photographs from which the cuts were made.

The Glasgow Subway.

The Glasgow subway, which has been under process of construction during the last two and a half years, and which will be a valuable addition to the rapid transit facilities of that city, is now nearly completed. This subway consists of two independent tunnels eleven feet in diameter and in the form of a loop six and a half miles in length. The tunnels are constructed on an average of

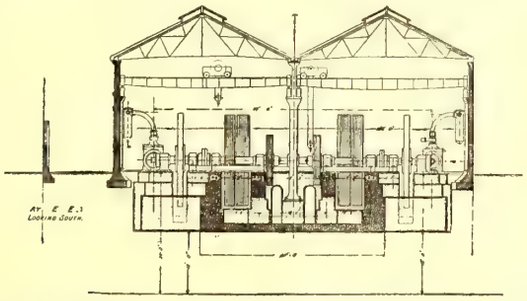


FIG. 1.—TRANSVERSE SECTION OF POWER STATION—GLASGOW CABLE RAILWAY.

thirty feet below the surface and close together except at the stations, where they widen to admit of a ten foot platform which is reached by stairs leading down from the surface. There are in all fourteen stations, the distance between any two being about half a mile. The system of compressed air chambers was employed in the tunnel construction, and the total cost of the subway has been about $3,600,000 exclusive of equipment and property franchises, the company being obliged to purchase all property along the line.

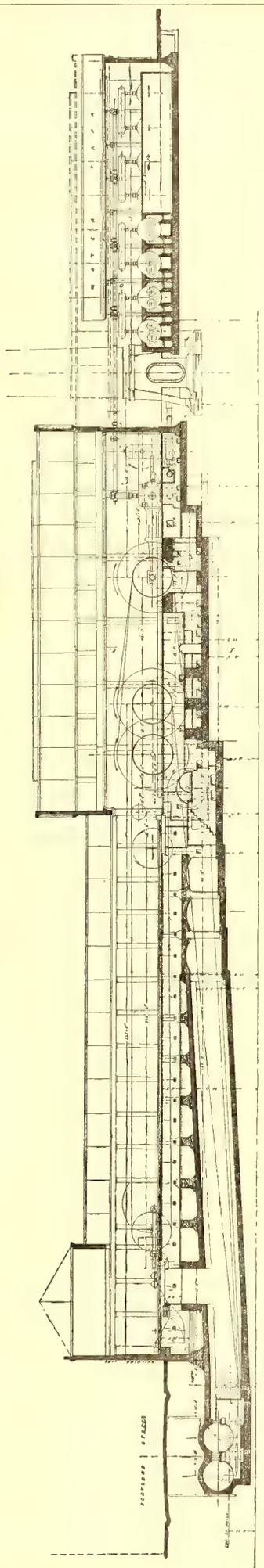


FIG. 2.—LONGITUDINAL SECTION OF POWER STATION—GLASGOW CABLE RAILWAY.

The question of the best motive power to introduce was decided in the early part of this year, the choice being practically confined to electric and cable power. The engineers of the subway, as some of our readers may remember, visited this country last November on a tour of investigation to learn the recent advances made in rapid transit methods in America. As a result, the cable system was selected. Through the kindness of David Home Morton, engineer of the subway, we are enabled to present the accompanying plans of the cable machinery and arrangement recently decided upon.

The power station measures 463 ft. 7 ins. × 100 ft. in its greatest dimensions. The boiler room will contain eight Lancashire boilers in four batteries of two boilers each, connected with the engine room by a duplicate set of steam mains. It is located close to a railroad siding, so as to admit of the greatest facility in the receipt of fuel. The engine room proper measures 138 ft. 4 ins. × 100 ft., and will contain two engines with cylinders 42 × 48 ins., operating under 100 lbs. steam pressure, and running at fifty-five revolutions per minute. One of these is directly connected with each end of a shaft seventy-seven feet six inches long, extending entirely across the engine room, and divided into sections, connected by plate couplings. Small auxiliary engines are provided for turning the shaft for inspection purposes, etc., without the necessity of operating the larger engine. The steam pipe system in the engine room is also duplicate throughout.

The engines are so arranged that either can operate either set of driving drums of the duplex cable system used. Upon the main shaft are mounted four driving

drums, fourteen feet in diameter, each of which is connected to the driven drum on the cable shafts, each twenty-five feet in diameter. The rope drive is used. The cable drivers are fourteen feet in diameter each, and are provided with Walker differential rings. The cable will be operated at a speed of fifteen miles per hour. The tension run has a length of 149 ft., and the course of the ropes is clearly shown in the elevation of the station (Fig. 2).

The main guide sheaves are located below a completed section of the tunnel, and as the conditions for driving foundations at this point are not good, shallow foundations were adopted, the sheave brackets being spread over a large area.

The new cables will arrive at the railway siding, located in the rear of the power room, and will be carried coiled in long loops on several platform cars. The end of the cable will then be taken up over a sheave high above the middle car, thence on over the roof of the boiler house, and down through the roof of the power house, onto the cable storage drums. From these the new cables are to be led overhead on the guide sheaves carried by the middle roof columns onto the tension tracks and spliced to the old cable. The tail of the old cable will be brought down over the second cable driving drums back through the foundation below the floor, and out through the wall of the power house to a drum for old cables, which will probably be placed under the water tanks just south of the chimney shaft.

The cars to be used in the subway will have double trucks, and will be fifty feet in length, each car being provided with a grip. The estimated weight of the trains when loaded is twenty tons each. The greatest possible number of trains which can be put on the lines would be thirty, fifteen on each track. A universal fare of one penny for second class, and two pence for first class, regardless of distance, will be made, and the cars and stations will be lighted by electricity. The tunnel will not be lighted except by the headlights.

Electric Railways in Europe.

A European electrical journal states that the total number of electric railways in Europe on January 1, 1894, was 43, with a total estimated mileage of 185, and total power station capacity of 10,650 K. W. The aggregate number of motor cars was 538. Germany stands first, with 61 miles in operation; England second, with 43, and France next, with 25. The other countries are credited as follows: Austria-Hungary, 19 miles; Switzerland, 13 miles; Spain, 8 miles; Italy, 7 miles; Russia and Belgium, each 2 miles.

The Lexington Avenue Cable Power Station of the Metropolitan Traction Company.

The work of introducing a substitute for animal power upon its various lines in New York City is being prosecuted by the Metropolitan Street Railway Company as vigorously as circumstances will permit. The plans of the company to install an underground electric system on one of its uptown lines have already been published in these columns. While awaiting the results of this trial the company is completing its projected cable railways on Columbus and Lexington Avenues.

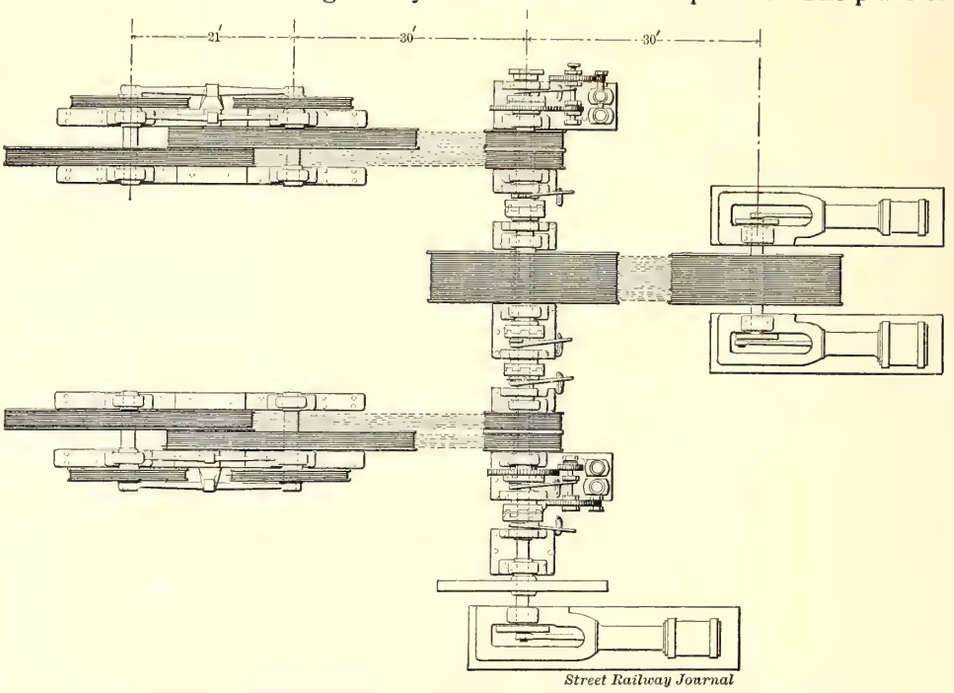


FIG. 1.—PLAN OF MACHINERY—LEXINGTON AVENUE CABLE POWER STATION, NEW YORK CITY.

The Lexington Avenue railway will be operated from a power station 130 ft. east of Lexington Avenue, and extending from 25th Street to 26th Street. This part of the city is devoted to residences, and owing to the high value of real estate, the cable machinery will all be located in the basement of the building. The floor of the engine room will be seventeen feet below the street, and its height will be forty-one feet in the clear. An apartment house similar to those in the neighborhood will be erected over the machinery, and upon separate foundations, as in the Houston Street station of the Broadway railway, so that the vibrations of the machinery will not be communicated to the rest of the building.

The plan adopted for the arrangement of the machinery to be installed at present is shown in Fig 1. A longitudinal section of the station looking west is given in Fig. 2. The outside dimensions of the building are 188 ft. on 25th Street, and 179 ft. on 26th Street by 197 ft. 6 ins. in length, giving a seven foot passageway from 26th Street on the west side.

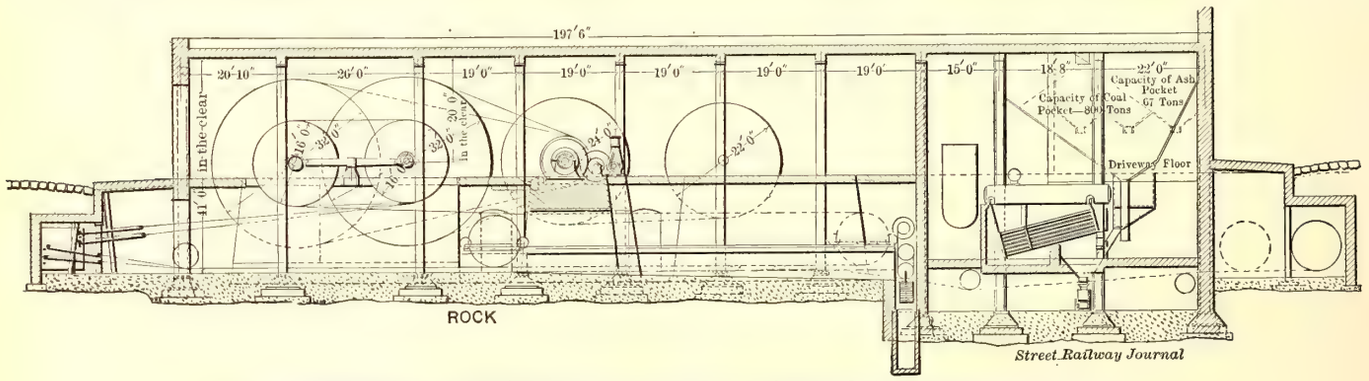


FIG. 2.—SECTION OF LEXINGTON AVENUE CABLE POWER STATION—NEW YORK CITY.

The station is constructed throughout so as to be readily converted into an electric power plant should future developments be such as to make such a change desirable, and it is designed for an ultimate capacity of four sets of duplex cable apparatus, or four sets of electric generators and engines.

As shown in Fig. 1, the present cable driving engines are two in number. One is a cross compound Allis engine with cylinders 30½ and 48 ins. × 48 ins. stroke, and operates at seventy-five revolutions per minute, a twenty-two foot driving drum which is connected to a similar drum on the jackshaft by twenty-two two and a quarter inch cotton ropes. The second engine, which is located at the end of the jackshaft, is a single expansion Allis engine with cylinder dimensions 30×60 ins. The flywheel of this engine is twenty-two feet in diameter.

The jackshaft is eighteen inches in diameter in the journals and twenty-one inches in the swell. In its present length of seventy-two feet, it is divided into seven sections connected by plate couplings sixty inches in diameter. Two sets of upright auxiliary engines are installed for turning the jackshaft slowly for inspection or other purposes, without employing the larger engines. The driving drums on the jackshaft are ten feet in diameter, and two in number. Each has twice the face of each of the thirty-two foot drums on the cable driver shafts, to which it is connected by nine two and a quarter inch cotton ropes.

The cable drivers are sixteen feet in diameter, and are provided with equalizing struts as in the other stations of the Traction Company. They are of the solid type and designed to operate the cable at a speed of from eleven to twelve miles per hour. The arrangement of the pit sheaves as well as of the tension run is shown in the longitudinal section. The Pennsylvania Iron Works Company was awarded the contract for all of the cable machinery employed as well as for its erection. This company was also awarded the contract for all sheaves, movable iron, etc., employed in the conduit construction.

The steam generating equipment is located at the 26th Street end of the building, and consists at present of two batteries each containing two Babcock & Wilcox boilers. The station will also contain, besides other station equipment, a 500 light, incandescent dynamo with switchboard and other appliances.

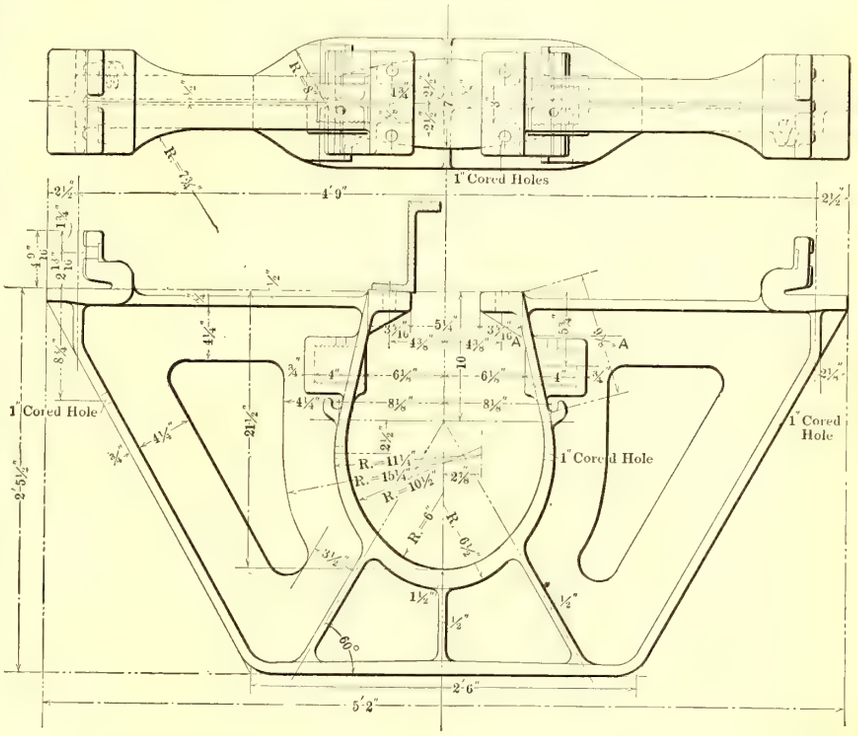


FIG. 3.—ELEVATION AND SECTION OF STANDARD YOKE FOR ELECTRIC OR CABLE CONDUIT CONSTRUCTION—METROPOLITAN TRACTION CO.



FIG. 4.—VIEW OF CABLE CONDUIT CONSTRUCTION ON LEXINGTON AVENUE LOOKING NORTH FROM 76TH STREET—NEW YORK CITY.

In the track construction, the contract for which was awarded to John D. Crimmins, a yoke is being used which is similar to that employed on the Columbus Avenue construction, except that it is so arranged that the conduit can be changed over to adapt it for electrical operation if desired. We present in Fig. 3 elevation and plan of this yoke, the pockets for the electrical insulators being clearly shown.

A portion of the work under construction is shown in Fig. 4, which presents a view on Lexington Avenue looking north from 76th Street. An enterance to the crossover vault at this point is shown at the lower right hand corner of the engraving.

Gas Lights in Electric Cars.

A contract has just been closed with the Columbus Central Railway Company, of Columbus, O., for the construction of a Pintsch works, and the company will proceed with the equipment of its street cars for this illumination. This road is an electric line, and the installation will be particularly interesting as being the first in which gas has been employed on electric cars. The decision to use Pintch gas was made on account of its economy, as well as its being a more steady and reliable illumination.

Price Hill Inclined Plane Railway of Cincinnati.

The operation of inclined planes forms a very important part of the street railway system of Cincinnati. The business portion of the city is located on a plateau



PRICE HILL INCLINED PLANE RAILWAY—CINCINNATI.

which rises abruptly from the river to an average elevation of about seventy-five feet, and which is backed by an irregular line of bluffs, having an average altitude of from 300 to 350 ft. above the river, over and beyond which the city has already spread.

The principal hills are named, respectively, Price Hill, Mt. Adams and Walnut Hills. Walnut Hills is on the north, and extends almost to the bank of the river. The heights are all reached by inclined planes, cable roads and, in some instances, by the electric lines, so that the rapid transit facilities of the city embrace almost every known method of traction, including horse car lines, cable and electric roads, inclined planes and one dummy line. There are four inclined planes, on three of which the electric cars are transferred from one level to the other and continue their course. The planes are provided with triangular shaped trucks, with platforms on the level, so that the electric cars are readily run on or off at the terminals. All the inclines are provided with the latest types of safety devices, and are operated in a very safe and satisfactory manner.

The Price Hill incline is designed for both passenger and freight traffic. The two lines are located near to each other, but are operated from separate stations. The passenger traffic is transferred from the street cars to the cab of the incline, and at the top of the hill a second transfer is made to connect with the lines on the upper plane. The freight section is designed for vehicle traffic, and the cars are capable of taking three or four heavily loaded wagons with teams at a trip. This is the only one of the Cincinnati inclines that has not been before described in these columns. The tracks are 800 ft. in length, and are laid on an average of 44.6 per cent., making a total rise of 350 ft. During the morning and evening hours, or when traffic is heavy, trips are made every three minutes. The incline carried about 1,000,000 passengers in 1893. The fare is five cents, except where the trip is to be continued, when five cents includes the street car fare into the city. On the other line the round trip for ordinary vehicles is twenty-five cents, and for heavily loaded trucks eighty-five cents.

The freight incline is operated by a 200 H. P., poppet valve, duplicate engine, manufactured by Frisbie of Cincinnati. The winding drums are thirteen feet in diameter. The passenger engines are 100 H. P., manufactured by John Cooper & Company, Mt. Vernon, O. They have been in service since 1875, and are still in good condition. The power station is located at the top of the incline, and adjoining it is a park and summer garden, well shaded and provided with rustic seats and with a railing along the edge of the bluff. From this location one of the most interesting views is had of the city and surroundings. All the bridges which cross the river, also Covington and Newport, are embraced in the outlook.

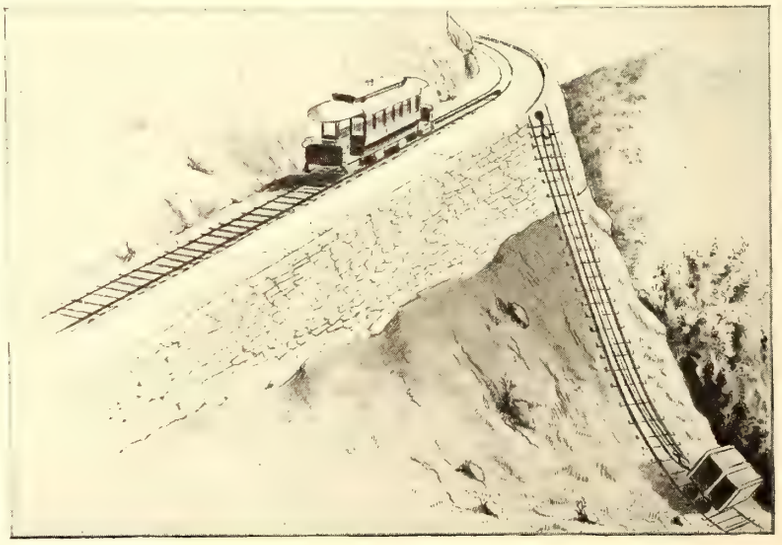
The inclines are operated under the management of Messrs. McDuffie Brothers.

Climbing Grades at Easton, Pa.

Easton, Pa., which lies at the entrance of the beautiful Lehigh Valley, is situated upon a high bluff located between the Delaware and Lehigh Rivers. The lines of the railway company, in consequence, lie nearly all on heavy grades, and special provisions have to be taken to control the cars at these points.

The Easton Transit Company now operates all the lines in the city. This company is a consolidation of the Pennsylvania Motor Company, the Easton & Bethlehem Transit Company, the Easton Transit Company, and the Phillipsburg Street Railway Company. Power is taken from the station of the local Edison Illuminating Company at the corner of Washington and 16th Streets. The company has forty motor cars, all from the works of the J. G. Brill Company, and about twenty miles of track.

All of the cars are equipped with a double set of brakes operated by two brake levers, one lever setting the four inside shoes, and the other the four outside shoes. The cars are all provided with extra long platforms, and contain a special compartment for the motorman, so that he may be unimpeded in controlling the car and operating the brake levers. The closed cars are equipped with Brill sand boxes, and seashore sand is used. The company is employing a cast iron brake shoe with



BALANCE WEIGHT SYSTEM FORMERLY USED FOR CLIMBING GRADES AT EASTON, PA.

wrought iron plugs. Westinghouse motors are used throughout.

An interesting experiment with a balance weight system for electric cars was made on the College Hill branch of this road. The system was abandoned some time ago, as in the company's opinion no particular benefit was obtained from its use. The apparatus, however, is still in place, and is the only example of its kind, so far as we know, outside of the somewhat similar system at Portland, Ore., and described in our issue for May, 1893. The

engraving on this page will give a very good idea of the arrangement of the balance weight.

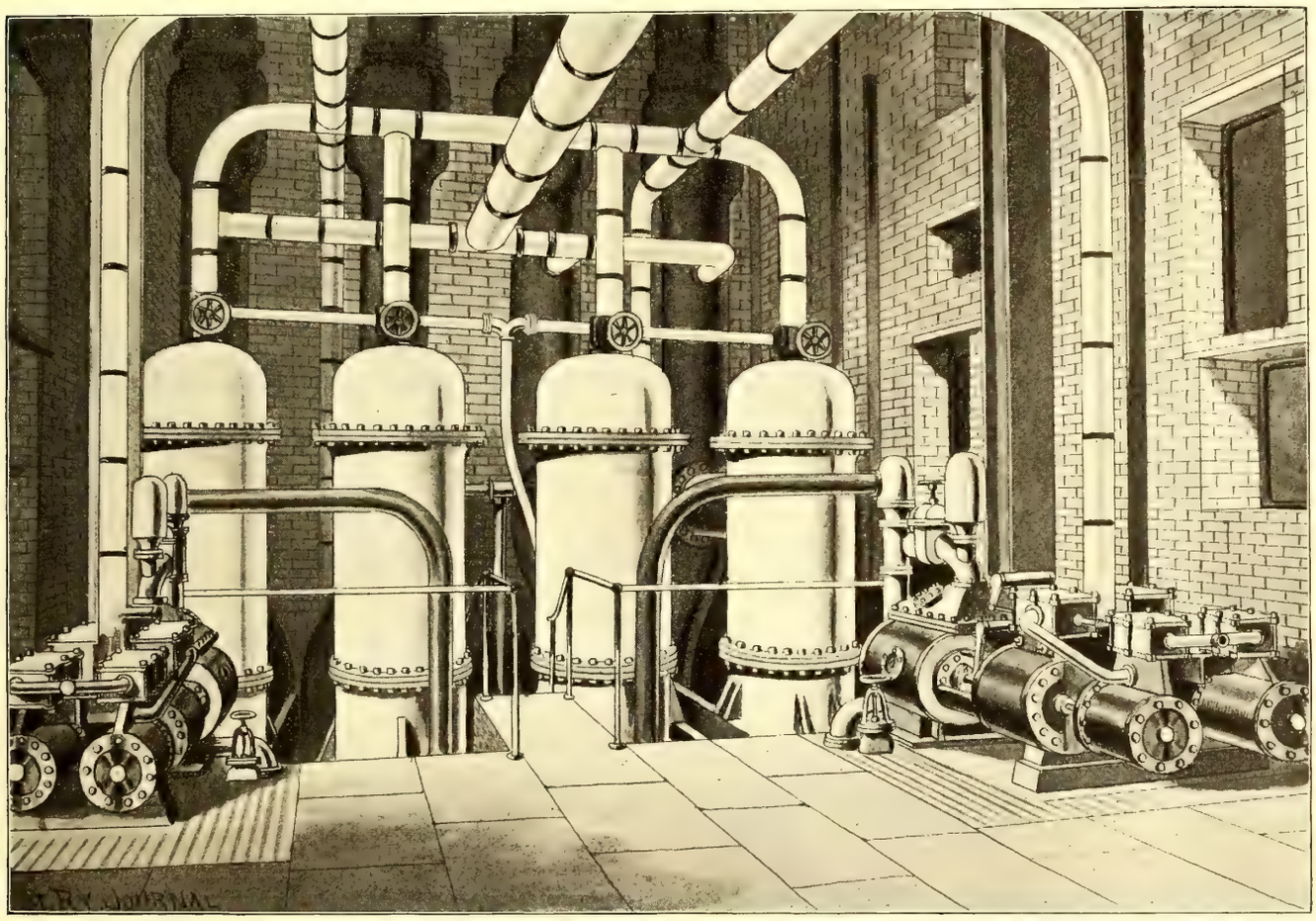
The grade operated is a continuous one of about 9 per cent. for a distance of about 1,500 ft., and the tracks are laid at the outside of the highway along the side of a steep hill. From the top of the grade the hill slopes to the base at an angle of about 60 degs., and on this incline a narrow gauge track was laid at right angles to the direction of the track. This track extends from the roadway to the base of the hill, a distance of about 120 ft. A four wheel truck, heavily loaded with pig iron, traveled up and down this track. This truck was attached to the cars by means of a steel cable which was carried around a block with several sheaves located at the top of the incline, and also on the balance weight car, so as to multiply the travel of the cable. From the counterweight the cable was carried through a conduit underneath the roadway and up between the two tracks, passing around a fixed sheave to change the direction of the motion. It terminated in a forged eye, to which was attached a few links of chain. Bolted to the ties was an anchor bar provided with a hole, through which the cable passed freely. When not attached to the car, the cable eye was drawn against the anchor bar by the counterweight. At the lower end of the grade was located another anchorage, to which was attached a short length of chain.

The operation of the weight was then as follows: The first car passing down the grade stopped at the top long enough for the conductor to attach the cable to the rear drawbar of the car. The weight of the counterbalance was such that it would be overbalanced by that of the car, and the latter would then pass down the grade at a moderate speed, without the use of a brake. At the foot of the hill the car was brought to a standstill, and the conductor fastened the stationary chain to the cable eye. The car was then backed up sufficiently to take the strain off the cable which was then unhooked, leaving the car to pass on its journey. The reverse of this action took place when another car reached the foot of the grade to make the ascent. Of course, the cars were obliged to run alternately in opposite directions, and some current was required to propel the cars up the grade, but not so much as if there had been no weight to assist the motors.

As the line was perfectly straight on the grade, no curve sheaves were necessary, supporting sheaves under the center of the track alone being required, and as the track was laid at the side of the highway, the operation of the cable did not interfere with the ordinary vehicular traffic on the highway. To show more clearly the arrangement used, the poles and overhead wires are omitted in the engraving.

A Large Heater Equipment.

A description of the new power station of the Philadelphia Traction Company, on Market Street near 33d Street, was published in our June issue. Reference was made to the heater equipment of the station, which will consist of four Goubert heaters. We present on this page an engraving showing the arrangement of the heaters, two of which are now in place, and two of which it is proposed to install later. The heaters are designed for high pressure, and are of 2,000 H. P. capacity each. Heaters of the same make are now in use in the power station of the Philadelphia Traction Company at the corner of 13th and Mount Vernon Streets, and have given excellent satisfaction.



VIEW OF FEEDWATER HEATERS AND PUMPS AT POWER STATION OF THE PHILADELPHIA TRACTION CO., ON MARKET STREET, NEAR 33D STREET, PHILADELPHIA.

The arrangement of heaters in the station under discussion is rather a novel one. The boilers are located in two rows, a space being left in the middle of the row for the heaters and pumps. The former will be placed in pits.

THE Market Street Railway Company, of San Francisco, expects to start its Mission Street line by electric power on September 1.

The Electric Plant of the New Haven Street Railway Company.

The New Haven Street Railway Company, which was the second in that city to commence operation electrically, is a recent corporation, consolidating the State Street Horse Railway, the Whitney Avenue Railway and the New Haven and the Morris Cove Railway. The Lake Saltonstall Railway has also just been made part of this company's system which now comprises twenty-three miles of completed track. The lines of the company lie largely within the city limits, and upon well populated streets, the terminus of the road being at the business center of the city, the Green. They are admirably located for traffic, serving exclusively the well known East Rock Park, Fort Hale Park, the old and new Government Lighthouses and Lighthouse Point, the suburban village of Morris Cove, Whitney Lake, etc.

The Lake Saltonstall line, which is the latest to be equipped, serves directly the suburban village of East Haven, and, in connection with a stage line, the village of Brandford which contained in 1890 a population of 4,600 A large summer population at Short Beach, Double Beach, Brandford Point, etc., also reaches the cars regularly by stage lines. As the towns of Brandford and East Haven have an aggregate all-the-year population of 8,000 or 9,000, and as this is practically doubled during the summer, it will be seen that this branch will do an exceptionally good out-of-town business.

The company is planning a number of very important extensions within the city, and by the end of the year will have from thirty-five to forty miles of track in operation.

The power station of this company is especially interesting, as it employs the rope drive method of operating the generators, being, we believe, the only example of an electric railway station east of Chicago using this method of transmitting power.

The plant was contracted for and furnished by the New England Engineering Company, and was personally supervised by the Hoadley Brothers, of Chicago, who were the engineers for the 52d Street power station of the Chicago City Railway Company, described elsewhere in this issue, and other stations. As will be seen by a comparison of the two plants, the method of drive is similar in many respects. The sectional view of the plant on the opposite page shows clearly the method in use at New Haven.

The power station, with the car house of the company, is located on the Quinnipiac River, and by means of a pier which has been built in the river, can receive its fuel directly from barges. A special form of foundation was required on account of the nature of the land on which the power house was erected. First, nearly 4,000 piles were driven, and upon these were placed heavy timbers, covered with three inch planking. This part of the foundation is so low that it is covered by water at high tide. Upon this, concrete foundations for the building, and piers for the engines and generators were built.

The car house and power station adjoin each other, and measure 80 × 250 ft. They are of brick, with an iron girder roof supplied by the Berlin Iron Bridge Company, of East Berlin, Conn. The car house is provided with an extensive repair shop, storage for over thirty cars, inspection pits, etc. The company has also other car houses at other points within the city.

The engine room is designed for a capacity of 2,300 H. P., consisting of two 650 H. P. and one 1,000 H. P., cross compound engines and three pairs of generators. The present installation is the two smaller units and two pairs of M. P., 200 General Electric generators.

The engines are of the improved Greene type with cylinder dimensions sixteen and thirty-six inches by forty-eight inches stroke. They are intended to run at 110 revolutions per minute, and at this speed will develop the full capacity under 130 lbs. steam pressure. They are fitted with E. K. Hill's valve gear, and assume somewhat the form of the well known Wheelock type, but several new features in the valve gear have been introduced by the builders, and it is said they are competent to regulate within one revolution when operating from zero load to the maximum power of the engine. They are able to take steam the full length of the stroke less the lap of the valve, which allows a minimum diameter of cylinder, thereby securing the greatest economy.

The flywheel, which was supplied by the Dodge Manufacturing Company, of Mishawaka, Wis., is nine feet in diameter, and is built in halves with two sets of arms and an iron sectional ring bolted together and lagged with well seasoned maple. It is grooved for twelve one and one eighth inch cotton ropes, the ropes of W. E. Hooper & Son, of Baltimore, Md., being used.

The course of the rope, commencing at the top of the flywheel on the side nearest the observer, is first around the generator pulley, over the idler, around the generator pulley again and then back around the flywheel, then from the generator pulley alternately around the flywheel and the idler, twelve times. From the last wrap on the flywheel it passes around the generator pulley, and then is carried through the floor around the lower deflection pulley mounted on timbers between the foundation piers, then around the sheave on the tension carriage, back under the upper deflection pulley to the first groove of

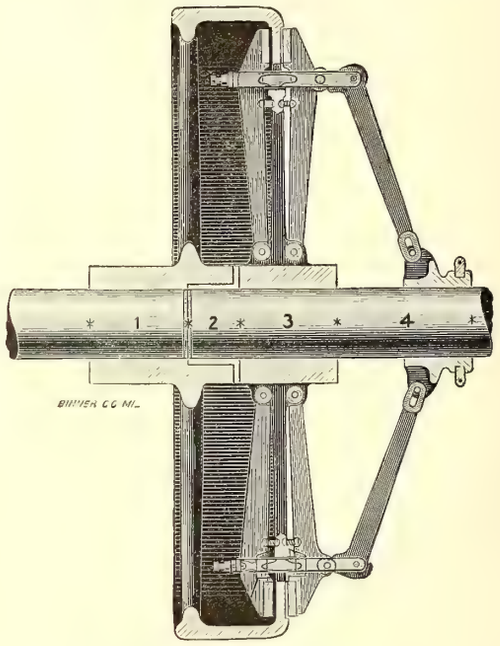


FIG 1.—GENERATOR FRICTION CLUTCH—NEW HAVEN STREET RAILWAY CO.

the idler. As will be seen, there are twice as many wraps around the generator pulley as around the flywheel, equalizing to a certain degree the difference in surface of contact which would otherwise exist between the two. The diameters of the sheaves and pulleys are as follows: the generator pulley is fifty-nine inches, the sheave on the tension carriage sixty-six inches, the idler pulley and the two deflecting sheaves, sixty inches each.

Connection between the generator pulley and generators is made by Filer & Stowell friction clutches. A section of the clutch which is giving good satisfaction is shown in Fig. 1. The friction surface is on the inwardly entending flange of a spoked wheel. Against this is made to bear the double set of friction arms, one set being pressed against the outside of the flange, the other being drawn against the inside of the flange upon the operation of the clutch.

The boiler room is designed for a capacity of 2,000 H. P., using four batteries of boilers, of 500 H. P. each. The boilers installed are of the Scotch compound tubular and other types, and were supplied by the Bigelow Company, of New Haven, Conn. The boilers belong to the progressive heating class, the first mentioned type containing really three boilers, through which the water passes while being converted to steam. One complete boiler comprises one shell, 60 ins. 6 ft., with ninety-six three inch tubes, sixteen feet long; above this is another shell 60 ins.

× 11 ft., having 114 three inch tubes eleven feet long, and above this is a steam superheater which is 60 ins. × 5 ft., and which contains 112 three inch tubes five feet long. The heat traverses the under surface of the larger shell, thence through the sixteen foot tubes to the upper water compartment. It passes through the tubes of this compartment and thence through the five foot tubes to the stack. The special claims made for these boilers are economy of fuel, dry steam and safety. The last boiler equipments has been of the ordinary return tubular type.

The operation of the plant has been carefully watched by electrical and mechanical engineers, owing to the novel features in use, especially that of rope driving for this class of work. The results have been very satisfactory both on account of the flexibility of the connection and the economy secured. During a test of the plant recently concluded and extending over a period of thirty days, an average of 4.1 tons of coal was used per day of eighteen hours, including the amount required in banking the fires at night. The number of cars run during this time was at no time less than sixteen, and on Saturdays, Sundays and holidays as many as twenty-six cars were run. As the period included July 4 and first ten days in July, the traffic was exceptionally large.

The roadbed is laid with fifty, fifty-six and seventy pound rails, and the cars are mostly from the works of J. M. Jones' Sons, of West Troy, N. Y., some of the Newburyport Car Manufacturing Company's cars being also used.

The officers of the company are: President, D. Correy; vice-president, C. A. Warren; secretary and treasurer, G. A. W. Dodge. Some of the officers and directors have been connected with it or its predecessors for over twenty years.

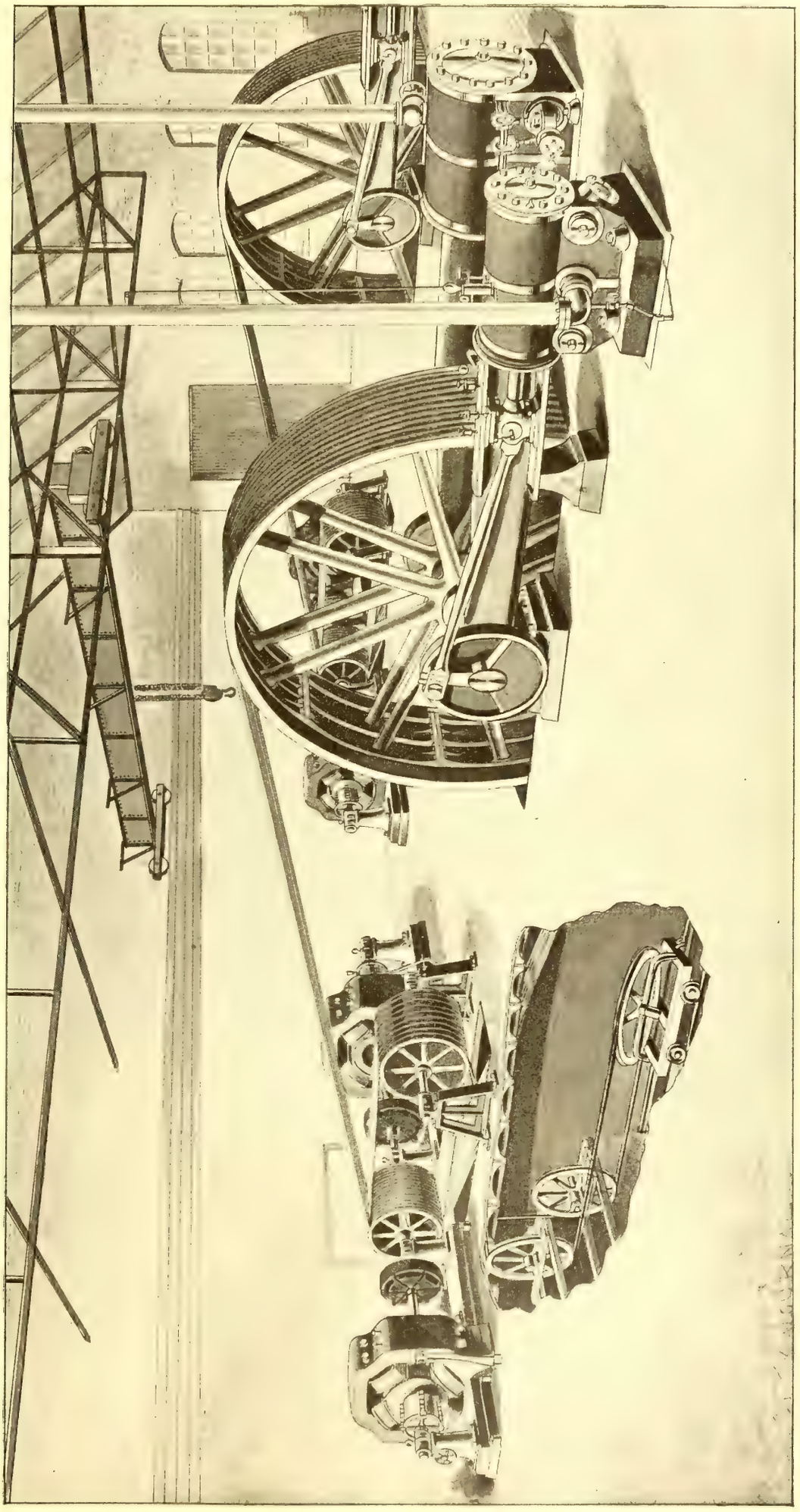


FIG. 2.—INTERIOR OF POWER STATION OF THE NEW HAVEN STREET RAILWAY CO., SHOWING METHOD OF ROPE DRIVING EMPLOYED.

The System of Cable Handling in Use by the Chicago City Railway Company.

By F. H. Fitch, C. E., Chicago City Ry. Co.

Not one person in fifty of the general public knows anything of the intricate working of the underground cable system. Most people see the gripman work his lever, but know nothing of the grip itself which is hidden underneath the car and in the tunnel. It is a daily occurrence, when a grip is exposed, to hear exclamations of surprise at its size, some people evidently expecting to see a machine about the size of a large man's hand.

But less still is known of the work done behind the scenes, of the anxiety of the chief engineer as he watches over a well worn and dangerous cable as a cat watches a mouse, of the nightly inspection for a single loose or broken wire, of the rapid yet systematic work of replacing an old by a new cable, which is done in the four hours between one o'clock and five o'clock in the morning. The handling of a single long piece of cable is by no means an easy task; hence a description of the methods and means used is not without interest.

The two methods of handling cable are in bights and reels. The former consists in coiling the cable upon the car or upon a floor, and its advantages are that the weight, while upon a car, can be more equally distributed, and in coiling, it is done with greater ease, since only a small portion of the cable is handled at a time. The other method, however, that of reeling the cable upon spools, possesses many advantages over the method of bighting, and if the proper appliances are arranged, reduces to a minimum the difficulties. Among the advantages of the reel system are compactness, less liability of the cable kinking as it passes into the street, and economy. The manner in which the difficulties of the reel system, the excessive weight and clumsiness, are overcome are best illustrated by a reference to, and description of the system used by the Chicago City Railway Company. Robt. J. Hill, chief engineer, is outspoken in favor of the reel system, and finds that he can reel all his cables, both old and new, to the best advantage, and with the least expense.

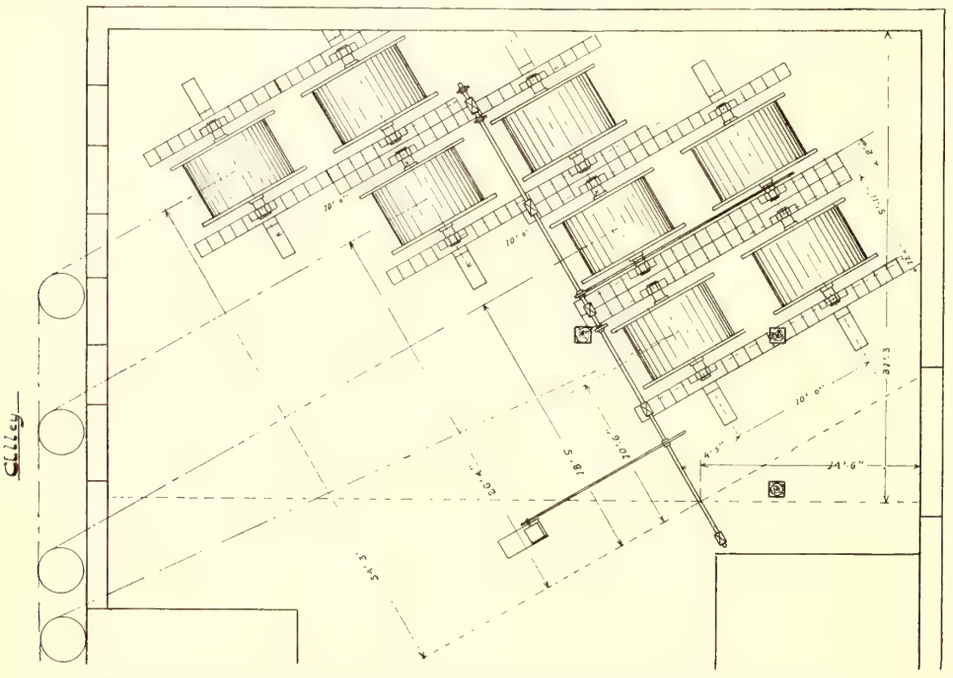


FIG. 1.—PLAN OF CABLE SPOOL ROOM—CHICAGO CITY RAILWAY CO.

There are in use on the lines of the Chicago City Railway Company ten cables, having a total length of 203,751 ft., and a total weight, when new, of 300 tons. It is necessary to handle every foot of this cable four times: From the cars to the place from which the cables are put into service; from this place into service; removing from service; and lastly, the final disposition to the junk dealers.

The average length of the cables used is about 20,000 ft., weighing thirty tons. To facilitate handling, as well as to distribute the weight upon the car on which it is shipped, the cable comes in two pieces, and each piece is reeled on two spools, making four spools in all, weighing about seven and one half tons each. One of the two spools upon which are reeled a half length of cable is just large enough for a quarter length, the other being capable of holding the full half length. From the cars to the power station each spool is placed on a separate truck, the intermediate length of cable, about 200 ft., being carried by men walking between the two wagons.

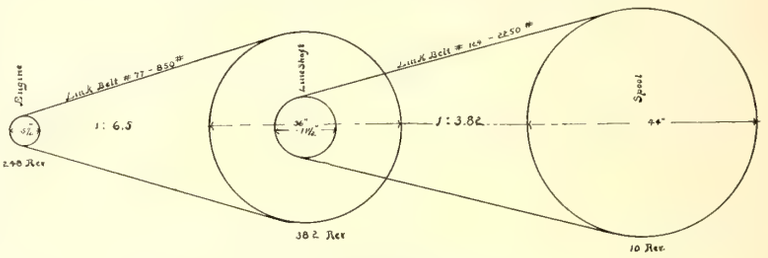


FIG. 2.—SECTION OF PULLEYS—SPOOL ROOM OF CHICAGO CITY RAILWAY CO.

The place in which the cables are mounted ready to be put into service, called the spool room, is shown in Fig. 1, which is a plan of the spool room at the 21st and State Streets power station. Four of the ten cables in use are here reeled and kept in readiness to replace a wornout predecessor. The manner of working is as follows: The larger of the two spools, upon which are wound one half of an entire cable, is mounted upon a six inch square shaft, the turned ends resting in the permanent bearings shown in the cut. The smaller spool is now mounted into temporary bearings, and its cable reeled off upon the larger spool previously mounted. It will be observed that to do this the two free ends of the cable are necessarily buried or next the spool cores.

The reeling from the smaller to the larger spool was formerly done by hand, twelve men being required to turn the larger spool near the finish, and even then it was slow work, one whole day being consumed for each half length of cable or actually reeling only 5,000 ft. By the present system the reeling is done by link belt from a line shaft, which is driven by a six horse power engine, which will be spoken of again. It may be well to give a few details of this work and the difficulties encountered, as a great deal in it was found to be experimental.

It is a very essential feature in reeling a cable to be careful in hammering it snugly and tightly into place. To accomplish this, the cable must wind at a uniform speed, which implies that the spool must turn fewer revolutions per minute as the coil becomes larger. This is done by reducing the speed of the engine. With a power arm of twenty-two inches, it is found that a spool holding 10,000 ft. of cable requires 2,250 lbs. stress to turn it. To hammer the cable well into place the spool should turn about ten revolutions per minute at the core and about four revolutions at the finish. Considering these points and that the engine used has a maximum speed of 250 revolutions per minute, the proportion of pulleys and number of link belt used are as shown in Fig. 2. The forty-four inch pulley attached to the spool shaft is a split pulley, and is moved from one shaft to another as required.

The engine used is perhaps the most interesting feature of all, and is shown in Fig. 3. It combines the features of a cable winding engine and a cable cutter, and was designed and constructed by E. A. Hovey, master mechanic of the company. The cutting machine and

engine are mounted upon a single pedestal, and the whole weighs 4,000 lbs. It is with ease taken from one power station to another, where it performs the double function of cable winding engine and cable cutter. The engine is a Westinghouse type, six horse power, having two cylinders. The growing tendency of junk dealers all over the country to refuse to handle old cable in a single piece, throws upon cable railway companies the necessity of cutting up their old cables into short lengths. However, even when the old cables may be marketed in one piece, it is found more profitable to cut them up, for a cable in ten foot lengths brings from $1.00 to $1.50 more per ton than a single piece cable. The Chicago City Railway Company, with its improved cutter, finds that the cost

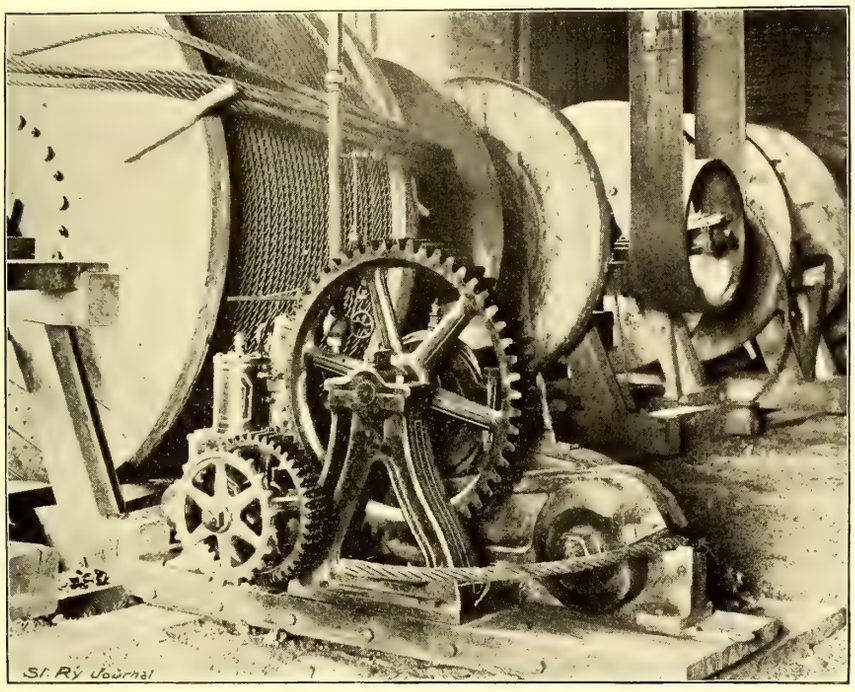


FIG. 3.—CABLE CUTTER AND WINDING ENGINE—CHICAGO CITY RAILWAY CO.

per ton of cutting up old cable is from forty-five cents to fifty cents per ton, so that in a very short space of time the machine will pay for itself.

Coal Consumption on the Chicago City Railway.

We present below some interesting data in detail upon the consumption and cost of coal per ton mile on the Chicago City Railway electric system for a period of three months ending November 30, 1893.

The total coal consumption was 3,185 tons or 6,370,000 lbs. at a total cost of $5,000.43. The total number of car miles run was 732,550.

The proportion of work performed by single motor cars was one-fifth, each weighing with load 17,005 lbs. The proportion of work performed by double motor cars was two-fifths, each weighing with load 39,940 lbs., and the proportion of work performed by box trailer was two-fifths, each weighing with load 23,048 lbs.

The average load of a car with passengers was therefore 17,005+39,940+23,048=79,993 lbs.; divided by 5 or 15,998 6 lbs., equal to 7.99 tons of 2,000 lbs. each.

The number of car miles (732,550), multiplied by 7.99 (the load in tons), equals 5,853,074.5 ton miles. The pounds of coal used (6,370,000), divided by the ton miles (5,853,074.5), equals 1.08 lbs. of coal per ton mile.

The cost of coal ($5,000.43), divided by pounds of coal (6,370,000) gives .000784 cent, the cost of one pound of coal. The pounds of coal per ton mile (1.08) multiplied by the cost of one pound of coal, .000784 cent, gives .000 846 cent, or the cost of coal per ton mile.

THE Philadelphia, Cheltenham & Willow Grove Electric Railway Company is the the title of a new company, which will build a line from Rising Sun to Jenkintown.

Practical Notes on Rope Driving—Part III.

BY M. E.

Weight and Speed of Ropes—Centrifugal Tension.—The weight of the rope employed for power transmission indirectly exercises an important influence upon the efficiency of the system at high speeds, owing to the centrifugal tension developed. Until within the last few years, this important effect has generally been ignored in planning rope transmissions, and, in some cases, with unfortunate results as to durability. It is not a little strange that the consideration which imposes a limit to the speed of rope wheels and belt pulleys, should have been totally ignored in the case of the ropes or belts which run upon them, and which, while so doing, are subjected to precisely similar influences.

The tension induced in a rope or belt running at a lineal speed of v feet per minute is

$$\frac{w\ v^2}{115200} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

w being the weight of one foot length of rope. This tension is quite additional to that which the transmission of power involves, and as it increases as the *square* of the velocity, it is easily seen that it will become a potent factor at high speeds. If, as hitherto assumed, we allow a given maximum working tension for a rope of given diameter, it will be evident that at high speeds the power transmitting capabilities of the rope will be much less than it might otherwise be considered, by reason of the need for correspondingly diminishing the "power" tension as the centrifugal tension increases. An example will better elucidate this point:

The weight of one foot length of well made manilla rope, one inch in diameter, is .32 lbs., and, at a velocity of 1,000 ft. per minute, the centrifugal tension would be $\frac{.32 \times 1{,}000{,}000}{115200} = 2.77$ lbs. If we allow a maximum working tension on this rope of, say, 160 lbs., the centrifugal tension represents less than 2 per cent. of the allowable tension, and its influence may therefore be disregarded. But at a speed of 6,600 ft. per minute, the centrifugal tension is $2.77 \times (6.6)^2 = 120$ lbs.; so that at this speed, 75 per cent. of the available tension is neutralized by the effect of centrifugal force, and if the maximum tension of 160 lbs. is, as assumed, not to be exceeded, the power transmitted, instead of being 6.6 times as great as that transmitted at 1,000 ft., will only be about $\frac{6.6}{4} = 1.65$ times that amount, thus showing the enormous loss of efficiency at high speeds.

The weight of the rope, although of much less *direct* importance in this connection than the speed, is nevertheless not to be left out of consideration, for from (3) it is seen that any reduction in the weight of the rope, while maintaining the same strength, would diminish the loss due to centrifugal tension in direct proportion. The actual weights of ropes differ somewhat, according to the construction adopted and material used, but for good

TABLE IV.

WEIGHT PER LINEAL FOOT OF TRANSMISSION ROPES.

Diam. in ins.	Weight in lbs.		Diam. in ins.	Weight in lbs.		Diam. in ins.	Weight in lbs.	
	Manilla	Cotton.		Manilla	Cotton.		Manilla	Cotton.
½	.08	.07	1	.32	.28	1½	.72	.66
⅝	.13	.11	1⅛	.40	.36	1⅝	.85	.74
¾	.18	.16	1¼	.50	.44	1¾	.98	.86
⅞	.24	.21	1⅜	.60	.56	2	1.28	1.12

manilla rope, the weight per foot may be taken at $0.32d^2$, d being the diameter in inches. As seen from Table IV, the weight of cotton rope is somewhat less, thus compensating for its slightly lower strength.

It will be understood from what has been said that it is important to fully appreciate the amount of centrifugal tension in a rope, in order to correctly estimate the amount of power it will transmit without exceeding the maximum working limit. Table V, which the writer has calculated for manilla rope of the weights given in Table IV, will be of service in this connection.

TABLE V.

CENTRIFUGAL TENSION IN MANILLA ROPES—POUNDS.

Velocity of Rope in ft. per min.	Nominal Diameter of Rope in Inches.											
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	2
1,000	0.7	1.1	1.5	2.1	2.7	3.4	4.3	5.1	6.2	7.2	8.3	11
1,500	1.5	2.4	3.4	4.7	6.2	7.6	9.7	11	13	16	18	25
2,000	2.7	4.3	6.1	8.2	11	13	17	20	24	28	33	44
2,500	4.3	6.7	9.6	13	17	21	27	32	38	45	52	69
3,000	6.2	9.7	13	18	24	30	39	45	55	64	74	100
3,500	8.4	13	19	25	34	42	53	63	75	89	102	136
4,000	11	17	24	33	44	54	69	82	98	116	133	177
4,500	14	22	31	42	55	69	87	103	125	146	168	223
5,000	17	27	39	52	69	86	109	129	156	183	210	275
5,500	21	33	47	63	83	104	132	156	189	221	254	332
6,000	24	39	56	75	99	125	157	188	225	257	303	396
6,500	39	45	65	88	116	145	183	217	261	307	353	462

As centrifugal tension is induced in both the tight and slack sides of the rope, it exercises a very complicated influence upon the rational determination of the horse power of ropes. The investigation becomes involved in the higher mathematics, and the resulting rules are too intricate and cumbersome to be of any practical utility. It becomes necessary, therefore, to employ some rule which, while taking full cognizance of the effect of centrifugal tension, will also be simple and easily applicable in practice. A good rule of this kind is

$$\text{H. P.} = \frac{(T_0 - C)\,V}{33000} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

in which H. P. is the horse power transmitted by one rope; V the velocity in feet per minute; T_0 the maximum working stress and C, the centrifugal tension, so that (T—C) is the *net* tension available for the transmission of power. We have previously taken the total maximum stress at $200d^2$ and if we allow 20 per cent. of this for slack side tension, we shall have $T_0 = 160\,d^2$, so that $\text{H. P.} = \frac{(160\,d^2 - C)\,V}{33{,}000}$. By this rule the writer has calculated Table VI, giving the horse power per rope transmitted at various speeds of from 2,000 to 6,500 ft. per minute. It will be seen from the table, that at a speed of about 4,400 ft. per minute, the power transmitted, under the conditions named, reaches its maximum. If T_0 is taken at a higher value or the weight of the rope reduced, for the same strength, the speed of the maximum efficiency will be higher than that given in the table and *vice versa*. As previously stated, this is not a mathematically correct method of taking centrifugal tension into account, but it is quite sufficiently accurate for all practical requirements. From the table it will be seen that at the lower speeds the power transmitted increases much more rapidly with an increase of speed than at the higher velocities. As the speed is increased beyond about 3,000 ft. per minute, however, the power transmitted increases much more slowly and between speeds of about 3,000 and 5,500 ft. per minute no great difference exists. At speeds above 5,500 ft. per minute, the power transmitted rapidly falls off, and at 6,500 ft. it is less than at 2,000 ft. under the particular conditions assumed.

Under these circumstances it will be apparent that the rope speed adopted may be varied within fairly wide limits to suit circumstances. The factors which usually decide the speed are the size of the rope, the number of

TABLE VI—HORSE POWER OF MANILLA ROPES.

Velocity of Rope. Feet per min.	Nominal Diameter of Rope in Inches.											
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	2
2,000	2.25	3.51	5.14	6.84	9.08	11.5	14.0	17.0	20.3	23.8	27.5	36.1
2,100	2.35	3.67	5.27	7.15	9.40	11.8	14.7	17.8	21.1	24.8	28.8	37.6
2,200	2.45	3.82	5.48	7.45	9.80	12.3	15.3	18.5	22.0	25.9	30.0	39.2
2,300	2.55	3.98	5.71	7.75	10.2	12.8	15.9	19.3	22.9	26.9	31.2	40.8
2,400	2.62	4.10	5.89	7.98	10.5	13.2	16.4	19.8	23.6	27.7	32.2	42.0
2,500	2.70	4.21	6.05	8.21	10.8	13.6	16.8	20.4	24.3	28.5	33.1	43.2
2,600	2.78	4.33	6.21	8.43	11.1	14.0	17.3	21.0	25.0	29.3	34.0	44.4
2,700	2.85	4.45	6.39	8.67	11.4	14.4	17.8	21.5	25.6	30.5	35.0	45.6
2,800	2.94	4.59	6.59	8.93	11.75	14.8	18.3	22.2	26.4	31.0	36.0	47.0
2,900	3.00	4.68	6.73	9.13	12.0	15.1	18.7	22.7	27.0	31.6	36.8	48.0
3,000	3.06	4.78	6.87	9.32	12.3	15.4	19.1	23.2	27.6	32.3	37.6	49.1
3,100	3.12	4.87	7.01	9.50	12.5	15.7	19.5	23.6	28.2	33.0	38.3	50.0
3,200	3.18	4.97	7.14	9.70	12.7	16.0	19.9	24.0	28.7	33.7	39.0	51.0
3,300	3.25	5.07	7.27	9.89	13.0	16.3	20.3	24.5	29.2	34.3	39.8	52.0
3,400	3.30	5.15	7.39	10.0	13.2	16.6	20.6	25.0	29.7	34.8	40.4	52.8
3,500	3.35	5.22	7.50	10.2	13.4	16.9	20.9	25.3	30.1	35.4	41.0	53.6
3,600	3.40	5.30	7.61	10.3	13.6	17.1	21.2	25.7	30.6	35.9	41.6	54.4
3,700	3.44	5.36	7.70	10.4	13.7	17.3	21.5	26.0	30.0	36.3	42.1	55.0
3,800	3.46	5.40	7.76	10.5	13.8	17.4	21.6	26.2	31.1	36.6	42.4	55.4
3,900	3.49	5.45	7.81	10.6	13.9	17.6	21.8	26.4	31.4	36.9	42.7	55.8
4,000	3.51	5.49	7.86	10.6	14.0	17.7	21.9	26.5	31.6	37.1	43.0	56.1
4,100	3.53	5.52	7.92	10.7	14.1	17.8	22.0	26.7	31.8	37.3	43.2	56.4
4,200	3.55	5.54	7.95	10.8	14.2	17.9	22.1	26.8	31.9	37.5	43.4	56.8
4,300	3.56	5.55	7.98	10.8	14.2	17.9	22.2	26.9	32.0	37.6	43.6	56.9
4,400	3.57	5.56	7.99	10.8	14.2	18.0	22.2	27.0	32.1	37.6	43.6	57.0
4,500	3.56	5.55	7.96	10.8	14.2	17.9	22.2	26.9	32.0	37.6	43.5	56.9
4,600	3.55	5.54	7.95	10.8	14.2	17.9	22.1	26.8	31.9	37.5	43.4	56.8
4,700	3.53	5.50	7.90	10.7	14.1	17.8	22.0	26.6	31.7	37.2	43.1	56.4
4,800	3.51	5.48	7.86	10.7	14.0	17.7	21.9	26.5	31.6	37.1	43.0	56.2
4,900	3.49	5.45	7.81	10.6	13.9	17.6	21.8	26.4	31.4	36.9	42.7	55.8
5,000	3.45	5.38	7.73	10.5	13.8	17.4	21.5	26.1	31.0	36.4	42.2	55.2
5,100	3.43	5.35	7.67	10.4	13.7	17.2	21.3	25.9	30.8	36.2	41.9	54.8
5,200	3.38	5.26	7.56	10.2	13.5	17.0	21.0	25.5	30.4	35.6	41.3	54.0
5,300	3.34	5.20	7.47	10.1	13.3	16.8	20.8	25.2	30.0	35.2	40.8	53.4
5,400	3.28	5.11	7.34	9.95	13.1	16.5	20.4	24.8	29.4	34.6	40.1	52.5
5,500	3.21	5.00	7.20	9.75	12.8	16.2	20.0	24.2	28.9	33.9	39.3	51.4
6,000	2.78	4.33	6.21	8.43	11.1	14.0	17.3	21.0	25.0	29.3	34.0	44.4
6,500	2.17	3.38	4.85	6.60	8.6	10.9	13.5	16.4	19.5	22.9	26.5	34.7

revolutions per minute and the diameter of the smaller pulley. If, for example, it is required to drive a dynamo at 450 revolutions per minute and to use one and a quarter inch ropes for the purpose, the diameter of the dynamo pulley, for satisfactory working, should not be less than thirty times the rope diameter or about thirty-six inches, presuming cotton rope is used. For manilla forty rope diameter should be the minimum pulley diameter employed. Taking a three foot pulley as above, we should have a rope speed of 4,240 ft. per minute, a very suitable speed as seen from the table. If, further, it is assumed that we are dealing with an unit of 200 H. P., ten one and a quarter inch ropes would fulfill every requirement and give very satisfactory results. If, on the other hand, it is proposed to use larger ropes—two inch for example—only four would be needed, if running at the same speed. But this would imply running two inch ropes over a three foot pulley, which means a rapid deterioration of the rope, owing to bending over a pulley very much too small in diameter. By the thirty rope diameter rule, a five foot dynamo pulley would be required, and thus would entail a rope speed of over 7,000 ft. per minute, at which speed the ropes would transmit less than one-half the required power unless the working stress was materially exceeded. The size and speed of the rope therefore depend directly upon the number of revolutions which the smaller pulley is required to make—at least this is so until the revolutions of the smaller pulley are under 250 per minute for manilla and 300 per minute for cotton. The largest sizes of rope advisable for any given number of revolutions of the small pulley are given in Table VII, a rope speed of about 5,000 ft. per minute being taken as the maximum allowable and the pulleys being taken at thirty times the rope diameter for cotton and forty times for manilla.

TABLE VII.

MAXIMUM ROPE DIAMETERS.

No. of revolutions of small pulley per min.	Largest diam. of rope advisable. Inches.		No. of revolutions of small pulley per min,	Largest diam. of rope advisable. Inches.	
	Manilla.	Cotton.		Manilla.	Cotton.
250	2	.....	625	¾	1
275	1¾	.....	650	¾	1
300	1⅝	2	675	¾	1
325	1½	2	700	⅝	⅞
350	1⅜	1¾	725	⅝	⅞
375	1¼	1⅝	750	⅝	⅞
400	1¼	1½	775	⅝	⅞
425	1⅛	1½	800	⅝	¾
450	1⅛	1⅜	825	⅝	¾
475	1	1⅜	850	⅝	¾
500	1	1¼	875	⅝	¾
525	1	1¼	900	½	⅝
550	⅞	1⅛	925	½	⅝
575	⅞	1⅛	950	½	⅝
600	¾	1	1,000	½	⅝

With a dynamo speeded sufficiently low to enable the larger ropes to be used, the most suitable size is determined by other considerations. In the independent rope transmission system—with which we are at present chiefly concerned—a larger number of small ropes entails the use of somewhat wider pulleys on both engine and dynamo, while there are more splices to make and probably a greater frictional loss, due to the differential driving effect, to which reference will be hereafter made. On the other hand, it is possible to use pulleys of smaller diameter, thus more than offsetting the cost of increasing the width. Moreover, should any one of the ropes fail, the increase of load upon the others will only be slight. In practice one and a quarter inch ropes are found to give good satisfaction for driving dynamos of moderate size when the conditions are favorable to their use, but one inch ropes are also largely used. For larger units one and a half to one and three-quarters inch ropes are more generally adopted, the latter being the largest size which it is advisable to use in any case. In mill driving practice at the present time, there is exhibited a noticeable tendency towards the use of smaller ropes, and one

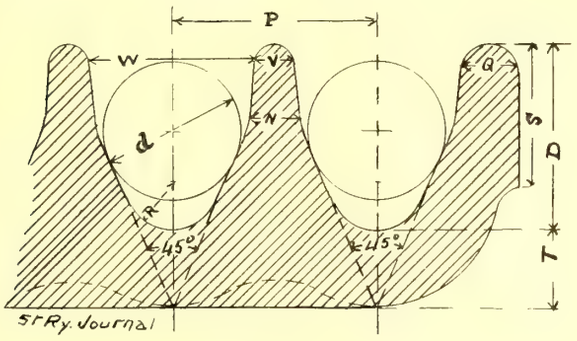


FIG. 1.

and five-eighths inch is now probably the most usual size adopted, while a decade ago two inch was most favored.

Pulley Diameter—The rules for the least pulley diameter given in the foregoing, viz., thirty rope diameters for cotton and forty rope diameters for manilla, cannot be disregarded without impairing the durability of the rope. If in any case the use of a smaller pulley becomes imperative, the load on the rope should be correspondingly reduced; the use of "hard," or tightly twisted rope should in this case be carefully avoided. As in belt driving, the slack side of the rope should, if possible, always be uppermost. With a fair length of drive the slack of of the rope will increase the arc of contact with both pulleys, thus augmenting the resistance to slipping, while necessitating less initial tension and its corresponding disadvantages. If the slack side is below, the reverse action takes place, each arc of contact being lessened and the risk of slipping correspondingly increased. For dynamo driving 10 per cent. should be deducted from the power of the ropes to allow for this effect.

Length of Drive—In mill driving no difficulty is usually experienced in obtaining an ample length of drive, but in the dynamo room economy of space is usually a much more important consideration. To ensure satisfactory results, the distance between the centers of the driving and driven shafts should not be less than one and a quarter times the sum of the diameters of the two pulleys. Thus for pulleys of twelve feet and four feet diameters, respectively, the distance between the shaft centers should not be less than twenty feet. This rule is a somewhat elastic one, but for all ordinary ratios of pulley diameters likely to occur in dynamo driving, it may be followed. As the difference in the diameters of the pulleys becomes less, the length of drive may be reduced if desired, but if the pulleys differ greatly in size a lesser length of drive than given by the rule should not be used unless the load on the ropes is correspondingly reduced.

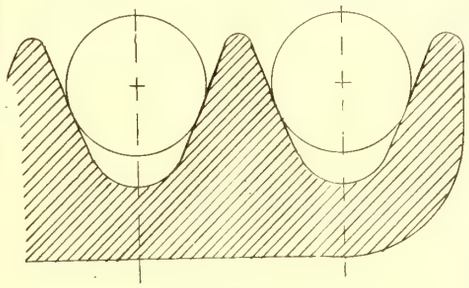


FIG 2.

Pulley Grooves.—With regard to the pitch and angle of the pulley grooves, practice differs to some extent. A groove angle of 45 degs. may, however, be relied upon to give good results, and is that most commonly employed. More obtuse angles have been tried, and they, no doubt, diminish the wear of the rope, owing to the consequent reduction of the wedging action, but this also implies loss of driving power, and a tendency for slipping to occur in the grooves, thus possibly doing more harm to the rope than would result from the employment of the more acute groove. Under otherwise similar conditions the power transmitted should be less with grooves with an angle of 60 degs., as sometimes advocated; for if the same power is transmitted it will be at the expense of increased back tension, strain on the bearings and fricitonal and other losses. With grooves so acute as 30 degs., on the other hand, the wedging of the rope into the groove, and consequently the power absorbed in releasing it is very much increased. With the smaller sizes of cotton rope, such as used for driving traveling cranes, this angle has frequently been used; but from the experience gained it is found that it considerably shortens the life of the rope. It is not to be recommended for dynamo driving, and for manilla rope it should certainly not be used.

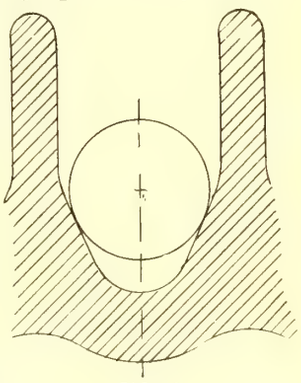


FIG. 3.

There is some difference in the pitch and also in the other proportions of pulley grooves adopted by various makers of rope driving plant, but the dimensions given in Table VIII, which have been calculated by formulæ established by the writer, may be taken as representative of the best leading practice.

To accurately turn a set of pulley grooves to the form shown in Fig. 1. is a somewhat costly process, and this has led to the use of plain or flangeless grooves, as shown in Fig. 2. The pitch and most of the other proportions used for Fig. 1, are applicable to this form of groove. The chief objection to this form is that the rope has a tendency to leave the groove if the speed is high and a rapid fluctuation of load occurs. Some makers go to the other extreme and adopt a groove such as is shown in Fig. 3. They are, however, now seldom met with; they are expensive in the first place, and experience has conclusively demonstrated that there is no risk of the rope leaving the pulley with the ordinary depth of groove, as in

Fig. 1. A liberal clearance should be allowed on each side of the pulleys—four or five rope diameters at least—in order that the ropes may be readily removed or replaced without being damaged.

TABLE VIII.

DIMENSIONS OF ROPE PULLEY GROOVES.

Diameter of Rope=d.	P	D	R	W	T	Q	V	S	N
in.	in.	in.	in.	in.	in.	in.	in.	in.	
½	⅞	¾	3/16	11/16	5/16	¼	3/16	½	
5/8	1 1/16	⅞	¼	⅞	5/16	5/16	3/16	5/8	
¾	1 3/16	1	9/32	15/16	⅜	⅜	¼	¾	
⅞	1 5/16	1 3/16	5/16	1 1/16	7/16	⅜	¼	⅞	
1	1½	1⅜	⅜	1 3/16	½	7/16	5/16	1	N = ¼ V
1⅛	1⅝	1½	7/16	1⅜	9/16	7/16	5/16	1⅛	
1¼	1 13/16	1 11/16	15/32	1 7/16	5/8	½	3/8	1¼	
1⅜	2	1⅞	½	1 9/16	11/16	9/16	7/16	1⅜	
1½	2⅛	2	9/16	1 11/16	¾	9/16	7/16	1½	
1⅝	2¼	2⅛	5/8	1 13/16	13/16	5/8	7/16	1 5/8	
1¾	2½	2⅜	21/32	2	⅞	5/8	½	1¾	
2	2¾	2⅝	¾	2 1/16	1	¾	9/16	2	

Small wheels, with few grooves, have usually a plain inner rim surface, as shown in Fig. 1, but with larger and wider wheels the rim may be corrugated, as indicated by the dotted lines in the figure. This plan adds somewhat to the first cost of the pulleys, but it frequently lessens the weight to a very material extent. It is of the utmost importance that all the grooves are of precisely the same diameter; that they are of exactly similar shape and carefully finished, so that the surface will not unnecessarily abrade the rope. The latter should never be allowed to touch the bottom of the groove; and finally, only the correct size of rope, for which the grooves are intended, should be used. It might be thought unnecessary to make this remark, but the writer has found on more than one occasion trouble arising from ropes being used in grooves which were intended for smaller sizes.

(*To be Continued.*)

Meeting of the Tramways Institute of Great Britain and Ireland.

A meeting of the Tramways Institute of Great Britain and Ireland was held at Holborn Restaurant, High Holborn, London, on July 5, for the election of officers and other business. The meeting was well attended, and Mr. Carruthers-Wain, the former president, was re-elected to that office. J. G. B. Elliot, secretary for the last year, was also re-elected. The annual dinner of the Institute was held at Holborn Restaurant at 7 P. M., and on July, 6, a visit was made to the Croydon tramways to inspect the Lührig gas motor.

Tho principal paper was read by T. Arnull, C. E., of the Birmingham tramways, and was on "Permanent Way Repairs." It was in part as follows:

Tramway Permanent Way.

By T. Arnull, Assoc. M. I. C. E.

It has been just two years ago since I had the honor of reading a paper on this subject before the Institute. In that paper* was given some account of the three varieties of rail that had been used on the Birmingham tramways, and of the effect of wear and tear upon them. The present short paper may be considered as a continuation of the former one, its object being principally to deal with a few of the points too lightly passed over on previous occasions.

Discussion of this subject naturally divides itself into a consideration of the rails on the one hand, and, on the other, a consideration of the joints. As to the rails, I exhibited several sections that had been taken from worn rails, showing the effects of wear and tear upon them; the conclusion suggested was that a rail was worn out and required replacing on a straight line of tramway after the passage over it of about 750,000 steam cars. After two years' further experience in the matter I am inclined to think this number rather too high, and that the rails should be renewed after a traffic of about 700,000 cars. No hard and fast line can be drawn as the rails vary in hardness. If the rails are on a curve the wear is, of course, greater, and proportionately in some way to the degree of curvature. On a curve of 40 degs. radius the rail has often to be renewed before it has carried the traffic of 250,000 cars. On the sharp curves we also have a rapid wearing away of the sides of the groove, which, of course, reduces in some degree the upper surface available for withstanding the wear.

Another influential factor in the life of a rail is the state of the road in which it is laid. If the road has macadamized margins there will always be a supply of grinding material in the shape of dust for spreading over the surface of the rail; in dry, dusty weather this supply will be increased, and the destruction of the rails correspondingly assisted; where the road is paved all across and the dust reduced to a minimum, we have these conditions at their best. I know of a case now near Birmingham where the granite margin to the tramway is only seven inches wide; the line has been in use about nine and a half years and has had over it about 300,000 cars, and the outer rails are quite worn out; the inner rails are in a much better condition because being further from the macadam margin they have kept cleaner. Inside the city boundary the granite margin has always been twenty-five inches wide, and a couple of years ago the street was paved all across. I expect the effect of this to be that we shall be able to get a life of 500,000 or 600,000 cars out of the rails, though they came from the same works and were laid at the same time as the rails which have been worn out by 300,000 cars.

There is a rather awkward question arises here, viz., When is a rail *worn out?* A rail has two functions to perform: The one is to carry the tram cars in the same way as a railway rail carries its traffic; the other is to form part of the surface of a road made for ordinary vehicles. In many cases the trouble does not arise from the wearing away of the tram of the rail, but from the part that does *not* wear away. All the danger arises from the projecting flange of the groove. On a horse line this trouble does not arise, since the ordinary traffic (and the effects of corrosion perhaps assisting) causes the projecting flange to wear away about as fast as the head which carries the load. On a steam tramway the case is different, and on tramways where the excessive traffic of the Birmingham lines has to be contended with the case is altogether different. Here the wear and tear on the head is so rapid that the corrosion has no chance, and the number of cars is so great that the ordinary traffic is in a great degree driven off the lines, so that this also has no chance to wear down the flange and assist in keeping it level with the top of the rail.

It is facts like these which bring into prominent relief the enormous advantages we should have in Birmingham by the adoption of a rail with a central groove, such as the Liverpool rail. Twelve years or so ago, when the Birmingham corporation was going to commence the construction of an extensive system of tramways, there was a desperate attempt made to induce it to adopt this rail; the Board of Trade held an enquiry at the Council House, but the corporation had had enough of compound rails, and insisted upon using the girder section, shown in Fig. 1, in spite of the advantages which the central groove offered. Subsequent experience has fully justified the decision

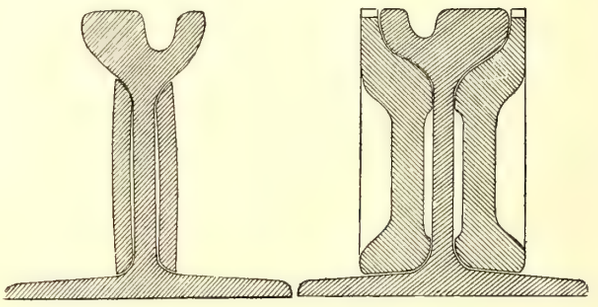


FIG. 1. FIG. 2.

then arrived at, seeing that the central groove then meant a compound rail, which compound rail was certainly unsuitable for the steam traction that was going to be used on the tramways. I know of but one case where the Liverpool rail was used on steam tramways, and that was the line from Dudley to Wolverhampton. Looking at the question solely from the point of view of the public interests, I am strongly of opinion that the girder rail, similar to that now in use in Birmingham, but with a central groove, is the only form of rail which is suitable for use on a steam tramway in a public street.

To turn now to the question of joints, it may be remembered that in my former paper I described two or three forms of joints, of which trial had been made. The original form, as shown in Fig. 1, was painfully wanting in all elements of permanence. Assisted by a soleplate it was vastly improved, but still a long way from perfection. I also described a form of cast iron fishplates (Fig. 2), so designed as to largely increase the area available for wear on the top and bottom of the plates. At the date of that paper they had had over them about 250,000 cars, and were still in a fairly satisfactory condition; when the traffic had reached about 500,000 cars, however, they began to get very troublesome; their tops, which were brought up level with the surface of the rail, did not wear down with it, so that in passing, the load of an engine was often brought directly to bear upon them, and some of them were broken. The general conclusion arrived at was that they formed a very good joint, and, with a soleplate, the best we had ever tried. They were, however, expensive in first cost, and did not last as long as the rail, and were therefore unsatisfactory. An obvious improvement was before us, either to make them of cast steel, or of malleable cast iron, but this would have largely increased the cost, and so the suggested improvements were not adopted. Their excessive rigidity was another objection, we could not bend them on a curve, and special curved castings meant more expense and trouble than could have been undertaken.

It is, of course, common knowledge to all using girder rails, that the joint always works loose. Now, if the joint in a rail were a permanently supported point, it is not easy to see how the tendency for it

*Published in the Street Railway Journal for August, 1892.

to work loose can arise. Since it *does* work loose, it is quite certain that if it be properly supported in the first instance, it does not remain so. If it is not supported it then has to act in some sort of a way under the passing traffic as a girder, the bearing places of which are irregular and shifting points at unknown distances from the actual joint. The problem awaiting solution is, therefore, altogether different from that of designing a joint in an ordinary girder. It differs from an ordinary girder in many ways. Its points of support, besides being irregular and shifting, will not in general be symmetrically arranged; its actual bearing points being perhaps usually on different sides of the flange on opposite sides of the joint. The consequence of this is important; the passing loads, besides producing a bending action, cause also a twisting or rocking action, which perhaps has the most powerful influence in pulling the joint to pieces.

It may be, therefore, safely concluded that no form of joint is likely to give permanent satisfaction unless these various disintegrating actions are properly resisted; the twisting and racking tendency as well as the bending. The most hopeful joint I have yet seen is one having the fishplates two feet long and seven-eighths of an inch thick, with a thinner horizontal projection to clip the bottom flange of the rail; underneath is a sole plate half an inch thick. There are, of course, six bolts through the web of the rail and four on each side through the horizontal flanges of the rail, and through both sole plate and horizontal flanges of the fishplates also. We only commenced laying these joints at the beginning of the present year, and it is yet too soon to report upon their merits. Considering our section of rail, however, it appears to be a joint well adapted to withstand vertical flexure, and also that twisting, racking action which is caused by unsymmetrical bearing joints, and which I believe to be even more influential in pulling a joint to pieces than the plain bending action.

Other papers read were "Ardagh's Prismatic Wood Paving Block for Roadways," by John Millington; "Patent Food for Horses," by F. Stiel; "Shoeing and the Proper Treatment of the Horse's Feet," by Charles Sheather, F. R. C. V. S.; "The Soulerin Brake," by Lugien Serrailier; "Ball Bearing for Tram Cars without Lubricants," by F. Purdon, C. E.

Statistics of Railways in the United States.

The Sixth Statistical Report of the Interstate Commerce Commission has just been submitted, and contains the following facts:

The total mileage of railways in the United States on June 30, 1893, was 176,461.07, being an increase during the year of 4,897.55 miles. The corresponding increase during the previous year was 3,160.78, from which it appears that there was some revival in railway construction during the year covered by the report. The tendency toward some form of consolidation during the year has been quite marked. A classification of railways according to length of line operated shows that there are 42 companies in the United States having a mileage of 98,385.54, being equal to 55.78 per cent. of the total mileage of the country. Twenty-six other roads control 11.20 per cent of total mileage, from which it appears that 68 companies controlled 76.98 per cent of the total railway mileage. The total number of employes in the service of railways on June 30, 1893, was 873,602, being an increase of 52,187.

The aggregate of property properly classified as railway capital was on June 30, 1893, $10,506,235,410, equal to $63,421 per mile of line. The amount of stock outstanding was $4,668,935,418, of which $3,982,009,602 was common stock, and $686.925,816 preferred. The amount of stock paying no dividends during the year was $2,859,334,572, being 61.24 per cent. of the total stock outstanding. Of stocks paying dividends, 5.25 per cent. of the aggregate stock paid from 4 to 5 per cent., 11.62 per cent. paid from 5 to 6 per cent., 5.24 per cent. paid from 6 to 7 per cent., and 5.33 per cent. paid from 7 to 8 per cent. The total dividends paid was $100,929,885. The amount of mortgage bonds paying no interest was $492,276,999, or 10.93 per cent. of the total of mortgage bonds, and the amount of income bonds paying no interest was $204,864,269, or 82.56 per cent. of the total of income bonds.

The total number of passengers carried during the year ending June 30, 1893, was 593,560,612. Passenger mileage during the same year was 14,229,101,084. The average journey per passenger was 23.97 miles. The number of tons of freight reported by the railways for the year was 745,119,482. Ton mileage was 93,588,111,833. The average number of tons in a train was 183.97, and the average haul per ton for the entire country was 125.60 miles. Passenger train mileage was 375,618,770, and freight train mileage 508,719,506.

The number of railway employes killed during the year was 2,727, and injured 31,729. The number of passengers killed during the year was 299, and injured 3,229. One passenger was killed for each 1,985,153 passengers carried, or for each 47,588,966 passenger miles accomplished, and one passenger injured for each 183,822 passengers carried, or for each 4,406,659 passenger miles accomplished.

THERE were filed, at Trenton, N. J., on July 13, articles of incorporation of a large electric railway corporation, having for its object the connection of New York and New Jersey by electric railways. The capital stock is $10,000,000. This enterprise is to be managed by two corporations, the Central Jersey Traction Company, with a capital of $500,000, and headquarters at No. 2 Wall Street, New York, and the New York & Philadelphia Traction Company, with a capital of $10,000,000, and general offices at Trenton, N. J. The officers and directors of the first named company are: President, Frank A. McGowan; vice-president, ex-Sheriff E. W Hime, of Newark; secretary, J. H. Baldwin, of Newark; treasurer, J. H. Darrall, of Trenton.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Bursting Flywheels.

EDITORS STREET RAILWAY JOURNAL:

The bursting of large flywheels in electric tramway power stations, is becoming frequent enough to deserve more than a passing thought from the officials of these companies. Those who have been through an unpleasant and expensive experience, such as the flywheel accident at Ben Venue power station, Pittsburgh, on April 19 last, and described in your last issue, would probably prefer taking chances with having the building struck by lightning or by a cyclone, the next time their "turn" comes; because they would have knowledge of an approaching storm some seconds, if not minutes, before the "performance" begins, and they could possibly take some precautions.

In most all, if not all such cases, the history of the circumstances attending the accident shows that the engine received an overload or was relieved of its load, more or less suddenly and unexpectedly, from short circuit or an open circuit. If it is a short circuit, the dynamo pulley or the belt or both give way and do some damage. The engine starts to race, and the flywheel "does the rest." If it is an open circuit, the racing is apt to begin then and there, and the flywheel then does it all. It is said that lightning will not strike twice in the same place; but this accident may occur any number of times in the same station. The question is, as the station is or can be protected against lightning can it not also be protected against something equally bad, if not worse? I think it can.

In various articles which I have contributed to this journal, and also in my paper read at Milwaukee, last October, on the use of storage batteries in connection with tramway power stations, I have tried to point out that their use would increase the efficiency of the power plant, and reduce the cost of power production, by equalizing and steadying the load, or in other words by making it practically constant independently of the rate of consumption on the trolley line.

I now wish to point out that the storage battery is the best possible preventive of flywheel accidents. With such an arrangement racing is impossible. The 450 H. P. engine at the Ben Venue station would then have developed 450 H. P. and no more, even though the short circuit raised the current to a load of 1,000 H. P. or *more*, and it would probably not have reached 500 H. P. even if the circuit had been suddenly broken, and the engine had started to "race," for the battery would have absorbed the surplus the instant the outside load began to diminish. There would have been no occasion to strain the dynamo pulley, or to break the belt; *and the accident would not have happened.*

The great obstacle and objection that storage batteries have had to contend with has been their heavy depreciation. But the cost of the "depreciation" which a bursting flywheel can cause inside of a few seconds will pay for the depreciation of the storage battery for several years. It would sometimes pay for a new battery besides.

The storage battery, costly as it may seem to be, is the best and cheapest preventive known, in the present state of the art, not only for bursting flywheels, but for "breakdowns" generally, in tramway power stations. It will be recognized and adopted as such in due time. However, it will probably take a few more flywheel accidents and dozens of "breakdowns" to make the tramway engineers realize that this is so.

C. O. MAILLOUX.

THE Union Depot Railway Company, of St. Louis, has just completed the construction of ten miles of new track, the entire construction of which occupied but six weeks. This is a remarkable record.

Established 1884.

THE STREET RAILWAY JOURNAL

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H. W. Pool, Advertising Department. H. W. Blake, Associate Editor.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

The Outlook for a Large Attendance from the South at the Atlanta Convention is very flattering. We have the personal assurance from the representatives of all the street railways except two that we have visited in Southern cities, that their roads will be represented at the convention. The trip to the convention, from present indications, will be an enjoyable one. As announced elsewhere in our columns, arrangements have been made to run a special train from New York City to Atlanta for the convenience and comfort of the Northern delegates who desire to avail themselves of its advantages. The trip as planned will be through the finest scenery in the South as well as through the most historic and prosperous sections of the Southern country. This arrangement will be appreciated by those who intend to be present at the convention, many of whom are already planning for a pleasant October trip.

"I Always Get Valuable Suggestions when I talk with you," said one of the most progressive superintendents recently to another equally progressive, whom he was entertaining. "And I was just thinking the same of you," said his guest. As we have often said, there is no way of adding to one's stock of practical information about his particular calling so efficient as personal intercourse with others who are working along the same lines. He becomes the best superintendent who visits the street railways of other cities or entertains the representatives of other lines who visit him. Next to a personal visit of this kind, the convention of the American Street Railway Association offers the best opportunity for a personal exchange of views on street railway subjects, and any person who attends the Atlanta convention may be absolutely sure that he will gain valuable suggestions from his conversation with other delegates, as well as from the proceedings.

The Question of Fire Insurance is an important one in street railway practice. With the general introduction of electric lighting from central power stations, the subject of electrical risks was carefully considered by the leading fire insurance companies, most of whom were disposed to take a liberal view of the matter. As a result many of the early lighting and street railway power stations were insured at a comparatively low figure. During the last few years, however, and especially during the last year, conditions have changed materially. Several disastrous fires, which have occurred, have been made the excuse for the adoption of an entirely different policy in respect to electrical stations and electric railway property generally. Rates have been arbitrarily raised in all sections of the country, and on all classes of railway buildings and property until now they have reached an almost prohibitive price. The builders of well constructed stations have been obliged to suffer for the faults of some of the early builders, and at present the most carefully built and designed plants seem to carry no recommendation to the underwriters for their safety against fire. A case to the point, of which there are many, is that of a street railway company in one of the central Western cities which has, besides a well constructed station, its own water supply and engineers and firemen on duty every hour of the twenty-four, with steam up to run the pumps should it be necessary. Notwithstanding these facts and that insurance has been carried for many years without loss, the rate on this station has just been doubled without evidence of any special reason. It would seem as if there were sufficient valuable property belonging to street railway companies in all sections of the country, to warrant some insurance company in making a specialty of taking such risks. If not there should certainly be some concerted action on the part of the railway companies, looking toward some organization which should protect them for a reasonable figure against possible loss by fire.

The Great Railroad Strike, into which at one time it seemed as if the street railway employes in Chicago would be drawn, is over, but it has left its lessons. These, if learned and acted upon, will be worth more to this country than the entire loss and damage to business occasioned by the strike, vast though it has been, and amounting as it has to millions of dollars. The strike has shown that transportation has become an integral part of our social and economic system, and that any serious interference with its free exercise would soon have the effect of producing business chaos. Transportation, both urban and interurban, has become in our present complex social order almost, if not quite as much of a necessity to individuals as food, clothing or the maintenance of peace and order by the process of law. One hundred years ago the cessation for a few days of communication between New York and Boston, or the withdrawal from service of the public conveyances within the limits of a city like New York would not have occasioned much inconvenience. To-day, the stoppage of all surface and elevated methods of transit in any large city would paralyze business. In other words, such quasi-public functions as are exercised by our street railway companies or steam railway companies, and upon the proper exercise of

which the prosperity of such a large proportion of our community depends, should not be dependent upon the action of irresponsible individuals. That there are or are not differences of opinion as to details of operation between the owners and employes of such enterprises, or the amount of wages paid to secure their continuance, concerns the public only in a very indirect way, and if any employe has been wronged, the law courts offer means of satisfaction. But for either owner or employes to attempt to coerce the other by stopping traffic, and thus inflict greater loss on others who are in no way connected with the dispute, is like mutiny at sea by which the safety of passengers is imperiled, or a strike of the police force of a city, through which protection to lives and property would be withdrawn. Any limitation of the privilege of employes to stop work at their option may seem to some inconsistent with the American idea of individual liberty, but it is a question whether, on the contrary, the liberty of others, *i. e.*, their privilege to use certain created avenues of communication, be not more imperiled. We are familiar with the extension of the right of enforced obedience under certain conditions, from military life to the field of private enterprise as on shipboard. And so long as under present social conditions it should seem desirable to continue the use of private for municipal or governmental direction in the transportation business, it is a question whether some similar safeguard should not be adopted to insure its faithful execution.

Franchise Valuations are subjects which seem to be foremost in the minds of mayors and other officials in most of our large cities at the present time, especially where arrangements are being made for equipping the remaining horse car lines for mechanical traction or for making extensions to existing lines. If it is right and desirable that street railway companies should pay into a city treasury certain sums as compensation for the use of streets, or for the supposed value of a franchise, then such action on the part of city officials as will defend the rights of the city and produce a revenue from this source is to be commended in every quarter, and if it is right in one city, it is right in all, and a standard of taxation for this purpose should be established in every locality. If the practice is wrong and unjust, it is wrong everywhere, and a united effort should be made in every quarter to have the injustice righted. It is held by street railway companies, and justly we think, that the service rendered by an operating company is in all cases sufficient compensation for the use of streets, and that no money returns should be demanded other than the ordinary real estate taxes, and possibly a small car license, the same as may be imposed on other vehicles employed in passenger transportation, or it may not be unreasonable to require that an operating company keep the streets between the tracks and rails in repair. But beyond this limit, there can be no justifiable reasons for demanding greater compensation, and if it is required, it will work to the detriment of the service and to the injury of the public, who are supposed to be benefited by the revenue. In certain cases, it will doubtless benefit officials or political parties, but this is the only class that can possibly be a gainer. An argument in favor of taxing street railway corporations is derived from the fact that street railways, after being operated for a period of years, sometimes change hands, and the original owners receive what is claimed to be a very large sum above the first cost of the plant, or for what may be termed its earning power. In cases of this kind, the city can have no more right to claim a portion of such increased valuation than it could for a portion received for the sale of a valuable corner lot, which formerly may have been the property of the city. When the lot was sold, the city doubtless received whatever it was worth, and if it was bought as a speculation by the holder, he is clearly entitled to all the increase over the original cost. The same is true of street railway franchises. New cities are frequently anxious to have street railways established, and offer very liberal inducements for capital to undertake their construction and operation. Property holders not infrequently pay a bonus to the operating company to induce the building of a line along certain streets. The same thing may be true of suburban districts in older cities. The corporation undertaking the construction of a line takes its chances as to the growth or decadence of the city. If a city should deteriorate, the authorities would never think of paying anything to the contracting companies, no matter how much may have been lost, neither does it feel obliged to help the company, though it may struggle for years to get earning power; and clearly the city has no more claim on the increased valuation of the line than it could have upon the increased valuation of private property. As a general thing the money received for the sale of a street railway by the individual owners is expended in the city in other business lines, either in the erection of business blocks, dwellings, or in manufacturing or business enterprises, so that really the city does derive benefit from the sale and in a more direct way than if certain amounts were paid annually into the city treasury, and were disbursed by the representatives of political parties. A case in point is that of a large city where the question of granting an extension of franchise, and the introduction of electric traction were being considered. The mayor insisted upon the insertion of burdensome conditions in the franchise which the company refused to accept; and in a personal appeal made to him by the representatives of the company, he stated that he did not care a blank whether the city received any returns for the franchise or not, but that he was working in the interests of his party, which required a certain amount of money, and that he should insist upon the conditions.

* * * *

Another reason given for placing a price upon a franchise grows out of the fact that competing companies in asking for franchises, offer to pay a certain sum on the gross receipts, or a stated sum in case they can secure the franchise. This is often done by persons with the hope of inducing their competitors to buy out the franchise after it is obtained, under fear of ruinous competition to both, or with the expectation of floating the securities that may be issued on the new concessions, and then getting out without any expectation that the road can ever be operated with any financial success. Or the bidders may agree to the conditions with the hope of some way avoiding the payment of the amounts named in the franchise. There are doubtless lines operating in certain cities which enjoy a liberal patronage, and which could well afford to pay a portion of their receipts into the city treasury, but such lines are usually a part of an extensive system which, as a whole, is operated at a loss or with a very limited income, and where the receipts of the favored line must apply towards the expense of oper-

ating the other lines. A case in point is that of one of the largest, and what is considered as one of the best paying street railway propositions in the country, in which twenty-nine separate lines are operated. Four of these pay a good return all the year. Fourteen of them pay expenses only during six months of the year. Three or four pay expenses for nine months in the year. The others are operated at a loss during the entire year, and we know from personal observation that the securities of the company and the dividends are kept up by the practice of the most rigid economy in all the departments.

* * * *

It is a recognized fact, by all those who have given the subject careful thought and are unbiased in their opinions, that the interests of the local authorities, the patrons of a street railway line, and the managers are one, and that any undue advantage taken by one class against another results in a direct injury to each of the others. If a tax is demanded, then the operating company must necessarily economize in some way to meet it. The wages of employes must be reduced, and kept at a minimum. What may be termed the luxuries of traffic cannot be provided, for the sum that would go to giving a gilt edged service would be dissipated in other directions. Less expensive and luxurious cars will necessarily be provided, a less number of cars employed, and it will be impossible to keep the equipment up to a healthy and first class condition. Even if expenses can be met, and a small dividend rendered on the investment, there will not usually be sufficient net income to provide a sinking fund with which to renew the track and equipments when worn out. Again, burdensome conditions are things that tend to render the securities uncertain, prevent the investment of capital in this particular industry, and work to the great injury of the business at large. Unfair treatment of capital always reacts upon the section where it is practised. A feeling of distrust once awakened, such investments, not only in railway, but other lines, as can be withdrawn will be transferred to other points, and it will be very difficult to attract new investors.

* * * *

On the other hand, particularly in a growing city, everything should be done to render street railway securities a favorite investment for capitalists. They should be issued for a long period, and not subject to depreciation by unfair or unjust legislation. Vast amounts of property, many millions, have been invested in this industry under the inducements of liberal franchises, with almost equally large investments in manufacturing establishments (car works, for instance), and in many and various interests connected with and dependent on the street railway business, and it cannot be expected that investors will willingly consent to any measures destructive or threatening to such investments. The duty of city officials at the present time would seem to be to preserve, not to destroy this comparatively young industry. They should allow it to maintain the position it has assumed, and encourage its development. The credulity of the public has been put to its extreme capacity of false impression relative to its conduct in this particular, but if the benefits which a street railway confers upon a city were carefully considered by those who are clamoring for excessive taxation, they would discover that they could not bestow upon this industry too great a degree of protection. Street railways give increased value to real estate bordering the routes, and especially to suburban property. This increased valuation results in an increased tax assessment, so that the city receives, because of the street railway, a very large increase from tax returns, while the individual owners of property are enriched to an amount beyond estimate. In fact, a large city can only exist in this country because of street railways, as they have a very decided influence on the social conditions of the people. Because of rapid transit facilities, wage earners and people of moderate means are able to own their own homes, or to obtain cheap rent in the outlying districts, where they can live under healthful conditions. The street railways prevent the Continental practice of people herding together in cramped tenements, where they are subject to unwholesome physical and moral conditions, owing to the vitiating influence of city air and life, so that the influence of the street railway as a factor in the social and moral conditions of the people cannot be estimated. The business gives employment, with good wages, to a large number of people embraced in the class of unskilled laborers, and furnishes cheap, safe and rapid communication for all parties between all sections of a city. The fear on the part of city officials that unless they exercise strict police authority over street railway companies, the service will be inferior, is not justified by experience. Street railway managers generally agree that in order to induce traffic they must provide rapid and safe service, and their cars must be reasonably clean, and their employes polite and attentive; in other words, that they must do everything to induce patronage, and this can only be secured by catering to the demands and convenience of the traveling public.

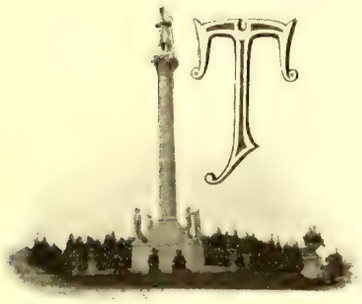
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The saving in operating expenses by the introduction of mechanical traction over that of animal power is not as large as people generally suppose, but mechanical traction is a necessity of modern life, and notwithstanding the large increase in the cost of first equipment and in operating expenses, it is demanded and must be provided. The history of many roads shows that the equipment, including roadbed and rolling stock and motors has failed much quicker than was supposed, requiring new equipments which have cost large sums, and in the case of electric traction at least no one can yet predict what the life of a plant may be, so that in no case can an operating company feel justified in offering to pay the assessments noted above; for in addition to the wear and tear of the service the best managed roads are subject to accidents and damage by fire or flood, and sometimes by the lawless acts of strikers. Provision must in all cases be made for settling accident cases, and since in the present state of the jury system of our country street railway corporations seldom get justice in the matter of settling accident cases, it is not safe to operate without a large fund to meet such demands. In any event the managers of a street railway must first protect the moneyed investors, and if there is to be extra economy in any direction it will, as noted above, be in the reduction of wages or in directions that will work to the injury of the patrons, so that we are of the opinion that if the people of the city would study carefully the street railway business from the operator's standpoint, and inform themselves regarding its dangers and difficulties, they would come to recognize the benefits they are receiving from the service, and would in no case demand from the corporations a compensation for the use of streets.

EDITORIAL CORRESPONDENCE.

DAYTON, INDIANAPOLIS, CHICAGO, BUFFALO.

Dayton, O.



THIS is a very pretty city, and is known as the "Gem City of the West." Its people are very proud of their city, and never tire of presenting its beauties and attractions to any strangers who may happen to visit the locality. The settlement is now about 100 years old, and was named in honor of Jonathan Dayton who settled here in 1795. The place was incorporated as a village in 1805, and a city charter was granted in 1841. The present population is about 75,000. The original city was embraced by a great bend in the Miami River, just below the mouth of the Mad River, which forms a union with the Miami at this point. The location has the advantage of an abundant water power, which has made the city a large manufacturing center; while it is also a market for the products of a large and rich agricultural region. In 1805, the village was nearly obliterated by a great freshet in the rivers, and it was proposed to change the location to the hills farther east, but it was afterwards decided to establish a system of levees and so protect the location from overflow. These barriers have been increased from time to time so that the streams are now permanently confined to their channels by means of ample levees, which in most sections are strengthened with a growth of large trees, and in the residence portions these have been converted into parks. Through a portion of the city the channel has been narrowed and bordered by heavy retaining walls, while the space behind has been filled with excavations from the river bottom, and in many places this made ground is occupied by substantial dwellings. A striking characteristic of the place is its unusually wide, level and well paved streets, substantial business blocks, public buildings, numerous bridges, and well shaded residence avenues. A peculiar local feature which attracts the attention of the stranger is the public market which is held from day to day, but which is made especially attractive on Tuesdays and Saturdays. The center of the market region is a small market house or city building, which extends through the middle of a block from one street to another, but on market mornings the market wagons, which are mostly one horse, covered vehicles, surround the entire block on both sides of the street as closely as they can be placed together and spread out into neighboring streets, making the largest collection of market wagons in one locality that we ever remember to have found. These wagons stand in front of dry goods stores and other buildings, and from them are sold fruits, vegetables, and in some cases merchandise of various descriptions. The market hours are limited to ten o'clock A. M., when all are driven off and the streets carefully swept.



FIG. 2.—CORNER OF 3D AND MAIN STREETS, DAYTON, SHOWING OLD AND NEW COURT HOUSES, WITH THE CARS OF THREE SYSTEMS.

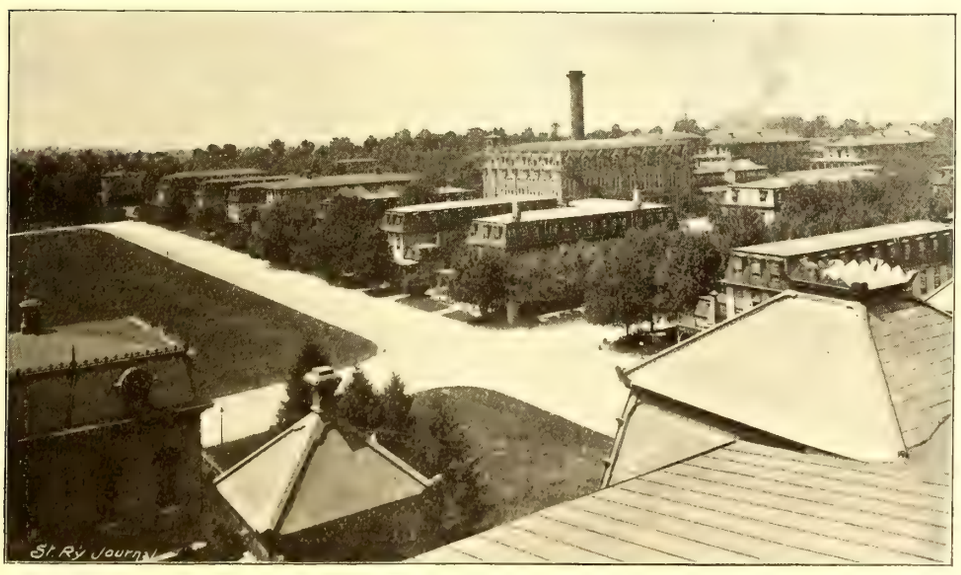


FIG. 1.—VIEW OF BUILDINGS—SOLDIERS' HOME, DAYTON.

The city is probably best known to the general public as the location of the Central National Home for Disabled Soldiers. The home occupies an elevation three miles southwest from the city boundary, overlooking the Miami Valley, and embraces a tract of 640 acres. The buildings are all of noble proportions and are located largely with reference to each other and with a view to provide all the possible home comforts for the inmates. The immediate surroundings of the buildings have been so improved as to make one of the most attractive resorts for pleasure seekers and visitors, who may have occasion to communicate with the inmates, to be found in the country. The main entrance to the grounds, near which two trolley lines from the city terminate in loops, is orna-

mented by a chain of artificial lakes, the main one of which covers eleven acres and around which one of the tracks circles. Back of the lakes are extensive greenhouses surrounded by well kept flower gardens with fountains and a grotto; all of which are designed with rare taste, and present a combination of rustic features rarely met with. There is also an alligator pond and numerous rustic houses, which provide inviting retreats for the maimed and destitute veterans, whose disablilities as a result of army service have incapacitated them from earning a living, but for whose comfort the Government has wisely and generously provided a home. The present number of inmates on the roster of the Home is about 5,500.

STREET RAILWAYS.

The rapid transit facilities of the city embrace about fifty miles of track on which cars are operated by animal, electric and steam power, and which are controlled by five principal companies. The largest mileage is operated by the

City Railway Company,

which has absorbed the lines formerly known as the Dayton Street Railway, Dayton & Soldiers' Home Electric Railway and the Fifth Street Railway. The management of the City Railway is in the hands of D. B. Corwin, president, and A. W. Anderson, superintendent.

The cars of this company are at present operated chiefly by animal power, there being an extension of the 3d and 5th Streets line which connects with the Soldiers' Home, and which is electrically operated. The work of converting the entire system to electric traction is now in progress, and almost all the material has been purchased, while a good portion of the track has been relaid with heavy rails and bonded. In the new construction a ninety pound, side bearing girder rail, eight and a half inches deep, is employed, the joints being connected by heavy twelve bolt fishplates, the bolts being one inch in diameter and set staggered. The rails were manufactured by the Pennsylvania Steel Company and the Johnson Company. The rails are spiked to oak ties, which are 5 × 7 ins. × 7 ft. except at the joints, where a ten inch tie is employed. Rolled tie plates and brace plates are

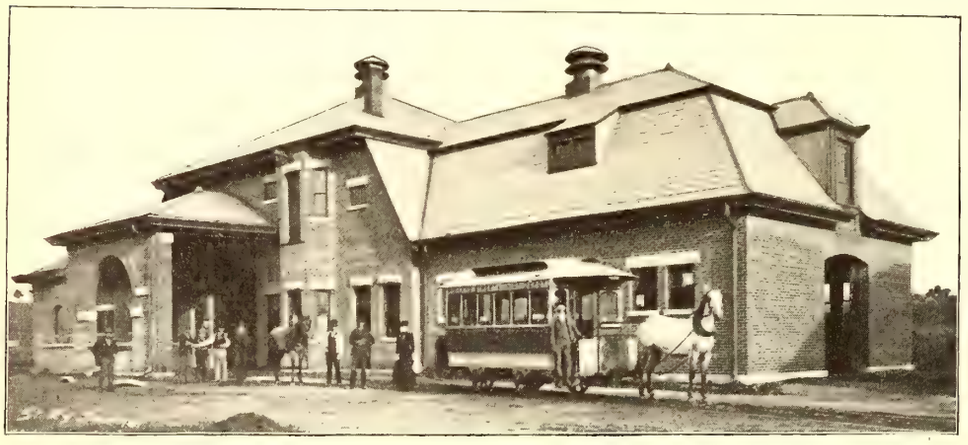


FIG. 4.—ONE OF THE CAR HOUSES—CITY RAILWAY CO, DAYTON.

employed on alternate ties. The ties rest on a gravel foundation from four to six inches in depth, the bottom of the excavation first being tamped solid. Concrete is employed for filling between the ties, and above that is a foundation of sand and the brick paving. The streets of Dayton are paved with asphalt and brick, vitrified brick being employed to a considerable extent. Between the rails and for toothing in the asphalt paving a peculiarly formed brick is employed. This is known as the Haydon block, and is 5½ × 10 ins. on the surface, 5½ ins. deep, and is made with two cavities on the under side, which are 3½ × 3½ ins. and 2½ ins. in depth. In the process of laying, these cavities are first filled with sand which tends to hold the block in place and also deadens the vibration. The surface of the block is roughened with pyramidal shaped indentations to provide a sure footing for animals. The bricks being of a dark brown color, they have the appearance of a double sized petrified waffle. The paving between the rails is laid flush with the tram. Outside the rails the material is the ordinary vitrified brick set edgeways. The work of paving is conducted by the city authorities, but the railway company pays for the cost of paving between the tracks and rails and eighteen inches outside, and also keeps up the repairs on this portion of the street. The principal franchises are for fifty years; that of the extension to the Soldiers' Home is perpetual.



FIG. 3.—OFFICE AND PRINCIPAL CAR HOUSE—CITY RAILWAY CO., DAYTON.

The overhead construction is supported by wooden and iron poles, iron center poles being chiefly employed, and the trolley wire is No. 0.

POWER STATION.

A new brick power station has recently been erected on the west side of the Miami River near the 6th Street bridge. The water for condensation will be drawn from six wells which have been sunk near the bank of the river. These wells are about thirty feet in depth, and the water rises in them to the level of the water in the river. The feedwater will be taken from a well eighty feet in depth, in which the water is found to be soft and pure. The building is constructed with two gables, as shown in the illustration, and is 138 ft. in length, with the boiler room and engine room each forty-eight feet in width which are separated from each other by a brick partition. There is a monitor roof over the engine room, with a large area of glass which gives abundant light. All the windows and doors of the station are unusually large. The roof is supported by a depressed truss, with tie rods extending entirely across each room. The foundations for the engines and generators are continuous and are 76 ft. in length, 14 ft. wide and 13 ft. in depth with pockets for the generators and flywheels. These are constructed with a concrete foundation two feet in thickness, above which is eleven feet of brick finished with a solid capstone fourteen inches in thickness, and for the engine foundations 15 ft. 9 ins. in length. The condensers, which are of the Wheeler type, are placed under the floor between the engines.

The present power equipment consists of three Buck-

eye tandem compound, condensing engines, of 400 H. P. each, which are each coupled direct to a Siemens & Halske 300 K. W. generator. The boilers, which were manufactured by Brownell & Company, of Dayton, are of the return tubular type, 72 ins. × 18 ft., six in number, and of 130 H. P. each. The brick smokestack is cylindrical, 125 ft. in height, with a seven foot flue. Coal is delivered from a steam siding directly into the boiler room, a spur track for this purpose having been laid by the railway company. There is a tower at one corner from which the feed wires will be led to the line. The structure is virtually fireproof, the floors being supported by I beams with concrete arches which are surfaced with hard maple flooring. Cast iron posts are provided for supporting the large doors, the object being to prevent the possibility of the doors settling, as is likely to be the case where the hinges of heavy doors are supported by wooden beams. An overhead traveling crane is provided for the engine room, which was manufactured by Edwin Harrington, Son & Company, of Philadelphia. All the appointments of the station are very complete, and every appliance provided that modern practice can suggest. The station was designed by Bert L. Baldwin, engineer of the Cincinnati Street Railway Company.

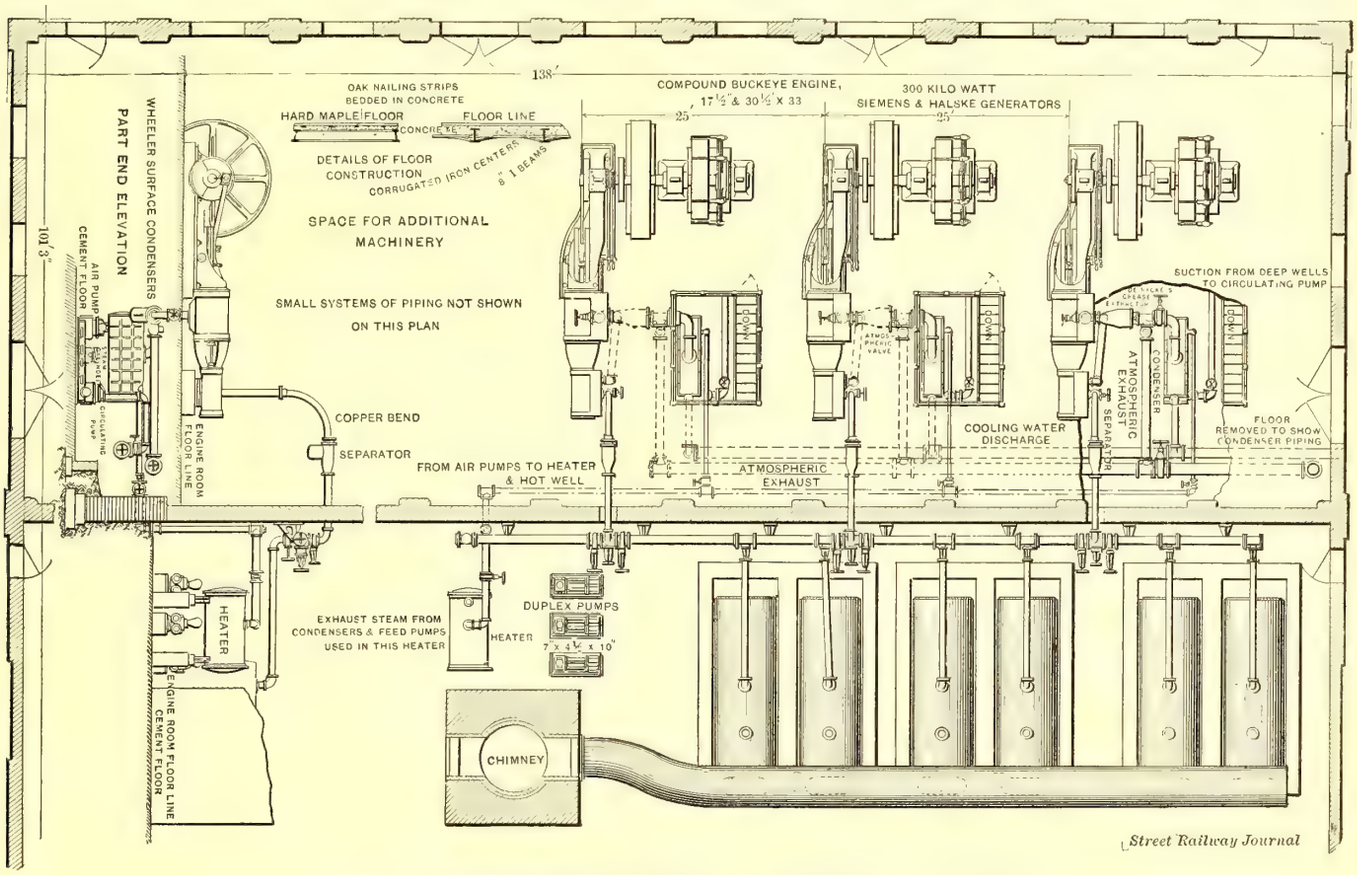


FIG. 5.—PLAN OF POWER STATION—CITY RAILWAY CO., DAYTON.

ROLLING STOCK.

The car equipment, with which the lines are to be opened, consists of twenty open cars manufactured by the Barney & Smith Car Company, of Dayton, O. These are furnished with cross seats with a center aisle, and are provided with fare boxes, as they are to be run without conductors. The cars are mounted on the Barney & Smith trucks, and are provided with a double equipment of G. E. 800, twenty-five horse power motors. The wheels are also of the Barney & Smith manufacture.

Motormen are paid twenty cents a trip, or about $1.60 a day for twelve hours' work. On busy days inspectors are placed on the cars to assist in collecting the fares. It is the opinion of the manager that whatever losses may occur from running conductorless cars will not amount to one-quarter the wages of a conductor. It is the practice of this company to employ lady clerks, both at the receiving stations and in the manager's office. Since the employment of ladies in these positions there has been no report of rudeness or incivility on the part of the employes, and the car men obey orders received from them as readily as though men were employed in these positions; and it is remarked that the interest taken by the ladies in their work, and their loyalty to the company is above that usually manifest on the part of male employes.

The power for operating the cars on the Soldiers' Home extension is generated at a small station located near the end of the 3d Street line, in which a generator of forty kilowatts is employed, which was manufactured by the Shawhan-Thresher Company, of Dayton. When the new station is completed this plant will be abandoned, and the entire system operated from the new power house.

The present stables and car barns belonging to the system are of brick and very substantially constructed. Two of these are shown in the accompanying illustrations. These will all be made over for storing the electric cars, and in one of them the repair shop will be installed. One of these station barns is now equipped with a transfer table which operates on a track extending under the porch, upon which the cars are drawn when they are transferred by the table to the storage tracks in the barn. This arrangement will be changed, and a loop will be built, by means of which the cars will be delivered to the storage track.

White Line Street Railway Company.

The system operated by this company embraces eleven and a half miles of track, and is interesting from the fact that it was among the first roads in the country to be operated by electric power. Electric cars were here put in service August 8, 1888, only six months after the electric road in Richmond, Va., began running regularly, and they have been ever since in continuous service. The line was originally equipped with the Van Depoele system including the generators and motors, and the cars at first were all painted white, hence the name of the company. In 1889, the tracks were extended to the Soldiers' Home, and passengers were carried the entire distance for one fare. The original generators have long since given place to those of more modern type, and recently the General Electric and Westinghouse motors have

been substituted. The original power equipment consisted of two Lane & Bodley straight line engines of 150 H. P. each, which stand side by side and are coupled to the terminals of the same shaft. From the flywheel, which is fourteen feet in diameter with a thirty inch face, the power was formerly transmitted by a belt to a countershaft, from which five Van Depoele eighty horse power generators were operated. In place of the five original generators an M. P. General Electric 200 K. W., generator has been substituted which is driven by a belt direct from the flywheel. This new machine is more efficient and is doing the work better than the five original machines. It is interesting to note that these engines, although in continuous operation for seven years, on an average of nineteen and a half hours, and much of the time heavily overtaxed, have never required any repairs, and in all this time the line has not been shut down on account of the engines but forty minutes. It is also interesting to note that the original cost of the Van Depoele generators was $3,200 each, and that a single armature cost $1,000. The machines are now being broken up, and it is found that the field coils consisted of 2,000 lbs. of copper wire. This is more wire than is now employed in the manufacture of the fields of the 300 K. W. machines which have been substituted.



FIG. 6.—SOLDIERS' MONUMENT AND HIGH SCHOOL BUILDING —DAYTON.

The original steam equipment consisted of five tubular boilers of 100 H. P. each, and more recently two of 125 H. P. each have been installed. The power equipment of the station is now being increased by the addition of two McIntosh & Seymour tandem compound, non-condensing engines, having cylinders 14½—23 × 22 ins., which are to run at 160 revolutions and are rated at 250 H. P. each. The pistons are coupled to the same shaft and are belted direct to an M. P., 300 K. W. General Electric generator. The new boilers were manufactured by Brownell & Company, of Dayton, and are 72 ins. × 16 ft. They are built with a doubt welt seam with three rows of five-eighths inch rivets. The shell, which is of the best flange steel, is seven-sixteenths of an inch in thickness, while the head is one-half inch. The domes are 40 × 40 ins. and the steam main is six inches in diameter.

C. M. Crane is the engineer of the station, and has been in charge of the plant ever since it was built, and with two assistants he keeps the plant going while he superintends the placing of the new machinery. The average number of cars now operated is fourteen, but frequently by the use of trailers as many as thirty-three cars are run. The average coal consumption for operating the line is five tons per day, which costs delivered $1.95 per ton.

ROLLING STOCK.

The summer equipment consists of open cars manufactured by the Barney & Smith Car Company, which are provided with fare boxes and fare conveyors. The fare boxes are placed to one side at the front end of the car, in rear and to the left of the motorman as shown in the accompanying illustration, Fig. 6. Registers are also provided on which the motorman records the receipts. The experience of operating without conductors has been very satisfactory to the company, especially in connection with the use of the registers. McGuire trucks are used. The system is operated under the supervision of A. C. Clark, vice-president, and A. H. Cole, superintendent, who has recently been appointed to the position, to succeed William Beach, the former incumbent.

Oakwood Street Railway Company.

The lines of this system embrace eight miles and are operated by horse power, one horse, bobtailed cars being employed. Charles B. Clegg is president and manager, and the work is already in progress for changing the line to electric traction. A new station has been built near the southern terminus of the road, which runs east and west through the city on Main Street. The new track construction will consist of a ninety pound rail, the same as is being used on the lines of the City Railway Company, except that the rail will be of the Johnson girder type, and will have a base of five and a half inches. The electric system to be employed had not been decided upon at the time of our visit. One of the cars on this line is shown to the right in each of the accompanying illustrations, Figs. 2 and 6.

Wayne & Fifth Street Railway Company.

This system embraces seven miles of track, and is also operated by one horse cars under the management of N. Routzahn, superintendent. The line crosses the city on Jefferson Street, runs east across the Mad River and extends into the manufacturing districts of North Dayton. We were not informed whether a change of motive power is contemplated or not.

Home Avenue Railway Company.

This is a steam dummy line which runs from the Union Depot to the Soldiers' Home. The line, which is under the management of W. P. Callahan, will doubtless soon be electrified.

Indianapolis, Ind.

The Citizens' Street Railway Company,

under the management of T. H. McLean, controls all the lines of the city embracing 100 miles of track, and the service caters to a population of about 125,000. The cars are all electrically operated, except on Kentucky Avenue, where one mule car is run for the purpose of holding a franchise.

Mr. McLean, previous to his connection with the Citizens' Street Railway Company, in August last, was connected with the Twenty-third Street lines of New York for sixteen years, and for a short time was manager of the Metropolitan Street Railway Company's system in New York. The Indianapolis system at the time he assumed the management embraced a trackage of forty-five miles, and the average number of cars operated was forty-five. During the year, it will be noted, the mileage has been more than doubled, and the number of cars operated increased to ninety-six. The average daily motor mileage is 12,994 and the trailer 1,005 miles.

Notwithstanding a falling off in receipts during the prevailing business depression, the expenses for repair and operation have been materially reduced, so that the net receipts show an increase over previous months. The

operating expenses per car mile are less than those of any other electric system that we have found, with one exception. How this showing is obtained will be noted from the following particulars of practice.

The number of car barns and stations have been reduced from seven to three, and a very rigid economy is practised in the repair shops. All of the supplies used are manufactured in the company's own shops. The car wheels are purchased in the rough and are bored and faced in the repair shop. A brass foundry is operated in connection with the shop, and all the brass and bronze supplies are here manufactured, including trolley wheels and harps, gong frames, journal bearings and many of the bronze trimmings, the material for these castings being old wire and scrap which is melted up for the purpose. The journal brasses when worn are turned out and refilled with babbitt, which is also manufactured on the premises, the standard babbitt mixture being employed. By this means the brasses are made to last a long period, as they can be rebabbited many times. Fuse boxes and the diverters used in connection with the controlling stand, are also manufactured in the shops. The repair shops are equipped with a good complement of iron and wood working tools, and include a Gould & Eberhardt automatic gear cutter. There are also a wheel press and axle lathes, also a milling machine for cutting keyways. A larger car axle than formerly is being em ployed. The wheel seat is now four inches, and the balance of the axle is turned down to three and three-fourths inches. In turning the wheel seat it is the practice to make it $\frac{1}{200}$ in. larger than the bore of the wheel in order to insure a close fit.

The trolley wheels as now employed are cast with a U-shaped instead of a V-shaped groove with an unusually thick flange. This, it is claimed, adds materially to the life of the wheel, as it gives a larger wearing surface for contact with the trolley. The trolley harp is made with a ferule which embraces the end of the pole and to which it is held by means of a nut on the end of the pole, so that the harp can be readily removed and replaced. The contact springs are also arranged so that they bend and pass through the sides of the harp, and are fastened to the lower part, which prevents their being worn in two by the trolley wheel. Experiments are being made with adjustable rim gear, which is so constructed that the rim when worn can be removed without removing the core from the axle.

In changing from closed to open cars and *vice versa*, it is the practice to take out the wiring and cables, with the exception of the lamp wires, inspect them carefully, repaint the insulation, and replace them. This practice has been found to add materially to the life of the connections.

The company has also worked a considerable saving in brake shoes, the practice now being to employ shoes of as hard material as possible. The shoes are purchased from a local foundry, and the instructions to the manufacturer are that the material shall be such as to make them very hard. This is contrary to steam practice, but it is found that it works a saving both on the shoe and wheel. This practice was suggested from the condition of the wheel tread, which on examination is found to be honeycombed from the effects of the current due to the flashes caused by poor rail contact. Because of the pitted condition of the tread, a soft shoe causes the wheel to slide, while a hard shoe does not affect it so much.

The power for operating the tools of the repair shop, including the wood working tools, is supplied by a fifteen horse power motor, which is operated from the line current. The shops are operated under the supervision of H. B. Niles, who is also electrician for the company.

POWER STATIONS.

With the increase in mileage and traffic it has been found necessary to erect a new power station, which is now nearly completed. This plant is located on the west side of the river on West Washington Street, in proximity to the river, from which the feed and condensing water will be drawn. The buildings are of ample capacity, and are designed for an ultimate equipment of 5,000 H. P. The engine room is placed in the rear of the boiler room, and the structure consists of a steel frame with corrugated iron sheeting. The ground dimensions of the boiler room are 80×75 ft., and it will be open to the roof which is unusually high. The present steam equipment will consist of two Zell improved safety boilers of 750 H. P. each, manufactured by Campbell & Zell, of Baltimore. These are equipped with Hawley down draft furnaces, and all the steam fittings are unusually heavy. Natural gas is to be employed as fuel, which is purchased at a very cheap rate. The building for the engine room is a brick structure 215×70 ft., and this will be duplicated for additional power. The engine equipment will consist of two cross compound, condensing engines of 750 H. P. each, manufactured by the E. P. Allis Company, of Milwaukee. The auxiliary equipment will consist of Reynolds independent jet condensers. One engine will be coupled direct to a Westinghouse M. P., 500 K. W. generator, the flywheel being located to one side of the armature. The second engine is provided with two flywheels, and will be belted direct to two Short generators having thirty-nine inch and fifty inch armatures respectively. It is proposed to operate eventually a direct connected generator from this second engine, when the flywheel will be removed.

The switchboard will be equipped with the latest improved instruments, and all the station appliances will be first class in every particular. As noted above, the water will be drawn from the river through a system of wells and a brick conduit leading from the station under the bed of the river. The wells will be sunk some distance from the shore, and protected by coffer dam and a triangular breakwater to prevent floating ice from coming in contact with the walls. The brick conduit through which the water will be drawn, is thirty-six inches in diameter, and terminates in a double well in the station, from the outer one of which the condensing water will be drawn, and from the center well, which is driven considerably deeper than the other, the feedwater will be drawn. A gate connection is made between the inner and outer wells, so that in case the feedwater supply should fail it can be drawn from the same source as the condensing water.

The old station, which has been previously described in these columns, is located near the Union Depot in the business portion of the city, and the equipment has been added to from time to time, and now embraces quite a variety of engines and boilers. The original equipment consisted of two 500 H. P. Hazelton boilers, to which were added later two Babcock & Wilcox boilers of 325 H. P. each.

The boiler compound for removing scale is introduced through the feedwater by means of a pipe communicating between a barrel containing the mixture and the suction pipe of the pump, an arrangement that is working very satisfactorily.

The original engine equipment consisted of one Wheelock 250 H. P. machine which was belted to a countershaft, from which three D 62 Thomson-Houston generators are operated. A double Wheelock engine, of 500 H. P., was subsequently added, and later a Westinghouse compound engine, of the Kodak type, which is direct coupled to a Westinghouse M. P., 250 H. P. generator. The additional generator equipment consists of one M. P., 250 K. W. General Electric machine and two D 62 machines. There is also one General Electric thirty light arc machine for lighting the park and groves to which the lines of this company extend.

In addition to the usual equipment of lightning arresters, including a number of non-arcing arresters, the station is protected by a tank arrester which consists of a wooden vat, about two feet in length, one foot wide and one foot in depth, which is kept filled with water, and in which two copper plates are submerged, one connected by a No. 0000 trolley wire to the ground, and the other by wire of the same size through a switch to the bus bar of the switchboard. In case a storm is approaching, a switch is thrown which places the tank arrester in circuit,

and although there is a loss of about six amperes of current while in circuit, it works so satisfactorily to protect the station that it is considered a very essential device. So far as experience goes, this arrester operates very successfully, and no trouble has been had from the atmospheric current since the tank arrester was employed.

ROLLING STOCK.

Among the new cars recently put in service are twenty-five vestibuled, single ended cars with twenty foot bodies manufactured by the Pullman Company, and twenty-five of the same type manufactured by the St. Louis Car Company. These cars have the doors placed to one side, and the back platform has only one step, being closed entirely around by the dash on the opposite side. In addition are twenty eighteen foot, open dash cars manufactured by the St. Louis Car Company, and ten double end, vestibuled cars, and sixteen sixteen foot, open dash cars manufactured by the same company. There are also twenty sixteen foot, open dash cars manufactured by the Brownell Car Company of St. Louis.

The open car equipment consists of seventy-five cars having glass fronts, single ended, with eight seats, manufactured by the St. Louis Car Company. These are operated with a screen on one side to protect the passengers from the center poles which are the prevailing construction. The company also owns seventy-five seven seated and eight seated open trail cars. Trucks of the McGuire type are chiefly employed, there being two of the Peckham and one of the Taylor trucks.

The original motor equipment consisted of the Thomson-Houston double reduction motors. Afterwards a number of S. R. G. motors were introduced. These have been made over in the company's shops and are still in operation. Among the more recent additions to the motor equipment are sixty-five equipments of the Westinghouse thirty horse power motors.

The more recent track construction is made with a ninety-three pound girder rail, and a large amount of this rail is already on hand. In the original construction what is known as electric girder rail was employed to a considerable extent, which was laid on chairs. This will be renewed with heavy rails as soon as the city is ready to improve the streets.

EMPLOYES.

The general manager hires and discharges all the employes. Motormen are required to have some knowledge of machinery and to be of average intelligence. Applicants are obliged to fill out blanks stating their qualifications and previous service, and are also required to be introduced by two business men, residents of the city and known to the management. Married men are preferred and also those living in the city and suburbs. The motormen on being employed are assigned to one of the road officers for instruction, who teaches them to operate the cars over all the lines. They are not required, however, to do any service in the shops before going on duty. The pay of motormen and conductors is fifteen cents an hour and they work twelve hours a day. Three crews are employed for each two cars. The present corps of car employes is a very efficient class of men, who seem to be performing their duties with a view to the best interests of the company, while they are attentive and polite to the public.

The fare is five cents, and a very liberal system of transfers is in vogue. The number of transfer tickets issued daily is about 9,000, while on Sundays and holidays it amounts to 14,000. The cars are equipped with two registers, one for recording cash fares and the other for the transfer tickets. Both the Sterling and Meaker types of registers are employed, there being 160 cars equipped with the former type.

The company owns and controls a large park located about five miles from the city, to which the cars from two connecting lines run. The grounds are well laid out and improved, and a good portion of the park is covered with a large growth of native trees. A handsome station is located near the terminal of the line, and the cars make a loop and receive and discharge the passengers directly into the station. The grounds about the station are ornamented with flower beds and foliage plants. There is a canal passing through one side of the grove connected with the park, beside which a number of pleasure boats are kept for hire. There is the usual attraction of merry-go-rounds and switchback railroads, all of which tend to attract visitors to the location. An old time farmhouse stands in the park in which meals are served in farmer's style to those who wish. A track near the park is provided with buildings, and set apart for the children sent out by one of the Fresh Air Missions of the city. The street railway company provides free tickets for the children sent out by this Mission, which are good on the cars at certain hours.

The first street car line was started in Indianapolis in 1864, and the first electric line June 17, 1890. W. T. Lewis, the present superintendent of the company, began service with the company as a driver in 1875. At that time only twenty-four cars were operated. The line was a single track road with turnouts, and no time tables were provided, each driver being left to make his own time. The driver started out with his team at six o'clock in the morning and ran to eleven, when a second team was substituted and driven till five o'clock, when the first team was again brought out and kept on duty until the cars were run in at eleven or twelve o'clock at night. The average life of the horses was only about two years. This treatment of the animals is in striking contrast with the present prevailing practice which requires the animals to make not more than sixteen or eighteen miles a day.

The franchise of the company does not require it to pay any car license nor anything on the gross receipts. A property tax, however, is required, and this is based on an estimated valuation of $1,600,000, which is supposed to be in lieu of a franchise tax. The company is at present in litigation with the city and with a rival company in regard to the period at which the franchise expires. The company claims there are yet a number of years for the franchise to run. An opposition company has been organized, which is making an effort to undermine the operating company, and has been making wild propositions to the Board of Aldermen for the purpose of securing a franchise, offering as high as from 5 to 14 per cent. on the gross receipts, as a compensation for the use of streets. The operating company, however, is not materially disturbed by these propositions, and is going ahead with improvements as noted above, and is providing in all respects a very acceptable service.

Chicago, Ill.

The trolley has at length gained the day in Chicago. Concessions have been granted to the North and West Chicago Street Railway Companies for operating the trolley on all their existing horse lines, and there is no doubt that the application of the Chicago City Railway Company for the employment of the trolley on the remaining South Side lines will soon be granted. At least there is a willingness on the part of the city authorities to grant the necessary franchises, but there are some questions in regard to the conditions which are not yet settled. All the companies have been required to make certain payments to the city, and on the North and West Sides there are conditions in regard to providing electric lights along streets over which the trolley lines are to operate.

The success with which the electric lines of the Chicago City Railway Company have operated during the past year and a half, especially during the months of the World's Fair, has had much to do in bringing the city authorities to a favorable consideration of the trolley franchises. The peculiar features of the electric plant operated by the Chicago City Railway Company were fully described in the August, 1893, issue of the Street Railway Journal, but the economy and success with which the plant is operated justify us in calling attention to the construction and methods of practice. The power station is located on Wabash Avenue between 52d and 53d Streets, and adjoins the power station of the State Street cable line, the two buildings extending through from one street to the other (Fig. 7).

The management now proposes to install an electric motor in the cable station for the purpose of operating the winding drums, so that all the power may be generated in the electric station, thus saving in the number of station employes. Should this experiment prove successful, all the other cable stations will doubtless be operated by an electric motor from power generated in a central station.

The power equipment of the present electric station consists of four Wheelock engines with Hill valves. These engines have unusually heavy crossheads and crankpins, all the parts being made sufficiently strong for larger cylinders than those now employed, the idea being that when additional power should be required larger cylinders could be substituted. The floor around the engines is covered with tin, from which waste oil can be readily removed, a very desirable feature, and facilitates the labor of keeping the engine room in a cleanly condition, a feature for which this station is noted.

The engines are coupled in pairs to the same shaft, and each pair drives, by means of continuous ropes, two Westinghouse M. P. generators of 700 H. P. capacity, the armature of each generator being coupled to the driving pinion by means of friction clutches of the usual type. The transmission ropes are of cotton, one and a quarter inches in diameter, and a portion of the wraps is led over an idler from the armature pinion, forming a compound wind, in order to equalize the friction contact with that of the driving sheave. The tension sheave is mounted in a horizontal position on a truck which travels back and forth on a track attached to the ceiling, and to which the two strands of the rope are led over perpendicular guide pulleys supported from the ceiling. A tension of only 150 lbs. is employed, and this is suspended next to the wall back of the station, and a railed in platform suspended from the ceiling is provided, so that access is readily had to the tension car and guide pulleys (Fig. 8).

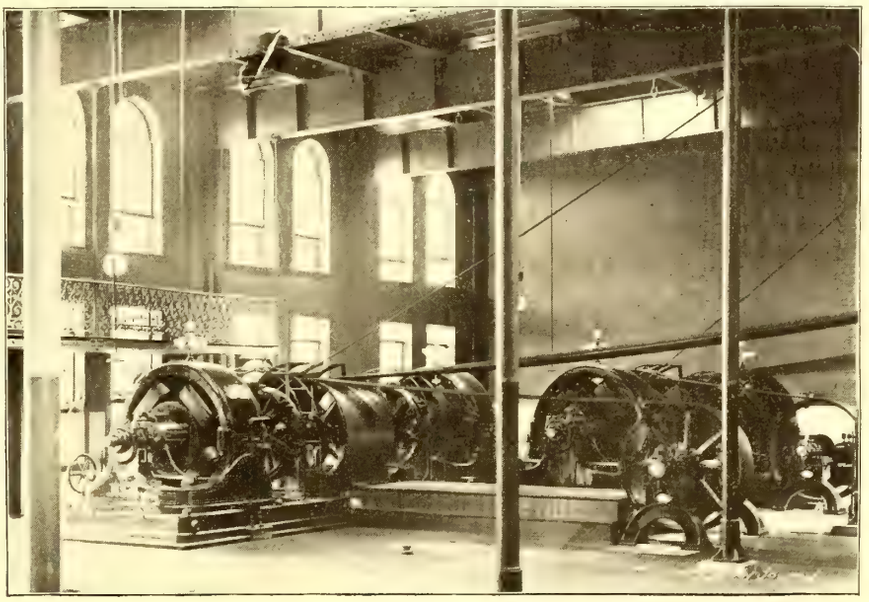


FIG. 8.—INTERIOR OF ELECTRIC POWER STATION—CHICAGO CITY RAILWAY.

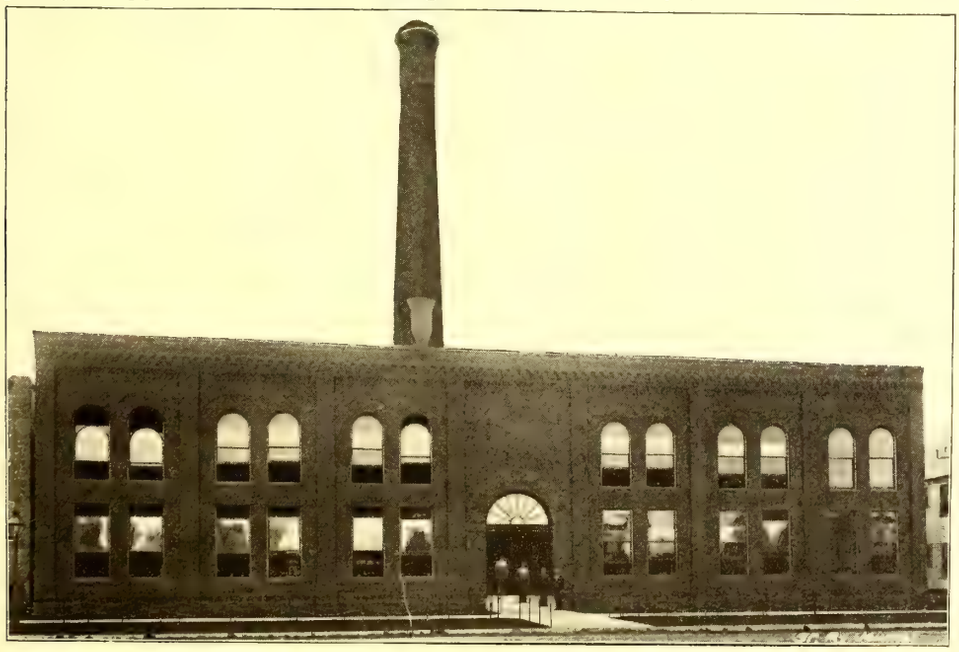


FIG. 7.—ELECTRIC POWER STATION—CHICAGO CITY RAILWAY.

The switchboard is located above the door on the street side of the engine room, and is supported by a balcony on which an attendant is constantly stationed to watch the instruments. The station is of sufficient capacity to accommodate all three additional units which will be added as soon as the new lines are constructed. The steam is generated in seven tubular boilers which are equipped with Murphy stokers. The rear of the boiler settings comes within a few feet of the partition wall between the engine and boiler rooms, and in order to provide for the removal of the mud drums through which the feedwater is led, openings have been provided in the partition wall. These openings on the engine room side are provided with doors, and have been converted into cupboards for the storing of waste, tools and supplies, the shelves of which can be readily taken out when it is necessary to remove the mud drums. To prevent the excessive heating of the rear flue doors, a sheet iron shield is placed inside the door, which is provided with a handle, so that it may be readily removed.

Among the station appliances is a Perfection oil purifier, manufactured by the Perfection Oil Purifying Company, of New York, in which the oil is filtered, and by its use a great saving in oil is effected, one barrel of dynamoline only being sufficient for oiling the engine and other parts, with the exception of the crosshead and crankpin, for twenty-one days, a little new oil being added each day. It requires about two barrels of oil a year for the bearings of the four generators, the self-oiling boxes being of sufficient size to hold a supply for ninety days. The average current for operating the system is from ten to twelve amperes per car. During the excessive traffic incident to the Fair 150 electric cars were run. The average number now operated is forty-five.

Among the interesting features of the electrical equipment of the station are two tank lightning arresters, which are placed in the basement of the station in position to be readily switched into the circuit. The water is contained in wooden tanks which are about two feet in length, one foot in depth and are provided with intake and outlet pipes, so that when in operation a current of water is constantly flowing, which prevents excessive heating. The tanks are thrown into the circuit by means of plug switches, and are readily connected whenever a storm approaches, the loss from leakage while in service being very small. The conductors between the tank and

machinery are provided with choking coils of heavy copper rods. The station has suffered no damage from atmospheric discharges since it has been in operation.

The motor equipment of the cars is chiefly of the Westinghouse type, and so far the armature repairs have been very slight, one man doing all the winding and other work besides. A new device to facilitate repairs is noted at one of the car barns. The hydraulic trucks which operate on tracks in the bottom of the pits and which are employed for removing the armatures, are in some cases provided with a small box which rests on the platform, having on its upper surface parallel wooden rollers about three inches in diameter, which allows the armature to turn as it is being lowered from its bearings, so that the pinion will free itself from the gear. (Fig. 9.) The device is the invention of A. D. Campbell, superintendent of repairs at one of the barns. Another useful appliance, which was also devised by the same person, consists of a tripod, with legs composed of one and a half inch gas pipe, which is employed for lifting the motor in case of a broken axle or wheel. In case of an accident of this

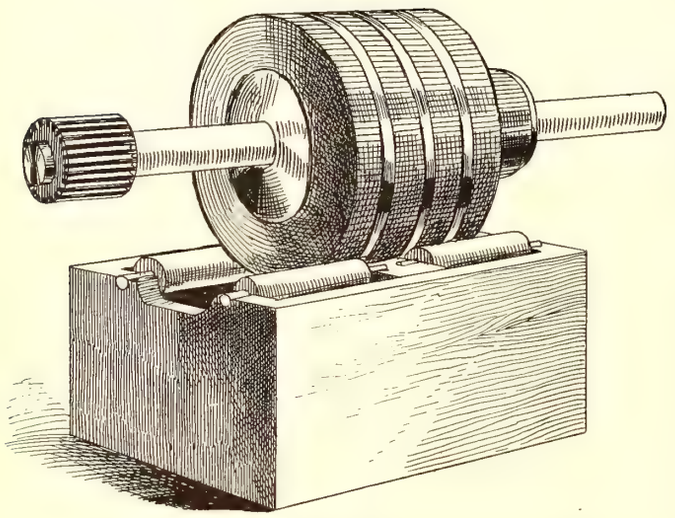


FIG. 9.—ADJUSTABLE ARMATURE REST—CHICAGO

kind, the tripod is placed on the floor of the car, when by means of a block and tackle the motor may be lifted into position, the attachment being made by an eye bolt screwed into the motor field, a hole being drilled and threaded for the purpose. With this device a crippled car can be returned to the barn either by power from its other motor or can be pushed in by another car.

To prevent the pulling down of the overhead construction by the trolley pole a guard has been devised by G. W. Knox, electrician of the company, which consists of horizontal rods, is attached to the base of the trolley harp, and which extend both sides of the wheel. In case the trolley wheel leaves the wire the guard comes into contact with the trolley and prevents the wheel from engaging with the span wires. As a means for holding up the trap door of the car when the motors are to be inspected, a button composed of a metal plate, having an offset and attached to one end by means of a bolt to one of the floor timbers, is provided. This is readily turned up in position when the door is opened, where it holds it firmly.

Trucks of the McGuire type are chiefly employed, and in order to prevent the low hanging truss rods from coming in contact with loose paving blocks or other obstructions, they are supported from above by means of a chain attached to the turnbuckle. This not only supports the rod but also prevents the turnbuckle from turning or becoming loose after being placed in position. The track scrapers, which are operated from a lever from the platform, are attached to the blades of the pilot. Some minor changes have also been made in attaching the parts of the motor; for instance, the axle collars are held in position by a larger set screw than is usually employed, and the commutator guard is attached by means of bolts extending through the frame, which prevents their working loose.

The company is now operating one of Lovejoy's convertible cars, a description of which was given in our last issue. This car was manufactured by the Wells & French Company, of Chicago, under the supervision of Mr. Lovejoy, and is finished in all respects in a very thorough and artistic manner. It is equipped with the G. E. 800 motors, and differs from most types of combination cars. When closed it can hardly be distinguished from the ordinary type of closed cars. All the adjustable parts are made close fitting, and there is apparently no tendency for the joints to become loosened or the parts to settle. When run as an open car the passengers would not ordinarily detect the presence of the sash and panels against the ceilings, the general appearance of the ceiling not being materially changed. The design of the inventor is to obviate the necessity of providing a double equipment for summer and winter use (Fig. 10).

Among the improvements on the cable lines which were introduced just previous to the World's Fair were five signal towers which were erected at different crossing and switching points on the line. These consist of

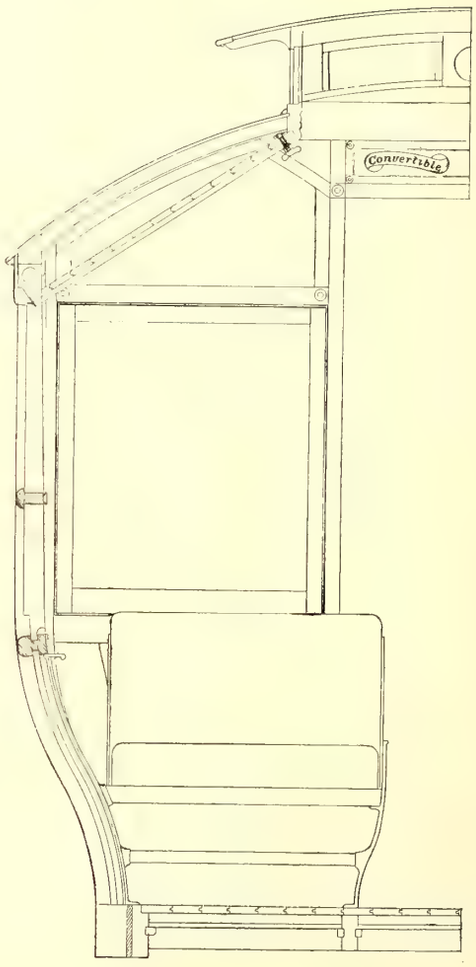


FIG. 10.—SECTION OF LOVEJOY'S CONVERTIBLE CAR—CHICAGO.

small cabs mounted on posts and provided with signals and rod mechanism with which the attendant can operate the switches. One of these is located at the junction of 55th and State Streets, opposite the power station, adjoining the park, and is shown in the accompanying illustration (Fig. 11). The day signals consist of wooden blades of different colors, one of which is labeled "Stop," and at night are provided with colored lights. By means of this station the trains on the main line and the branch line on 55th Street are safely controlled. These towers are operated in a very satisfactory manner, insuring safety and facilitating the movement of trains.

Among the improvements made by the Chicago City Railway Company are the renewing of the rails on the

Cottage Grove and State Street cable lines from 39th Street, south. The new rail is a seventy-four pound, four and three-quarter inch girder, and of a somewhat new design, having a beveled head, from a design shown in our last issue in connection with a paper on wheels and rails by Fred. H. Fitch, and the joints are to be electrically welded. The new form of rail has been adopted to prevent, if possible, the uneven wear on wheels and the wavy condition of the rail surface, which is the principal defect in the old construction, and which is apparently caused at points where one rail is higher than the other by the slipping of one wheel to keep up with the other. The experiment is being tried of cleaning the cable and conduits by means of flushing them from the city hydrants, a peculiar shaped hose nozzle being provided to lead the water through the slot. By this means it is hoped to reduce the expense of keeping the conduit clean, which now requires the services of thirty-three men every day in the year at a cost of $28,000 per year, the work of cleaning being augmented by the peculiar form of yokes with which the conduit is constructed, there being a curved cross brace above the bottom of the yoke, which interferes with the movement of the cleaning tools, it being necessary to lift the hose over the brace every four feet.

MONTHLY MEETINGS.

One of the commendable features of practice introduced by Superintendent Bowen is a monthly meeting of the heads of all the departments with the superintendent, which is usually held on Saturday afternoon from one to five o'clock, to which some of the employes known as the handy men are also admitted, being given a half day off for the purpose. At these meetings papers on different subjects are presented by the foremen of the different departments, the subjects being assigned by the superintendent at previous meetings. Sometimes committees are also appointed to assist in the preparation of these papers. The work of preparing these papers requires considerable study and investigation on the part of the authors and gives them an opportunity to inform themselves on the particular subjects pertaining to their departments and induces them to take more interest in their work. In connection with these meetings the foremen of the different departments are asked to criticize or give their opinions on the practice of the different departments. and to make any suggestions as to how the work may be economized or improved. Sometimes a set of questions, like that below, is sent to the foremen in advance of the meetings, to which they are expected to reply:

Section of rail to use; weight, shape and size?
30—60 or 90 foot rails?
Welded, riveted or bolted joints?
Kind of paving with details of work?
Shape of top of roadbed?
What kind of rail filler to use?
Which of our lines will it pay to continue to use horses upon? Why?
Open or closed car motors?
What cars should we take for motors?
Single or double motor equipment?
What truck to use?
What electrical equipment?
What trolleys?
What controllers?
What lamps?
Should we ourselves make trucks and construct work on line and roadbed or let out by contract? Why?
What rate of speed should be scheduled?
Should cars be vestibuled?
What is the best brake for electric train motor and trailer?
What fender is best?
What form of rail joint and bond is best?
What is best size and weight of wheel?
What is best form of barn reconstruction as to tracks, doors, elevators, shops and offices, in a general way?
What is best distribution of lights in cars; position, power and number?
What is best heating device?
What oils should be used on wheel journals—(armature—shaft—bearings)—commutators—controllers—trolleys?
What is best car seat to adopt?
Should shops be in each barn or central? How about supply parts, store rooms, etc., as to location and arrangement?
What is the best method of keeping motor cars washed clean and lamps clean?
Should elevators, transfer tables and lights be run from main power house for each barn, or steam plant be in each barn? also
What detail change can you suggest for economy or efficiency in any part of the electric railway as used by us to-day?

As an auxiliary diagrams are kept in the superintendent's office, which are framed and placed in a position to be inspected by the heads of the departments, on which efficiency curves are drawn each month, being laid out from the reports of the foremen of the different stations and different departments. One of these diagrams shows the relative cost for feeding and caring for the horses at the different stables; the relative cost for track construction and repairs from month to month, and one the general efficiency of the entire system. Since this practice has been introduced the operating expenses of the different stables and car barns have been greatly reduced, in one case amounting to $4,000 per month, the principal saving being made in the amount of feed per horse and in the number of attendants. The cost per animal, however, is not allowed to go below a certain amount. At the end of each month the superintendent sends a statement to the foremen of each department, giving a list and cost of all the supplies that have been ordered for that department for the month, with such comments as may be found necessary, whether too much or too little has been ordered. If too much, they are advised to lessen the amount for the following month. These statements also include the amounts ordered by the heads of all the other departments, so that each is able to compare his work with that of others.

The immediate control of the car men is assigned to a chief supervisor with three assistants, two of whom with the chief constitute a board or commission, which meets every morning to receive and act upon the reports of the inspectors, and the complaints of passengers, and who sit once a week to try such employes as may be ordered before the board for any cause. In case an employe is ordered to report before the board, he is understood to be suspended for that day.

The number of car employes on this system is now 1,700, and out of this number there are on an average about forty punishable offences reported each week. The daily complaints from passengers run from five to eight, and about 250 complaints a week of a more or less serious nature come before the board.

Notwithstanding the falling off of traffic after the close of the Fair, very few of the extra men were discharged. No new car employes, however, are being hired, and the force is being reduced only by discharges for cause, the policy of the management being to give employment to as many extra men as possible to help them to bridge over the hard times, and this notwithstanding the fact that the wages paid by this company are higher than those paid on any other line in the country.

The inspectors, while on duty, are stationed at different points of the line, and are constantly watching the movements of the cars, and for any infringement of the rules on the part of the employes. In case a conductor gives a signal too soon when passengers are boarding or alighting, or in case a gripman, driver or motorman fails to heed the signal of passengers, or if a car comes in ahead of time, the facts are noted and reported to the board and the offender is reprimanded, suspended or fined according to the nature of the offence. The inspectors also superintend the raising of blockades should any occur from accident or the passage of processions in the street. The average headway of the cable trains of the two principal lines being a minute and a half, it is estimated that a blockade of an hour results in the loss to the company of at least $600.

In case an employe is suspended or discharged by the action of the board he has the right of an appeal to the superintendent, who reviews the case and acts accordingly. In only one or two instances has he found it necessary to change the ruling of the board. The work of this commission relieves the superintendent of a large amount of detail work, as only the serious cases are brought to his attention, and a summary of the complaints is presented from day to day. The heads of all the departments are made responsible for the efficiency of the men under their charge, and so complete is the organization of the oper-

ating forces that the actual work of the superintendent is less than that required on many smaller systems.

West Chicago Street Railway Company.

During the last year the Blue Island Avenue cable line of this system, which is under the management of John B. Parsons, has been put in operation, the legal complications which prevented the completion of the street tunnel having been removed. The new cable line is operated from two power stations, one located at Blue Island; the other, which operates the rope through the tunnel and city loop, being on Van Buren Street, both of which stations have been described in these columns. The winding drums of the latter station are independently driven by cotton ropes from the same pinion, while those of the Blue Island station are operated by intermediate gears. The winding drums in both stations are equipped with the Walker differential ring.

The tunnel grades are about 10 per cent., and as a precaution to prevent the running away of cars in case the grip fails to hold, a rack is placed in the surface of the track between the rails, which is designed to engage with a pinion mounted on the grip. The pinions, however, have not been as yet provided. The conduit of the Blue Island system is shallower than is usual in cable construction, being only two feet in depth, and a bottom grip is employed. This grip is working in a fairly satisfactory manner, but longer jaws are to be employed. The first tunnel rope on this system had a life of about seventy days, the traffic not being as heavy as it is through the Washington Street tunnel.

During the last year a duplicate rope has also been put in service through the Washington Street tunnel, which operates around the new loop which extends into State Street. The Milwaukee Avenue cars follow the course of the old loop and the Madison Street cars that of the State Street loop. This arrangement facilitates the movements of trains, gives the opportunity of loading and unloading without the trains interfering with each other, and has added much to the life of the ropes. The average life of the tunnel rope up to the time the duplicate rope was installed was only from twenty to thirty days. Since the two ropes were operated the rope on the State Street loop has a life of about sixty days, and that of the LaSalle Street loop seventy-five days, or an average of seventy days, and this notwithstanding that the rope of the State Street loop is depressed at five points for the purpose of crossing other ropes, once for crossing the other loop and four times for crossing the ropes of the North Side Company. The life of the ropes on the two main branches has also been materially increased, and is being increased from month to month. This result is partly secured because of improvements made in the rope by manufacturers, the purchases being made for the most part from Roebling and Hazard, but the chief factor in adding to the life of the ropes is due to the changes made in the position of deflecting pulleys, extra care on the part of the gripmen, and the employment of a softer metal in the grip dies (dies of rolled steel being employed, which are 25 per cent. softer than those formerly used), and a careful and constant inspection of the ropes.

The average horse power per car required for operating the cable lines of the West Chicago Company, including the friction of engine, machinery and rope, is three and a half horse power. This is for the ordinary size cars which weigh about 8,500 lbs. each. For hauling the combination cars, which weigh about 16,000 lbs., it requires an average horse power of five.



FIG. 11.—55TH STREET CABLE POWER STATION AND SIGNAL CAB—CHICAGO CITY RAILWAY.

ELECTRIC LINES.

Concessions having been secured from the city authorities, as noted above, for the employment of electric cars on the remaining horse lines of the West Chicago system, the work of electrifying a portion of the lines is already well under way, and the central power station will be located at the corner of Western and Washington Avenues on the property now occupied by the horse car barns and repair shops. New buildings will be erected, and the ultimate capacity of the station is to be 6,000 H. P.

North Chicago Street Railway Company.

This company is also making preparations to equip a portion of its lines for electric traction this season. The first lines constructed will be operated by power from the North Chicago Electric Company's plant, but a brick central power station is being built at the corner of California and Roscoe Avenues from which all the lines will be eventually operated. The ultimate capacity of this station will be 8,000 H. P., and the power equipment will consist of four 1,000 H. P. units, the engines being cross compound and manufactured by Fraser & Chalmers. Boilers of the Zell type will be employed. The generators are to be of the Siemens & Halske type of 500 K. W. capacity each. The smokestack is to be 200 ft. in height, with a fourteen foot flue.

The conditions of the new electric franchises for the North Side require the company to pay a license of $50 per car per year to the city. The new tracks are being

laid with an eighty-five pound Johnson girder rail seven inches in depth resting upon tie plates and brace chairs, the ties being two feet centers. A new car equipment is to be provided for the electric lines, and a sample car is now being built by the Wells & French Company, of Chicago. Both the open and closed cars for this system are hereafter to be finished in natural wood, ash being chiefly employed. All the cable cars are being equipped to be lighted by the Pintsch gas system, and improvements in other directions are also being made.

Superintendent Roach, of this system, is giving his special attention to the improvement of the ropes employed on the cable lines. As already noted in these columns, ropes manufactured by Cradock, of Wakefield, England, are employed in the LaSalle Street tunnel, which have had an unusually long life. The erratic life of ropes has suggested that possibly a composition metal can yet be found from which to draw a wire that will insure a longer life. The superintendent is of the opinion that the ropes break up from crystallization due to the effects from the grip chiefly, and that if phosphor can be removed from the metal the tendency to crystallize can be obviated. Experiments are now being conducted by the Roeblings with a view to accomplishing this result Samples of imported ropes are being analyzed by the superintendent, and he is also conducting experiments in. his own shops.

Some change has been recently made in the grips employed on these lines which has strengthened the device materially. In place of four separate plates in the grip shank three are employed. These are six inches in width in place of the four and a half inch plates, and now the grip never fails to hold the rope with heavy trains through the tunnel. The delays on these lines, due to the failure of grips or ropes, which were common in the early history of the road, are a thing of the past, and the lines are now being operated with great satisfaction to the traveling public. The lines are carrying a larger number of people than they did in 1892, but not as many as were carried during 1893, the increase being due to the World's Fair. It is also noted, as is the case with all the cable lines in the city, that the accidents during the year of the Fair were less in proportion to the number of people carried than in previous years.

The regular fare is five cents, and transfers are made over a number of lines. Employes ride on their badges, the number of the badge being reported by the conductor on his trip slip. The tracks of the cable line on Lincoln Avenue are being renewed with a heavy rail, the new construction being a seventy-six pound, six inch rail of special design.

The pay of conductors is $2.50 per day, gripmen and drivers $2.25.

Buffalo, N. Y.

The rapid transit system of the city embraces 128 miles of track, which is controlled by the Buffalo Railway Company, and the lines cater to a population of about 300,000. There are five outside lines operated by other companies, which serve as feeders to the principal system. During the last three years in which the system has been under the management of H. H. Littell, seven additional miles of track have been built, and four of the former car barns have been rebuilt to adapt them to the storage and repairs of electric cars, and five new car houses have been built.

The average number of cars operated is 180, which is often increased by the addition of trailers to 240 or 250. Included in the rolling stock equipment are thirty eight wheel cars.

The power equipment has recently been increased by the addition of two vertical compound engines of 1,250 H. P., manufactured by the Lake Erie Engineering Company. These are each coupled direct to Thomson-Houston 800 K. W. generators. One of these engines was employed last year in operating the Intramural road at the World's Fair grounds. The original equipment of the Buffalo station consisted in six vertical engines of the same type, of 600 H. P. each, and three 300 H. P. Ball engines of the tandem compound type. These operated nine Edison generators of 200 K. W. capacity each, and six M. P generators of the Thomson-Houston type of the same capacity. The boilers are chiefly of the Babcock & Wilcox patterns, there being two of the tubular type, and are all equipped with the Roney stoker. The boiler equipment has recently been increased by the addition of several large boilers of the Babcock & Wilcox type. The ultimate capacity of the station is said to be 3,000 H. P.

The station is located on the bank of the ship canal from which the water for condensing purposes is drawn. The coal is elevated and transferred by worm conveyors to storage bins, the conveyors being operated by an electric motor.

The feedwater pipe is provided with a thermometer which indicates the temperature of the water, the average temperature being 170 degs.

An economical feature of engine room practice is the boiling of the waste rags after being once used, which removes the oil and results in the saving of oil and waste, the rags being used over and over again. Linen rags are used in place of the ordinary waste, and care is exercised in the purchase that the stock does not include bosoms and cuffs, which are not adapted to use as waste.

The company is using a number of trucks which have been designed by the master mechanic of the company and which are built in the company's shops. These are designed for twenty-one foot bodies, and weigh 4,100 lbs. It is also employing a home made fender on many of its cars, which is adjustably attached to the truck, and is changed from end to end by the car men at the end of the routes. The design is simple and has proved very efficient in preventing serious accidents.

The repair shop has recently been equipped with a fair complement of new iron working tools; the wood shop is also provided with a number of wood working tools, which are all operated by electric motors.

Considerable new track is being laid, for which a nine inch rail is employed. This is replacing the rail of the Richardson type, which was formerly laid on chairs, and which is failing under electric traction.

The development of transit facilities is now keeping pace with the needs of this rapidly growing city, and it is the policy of the management to keep up with the demand, the improvements noted above being in this direction.

The Necessity of Good Brakes.

Improved methods of braking over those employing manual power, seem to be a necessity in these days of street railway progress. The old horse car, for which the hand brake was designed, and for which it always proved sufficiently satisfactory, not only ran at a much slower speed, and hence could be more easily stopped, but was much smaller and lighter, carrying, as it did, no heavy equipment. The inertia to be overcome in braking the modern cars has increased directly with the weight, and as the square of the speed at which they are driven. In other words, a twenty-eight foot, closed electric car weighing, say, 20,000 lbs. without passengers, and running at ten miles per hour, has sixteen times the energy to overcome when the brakes are applied than a horse car of one-fourth the weight and running at one-half the speed. At the same time the necessity of quick stops to avoid accidents has, if it has changed at all, been increased, because the horses of the horse car acted as a sort of advance guard, and would turn out of the track in case a person fell in front of a car, thus allowing ten feet extra distance in which to stop the car.

The fact that air brakes have been found superior to all others in steam railway service has naturally suggested the use of compressed air as a desirable agent for braking street cars, and the extensive adoption of them by the Third Avenue Railway Company, of New York, as well as other companies, seems to show that they are proving efficacious.

It has been well said that "half the fender is in the brake," and undoubtedly many of the accidents which have occurred on electric and cable lines could have been avoided had it been possible to stop the cars promptly by a quick application of the brake shoe.

Air Brakes on the Third Avenue Railway, New York.

The use of air brakes for cable cars has been given a thorough trial during the last few months by the officials of the Third Avenue Railway Company, New York. The test has occurred on the 125th Street and Tenth Avenue line of this company, and has been attended with marked success. This line of the Third Avenue Railway Company is operated under circumstances which emphasized the necessity of employing a more efficient brake than one operated by hand power. The routes covered are 125th Street from river to river and Tenth Avenue from 125th to 186th Streets. The first is the business thoroughfare of upper New York, and is always crowded during business hours with vehicles and shoppers, often calling for sudden stops to avoid accidents. Tenth Avenue is a succession of grades (some of which are shown in Fig. 1), and being the direct route to the pleasure resorts, Fort George, High Bridge and Van Cortland Park, is a road of very heavy traffic. Most of the cars run are mounted on double trucks, and all are of large size. These facts made formerly the employment of an extra gripman to help in setting the hand brake, a common occurrence. Such arduous conditions rendered the trial of any brake system particularly severe and made the result correspondingly interesting.



FIG. 1.—GRADE ON 10TH AVENUE LOOKING SOUTH FROM 145TH STREET.

At present there are 120 cars and trailers on the line equipped with the Genett air brake, the construction of which is familiar to our readers through descriptions in our former issues. These cars have been running continuously for a considerable time and cars are now stopped in much shorter time and on grades where formerly no stops could be made. A loaded thirty foot closed car, when descending a 9 per cent. grade at full speed can now easily be brought to a full stop within less than a car length, and in a much shorter distance than that if necessary.

A very good idea of the great inconvenience in operating the brake and grip lever is shown by the fact that hitherto harness has had to be worn by some of the gripmen on the cars operated without air brakes. As the operation of these hand brakes requires the expenditure of a great deal of manual force, the selection of gripmen has been naturally limited to those only who had great physical power and endurance, while on the cars equipped with air brakes any man of sufficient intelligence can act in the capacity.

A new application of air power was also made by the Genett Company on this road last month. This was its employment to operate the grip as well as the brake, both being controlled by the same handle, and one movement only being required to accomplish the results. Car No. 421 equipped in this way was put in operation about June 28, equipped by the Genett Air Brake Company, and up to the time of going to press with this issue had made all its daily runs without accident of any kind. The car is of the thirty foot Brill closed type and weighs, empty, 12,500 lbs. On the front platform are only two handles, the throw-off, which is used only at the termini of the lines in crossing over, and the Genett controller handle. The latter is arranged for three positions, one each for the following conditions: Grip closed with brake off; grip open with brake on; and grip open with brake off; the last being used in descending grades by gravity.

The advantage of having only one handle is to simplify the gripman's duties so as to make mistakes impossible. If in cases of emergency he has suddenly to move two or more heavy levers to avoid collision, the chances are more that a disastrous accident will result than if but one handle has to be moved.

Fig. 2 shows the old style car having different handles which the gripman was obliged to use. Fig. 3 shows platform of 421 car with the levers removed. There is no



FIG. 2.—GRIPMAN OPERATING GRIP AND BRAKE BY HAND POWER—3RD AVENUE RAILWAY.



FIG. 3.—GRIPMAN OPERATING GRIP AND BRAKE BY COMPRESSED AIR—3RD AVENUE RAILWAY.

need for levers on cars equipped with the Genett air brake and grip controller, and the absence of these is a boon appreciated no less by the gripmen than by the railway officials. What was formerly a hard thing to do has now been made so easy that a child, if necessary, could work the handle, although, as the Genett Air Brake Company says, "they do not recommend juvenile employes."

This new device marks a new era in the successful handling of heavy cars or trains in street railway practice.

Carrying the Mails in Brooklyn, N. Y.

The Atlantic Avenue Railway Company has recently completed at its shops, 24th Street near Fifth Avenue, an electric postal car. The car was designed by the officials of the railway company, assisted by the postal authorities

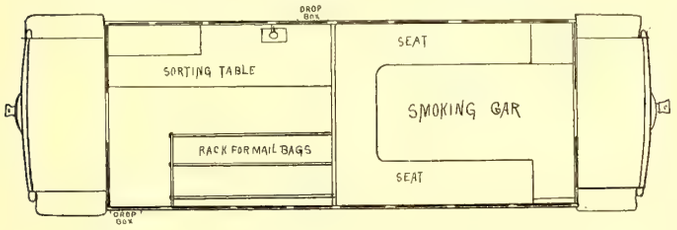


FIG. 1.—PLAN OF POSTAL CAR—BROOKLYN, N. Y.

of Brooklyn, and is patterned after the standard type of postal car used on steam railroad lines.

Only half of the car will be used for postal purposes, the other half being a smoking compartment. A plan of the arrangement of the car is given in Fig. 1. The car is of the Accelerator type, and along the side opposite to that where the door is placed is a shelf, above which are pigeon holes for distributing the mails. The rubber stamps for canceling and post marking are kept on this shelf. On the opposite side of the car are the pouch racks

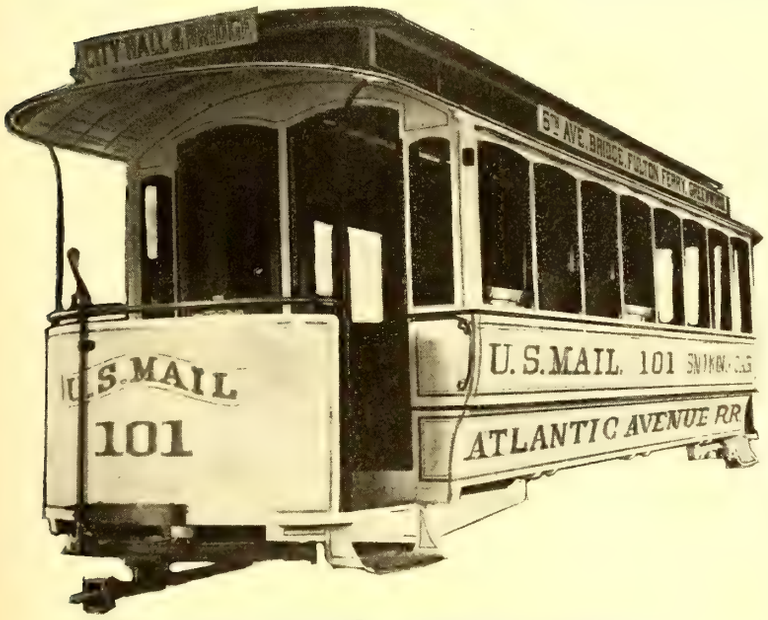


FIG. 2.—VIEW OF POSTAL CAR BODY—BROOKLYN, N. Y.

provided with bars and hooks for holding the mail pouches open. Drop letter boxes are provided at each corner of this compartment, as shown.

The exterior of the car presents a very handsome appearance. It is painted white, like the United States mail cars which are run on steam routes. The mail compartment is lettered in gold leaf, "U. S. Mail," the smoking compartment being lettered "Smoking Car." The windows are covered with wire screens. The car is mounted on a Brownell truck.

It is the present intention of the company to put two of these cars in service immediately. One will run on the following route: Starting from the Post Office, the car will go through Adams Street, Boerum Place, Atlantic Avenue to Fifth Avenue and then to 36th Street. The other car will run on the Brooklyn, Bath & West End division, and will stop at the following stations: West Brooklyn, Blythebourne, Bath Junction, Lessers Park, Van Pelt Manor, Bath Beach, Bensonhurst, Unionville and Coney Island.

Cars put in Operation by the People's Traction Company, Philadelphia.

The first electric cars of the People's Traction Company, of Philadelphia, were put in operation July 9, at 8 P. M. The line on which the cars were run was the 4th and 8th Streets, which is operated by the People's Traction Company. The regular service on this line was commenced July 11. The Girard Avenue line of this company was also put in operation last month. 100 cars will be used on these two lines and on the Germantown line of the company.

The track construction on the other lines of the People's Traction Company has been largely completed, forty miles, out of a total of seventy-five, being now ready for use.

The company has received 300 cars, including both open and closed types, from the builders, the St. Louis Car Company and the Lamokin Car Works. They are extremely tasteful in design, and are said to be as handsome as any in operation in any city. The open cars are of the ten bench type, and the closed cars are twenty feet inside measurement. Each car is lighted by ten incandescent lamps, including one on the back platform.

When the Girard Avenue line was opened a regular ovation was extended to the cars by the residents along the line. The streets were illuminated, and fireworks were set off as the first cars, led by one occupied by a band, were put in operation.

The power station, which is located at Delaware Avenue and Beach Street, contains direct connected Allis engines and G. E. 1,500 K. W. generators.

The Tallest Chimney in Canada.

A stack, which is claimed to be the tallest in Canada, has recently been erected by the Toronto Street Railway for its workshops, at the corner of Frederick and Front Streets.

The foundation for the undertaking was commenced March 3, 1894. When excavating, the solid rock was struck eighteen feet below the surface. Upon this was built the masonry and concrete foundation, forty feet square; this was stepped up to twenty-four feet at the ground line, upon which the large shaft is built. From the ground for fifty feet the chimney is square, and this point is marked by a string course of toothed brick laid on edge. From this the chimney is built circular with a slight batter to the top. A band of yellow brick registers the height of 100 ft. in the Greek key pattern, and another band in a different design shows the 200 ft. mark. The cap, which is 250 ft. above the ground, is three feet six inches high, and eighteen feet three inches in diameter.

The minimum diameter is twelve feet, and for a height of seventy-five feet the stack is lined with firebrick. There are two smoke entrances fifty feet from the ground, 7 × 11 ft. 6 ins., which are built circular top and bottom.

The stack was built by James Hill, of Toronto, from designs furnished by F. S. Pierson, chief engineer of the Broadway & Seventh Avenue Railway Company, New York.

Fenders for Newark Cars.

The Newark Board of Works has ordered that all trolley cars in Newark shall be equipped with life saving fenders before October 1, and has passed a resolution imposing a penalty of $50 a day thereafter for each car unprovided with a fender. The company has made many tests of patent fenders, and, it is said, has decided to accept an automatic one invented by S. A. Darrach, of Newark.

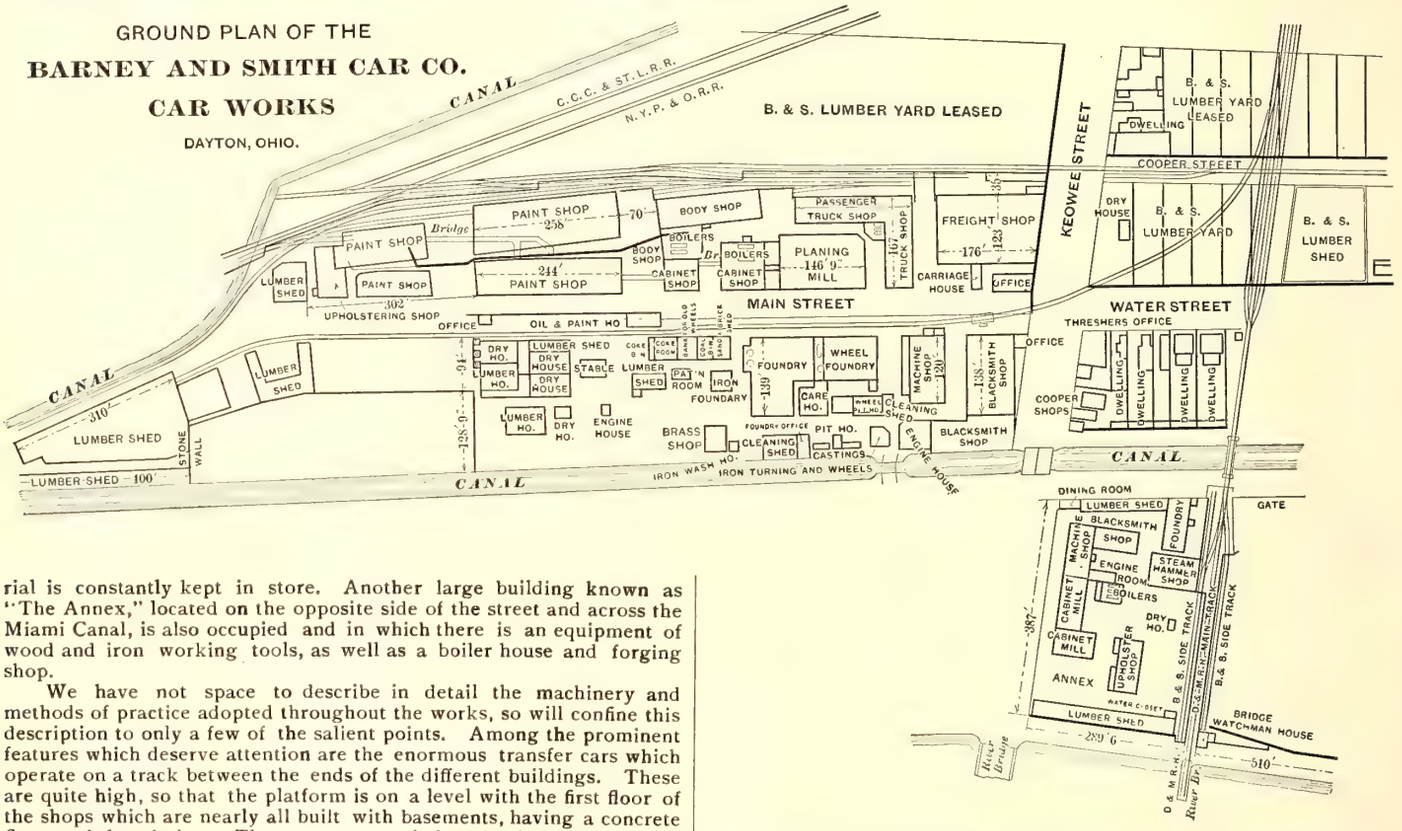
Some of the Principal Industries of Dayton, O.

Works of the Barney & Smith Car Company.

These works were started in 1847, and since have been engaged in the manufacture of steam cars both for freight and passenger service, including sleeping cars, and are now claimed to be only second in extent and capacity to the Pullman Works, at Pullman, Ill. The works employ in ordinary times 2,000 hands, but owing to the present industrial depression only 500 are now employed, and these are chiefly engaged in the manufacture of street cars, a branch of the business which was introduced about a year since, in which time over 200 cars have been turned out for street railway service. In this department the same practice prevails, as in the steam department, of manufacturing all parts of a car in the shops, including trucks and wheels.

Among the first street car equipments turned out were the four window vestibule cars, described and illustrated in our last issue in connection with the lines of the Cincinnati Street Railway Company, and in which the finish is of the same high order as that employed in the manufacture of steam cars, and which has given the company a wide reputation.

The works are located in the northeast part of the city on Keowee Street near the Mad River, and consist of a number of detached buildings conveniently located for the transfer of parts and material from one shop to another, as shown in the accompanying illustration, and in proximity to extensive lumber yards, in which a large stock of material is constantly kept in store. Another large building known as "The Annex," located on the opposite side of the street and across the Miami Canal, is also occupied and in which there is an equipment of wood and iron working tools, as well as a boiler house and forging shop.



We have not space to describe in detail the machinery and methods of practice adopted throughout the works, so will confine this description to only a few of the salient points. Among the prominent features which deserve attention are the enormous transfer cars which operate on a track between the ends of the different buildings. These are quite high, so that the platform is on a level with the first floor of the shops which are nearly all built with basements, having a concrete floor and foundation The movement of the transfer cars back and forth, and the loading and unloading of the new work as it passes from shop to shop is controlled by a large traction engine, which is designed to run on the ground or on a plankway, and which can be moved to any place in the yard, and which is also employed for the shifting of freight cars. The traction engine is provided with a large windlass operated by a small engine upon which a strong rope is wound, and which is employed for hauling the cars out of the shops and onto the transfer table, the rope being deflected round corners and in any direction by means of pulleys anchored at convenient positions. The shops are provided with smaller four wheel trucks on which the bodies in process of construction are moved about, and on which they rest until they leave the paint shop.

In the wood working department the tools are all of the latest designs, and adapted to the production of all possible shapes and parts, the policy being to have good tools, have them kept in good order and run at a high speed in order to produce first class work. The work is classified and finished on the machines particularly adapted for that class of work; for instance, the planers are not employed for dressing heavy oak timbers and then adjusted for the planing of boards, but machines are provided both for the timber and the board work, also separate machines for the freight and passenger work and street car work. This insures a good finish, as the tools are suited to the material in hand.

In the cabinet shop the material for the panels and other inside work is run through a scraping machine after being planed, and before being delivered to the sandpapering machines. The sanding machines are of the Invincible type, with the rollers carrying three grades of sandpaper, so that the parts when leaving the machine are smooth and ready for the finishing coats. The interior finishing for the street cars is hand rubbed and polished, after the practice adopted for finishing the decorations of the high grade steam work, three coats of varnish being sandpapered off in succession and then treated to an oil finish. The company manufactures its own three ply veneers for ceilings, there being a department set apart for this class of work, in which cauls, presses and gluing apparatus are provided. In the manufacture of veneers only the very best stock is employed. When ready for use care is exercised in selecting veneers of about the same color with which to finish the car, so that the light and dark shades are not mixed.

In the manufacture of cove and side panels for car bodies the material is first steamed, then bent to shape over slat forms, when it is transferred to the drying kilns where it remains until thoroughly seasoned. This prevents the panels from checking after being put into service.

In the manufacture of the hoods the individual boards are steamed and bent on a form so that the material does not spring after being put in service and cause the end of the dash to turn up, as is sometimes noticed after cars are put in service. The rim of the hood, when laid on a flat surface, touches at every point. Only simple stencil decorations are employed for ornamenting the ceilings.

A number of carving machines supplement the tool equipment of the cabinet department, which are located on the upper floor of the annex. With these machines many designs are worked out about equal to hand carving, but much less expensive.

Small trucks, with frames and boxes of various shapes, are provided for the convenient transportation of the small parts about the works.

Great care is exercised in the selection of the lumber employed in car building, and a large stock being carried it is allowed to become thoroughly seasoned in the yards before it enters into car construction, being also kiln dried, for which purpose kilns with ample capacity are provided. The yellow pine for sill construction is purchased for the most part from a region south of Birmingham, Ala., the same as is employed for the construction of steam cars. At one time Oregon fir was employed in these works for car sills in place of yellow pine, but was afterwards discarded, as after becoming seasoned it was found to turn brittle, and though having greater tensile strength when green than other timbers, it was found not suitable for this class of work. The oak employed is grown in the vicinity of Dayton, while the ash is purchased for the most part from dealers in West Virginia, and cherry comes from a number of the Western states, but which, as is well known, varies greatly in quality, but only the highest grades are employed in these works. Mahogany lumber is purchased in large quantities, and lots often remain in the yard for ten years before being used, so that it becomes thoroughly seasoned.

The iron shops are also equipped with a high grade of tools, among which are noted heavy punches and bending machines for forging the plates and braces for freight trucks. There are also a number of steam hammers for the manufacture of drop forgings, with a large assortment of dies for the forming of special parts. Numerous gang drills, wheel borers and other special machinery help to make up the equipment.

The foundry department is extensive, and a large number of moulding machines are provided for making the moulds for the smaller parts.

The wheel department of the foundry is provided with a traveling crane operated with wire ropes, and has the capacity for about 150 car wheels per day, the annealing pits being sufficient for the storing of

1,000 wheels. There are also auxiliary machines for cleaning, boring and fitting the wheels.

Among the street cars in process of construction we noted a large number of open cars being built for the Philadelphia Traction Company, and a large number of open cars with center aisles designed to be operated with a fare box, having doors and ends like closed cars with low platforms. One lot of open cars is provided with guards to prevent the passengers getting off on the wrong side. These consist of wooden strips extending the entire length of the car, about three inches in width and feruled to slide up and down on the outrigged bronze handles of the side post. These guards can be readily slid up by two persons against the eaves panel, where they are held by a heavy spring, and can be readily let down when required, the alternate sides being used, depending upon the direction of the car.

The trucks manufactured by this company are of a new design, and have been illustrated in previous issues. The side bars consist of I beams with an inch strip of wood between, and through which the bolts for holding the body pass. They are also provided with flat springs and have long bodies for an adjustable brace or bracket at each end to prevent oscillation.

Among the orders in hand were a number of cars which were being manufactured for a road in Texas.

The works are operated under the supervision of A. M. Kittredge, with W. Vose as assistant superintendent. Mr. Vose is well known in the steam railway field as the author of a work on car building which first appeared as a serial in the columns of the *National Car Builder*.

Brownell & Company's Boiler & Engine Works.

As a general thing there is very little of interest connected with a boiler shop. The usual opinion is that it is a noisy place, that most of the work is done by shears, rollers, sledges and hammers, and that seeing one is seeing all. But this is not the case with the works we are about to describe, for it is one of the most interesting plants we ever visited. The machinery employed and the tools and appliances for handling and adjusting the parts are numerous, of novel design, and are evidence of a high order of inventive talent. The employment of labor saving devices in all departments is the secret of the remarkable development of the business, and explains why, even in these dull times, the shops are kept running at their full capacity night and day.

The Brownell boilers have a wide reputation and are generally sold at prices which defy competition. The works also turn out stand pipes for high duty water stations, and high speed engines which are limited to about 150 H. P. The company has recently purchased the valve patents of what has been known as the Sioux City engine, and will manufacture this type of engines, but instead of straight valve automatic mechanism will be employed. The works occupy a large tract on the outskirts of the city to the west, the main structures being of brick and conveniently arranged for the transfer of the material from one shop to another. On approaching the works the principal building in the foreground is the machine shop, two stories in height, with a ground plan of 200×60 ft. The office occupies the first floor of a three-story tower at one corner next the street, the dimensions of each floor being 30×30 ft. The draughting room is above the office, and the third floor is occupied as a store room. The first floor of the main building is known as the machine shop, and the entire space is filled with iron working tools of every description and of the latest patterns, one of the principal machines being a twelve foot wheel borer. The second floor of this building is known as the pattern shop, and is equipped with the necessary wood working machinery. The blacksmith shop is next in order, with a ground space of 60×150 ft.,

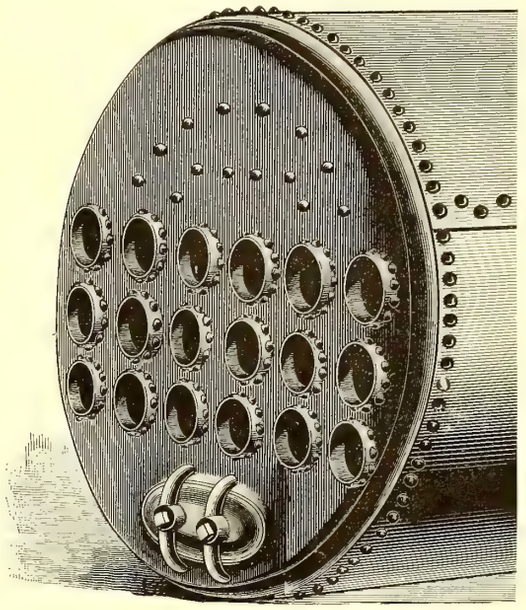


WORKS OF BROWNELL & CO., DAYTON, O.

in which are located nine forges. The boiler shop, which is the principal place of interest, is 200×50 ft., with an L at each end of 50×50 ft., and a wing to one side of 70×240 ft. This includes the sheet iron department and the flanging department.

The first machines which attract attention on entering the boiler shop are the Allen automatic riveting machines. These are operated by compressed air, and consist of a double long lever or shears to which the riveting apparatus is attached, and which will reach well within the boiler shell. A hot rivet being inserted, the first operation is to clamp the plates by pressure, when the hammer is started and the blows continue until the metal has partially cooled, which prevents the rivet from stretching. These riveters, of which there are a large number, are supported by a block and fall from an overrunning trolley, and can be operated in almost any position, being supplied with air from flexible connections. There is a set of twenty foot rollers for bending the boiler plates, which are among the largest in the country. By means of these rollers long bottom sheets can be bent, so that the boiler can be built with one continuous bottom sheet, when desired.

The flanging tools are among the most interesting portions of the equipment, and these comprise tools for the flanging of the flue holes in the flue sheets, and also for the flanging of the edge of the sheets. The flue sheets are first cut to the proper diameter, and then are



BOILER—BROWNELL & CO., DAYTON, O.

brought to a white heat in a large brick furnace in which crude oil is employed for fuel. From this they are moved on an iron truck to the flanging machine proper, in which they are centered in a horizontal position and permanently clamped, the edge at one side being embraced by a pair of horizontal rollers, about six inches in diameter, which are attached by a quadrant to a crank arm, and which when set in motion passes rapidly around the plate, the horizontal rolls gradually turning up at an angle, thus bending and forging the edge of the plate in one operation. The flue holes are then drilled in the ordinary manner, and when designed for large flues are each flanged, as shown above, by being heated one hole at a time over a flat forge, when they are transferred to the flue flanger which consists of a perpendicular spindle terminating in a head with small rollers set at a particular angle. The plates are shifted from the forge to the flanging machine by means of automatic jib cranes, of which there are a large number about the shops. The cranes are lifted bodily by means of pneumatic cylinders located under the floor, the perpendicular arm of the crane being a continuation of the pneumatic piston. There are also numerous flue scarfing and welding machines, heavy punches and shears and boring machines.

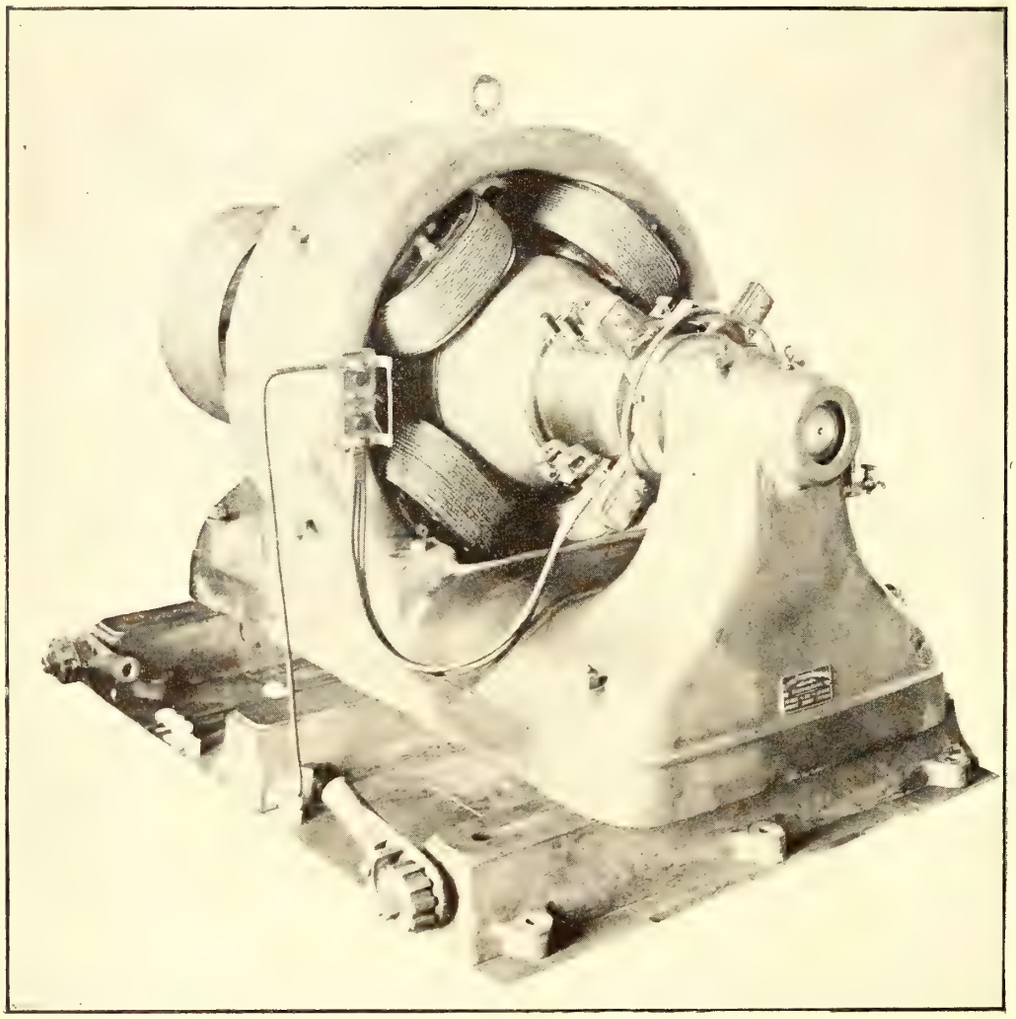
Parallel to the boiler shops proper is the shipping shed, which is 70 × 200 ft., through which a spur of one of the steam lines passes. Passing back through this we come to the engine and boiler room, in which are also located the large Ingersoll & Sergeant air compressors which supply the air for the riveting machines and for the operation of the cranes. Next this is the rattling room and the fitting department for the boiler fronts, which is 60 × 180 ft. The foundry is 200×60 ft., with a cupola located in an L near the center, and which is provided with automatic machinery in keeping with that in other departments. Next, and last, is the pattern storage building, which is of brick, 160 × 60 ft., with solid side walls, lighted only from the roof and at the ends, and is practically a fireproof building. The interior is fitted with racks and platforms with steps communicating between the different tiers, and admirably designed for the storage of patterns, which are classified and so labeled that any pattern can be readily found, the building in all respects being a model in the class for which it is designed.

Shawhan-Thresher Electric Works.

The shops of this company occupy a large building on Library Alley, just off main Street, and near the business center of the city, and are equipped with a full complement of new iron working tools. The company, however, anticipates moving into more commodious quarters in the near future. The business consists in manufacturing generators and stationary motors after the Shawhan patents, the designs being quite different from those of the motors and generators in ordinary use. Electric motors up to fifty horse power are known as the iron clad patterns, but the motors are of the multipolar type, and very like the generators. The iron clad motors are designed to prevent the dissipation of the lines of force, the surface of the fields remaining non-magnetic. The field coils are wound separately and are placed over the interior projections of the fields, and can be readily removed or replaced. The company is also about to begin the manufacture of a railway motor modeled after the design of the stationary motors.

The design is for a single motor flexibly connected to both axles, but without the employment of beveled gears.

Among the plants recently equipped by machines from these works is one at Kings Mills, O., operated by the Kings Mills Power Company. The plant is designed to generate and transmit electric power for various purposes. The power consists primarily of two Stilwell & Bierce Victor turbine wheels, of 250 H. P. each, and a 400 H. P. Buckeye engine, which is supplemented by two M. P. generators of 200 K. W. capacity, from which the current is transmitted to twenty-one motors of the Shawhan-Thresher manufacture, varying from twenty to 150 H. P. One of its generators is also employed in the Dayton & Soldiers' Home plant of the City Railway Company, which is referred to in another connection of this issue.



GENERATOR—SHAWHAN-THRESHER ELECTRIC WORKS.

Works of the Jenney Electric Company, Indianapolis, Ind.

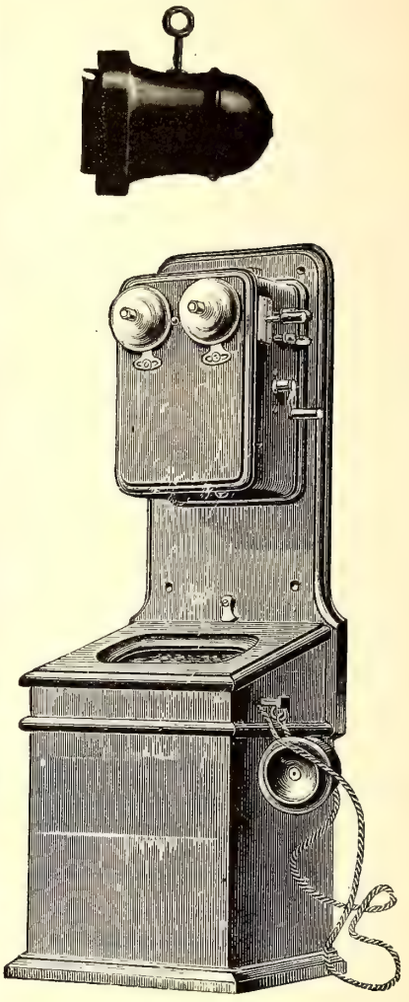
The shops of this company adjoin the works of the Woodburn Serven Wheel Works, and are admirably equipped for the production of first class work. The business has, however, outgrown its present quarters, and the company proposes soon to build more commodious shops near the outskirts of the city, when it will begin the manufacture of larger machines, and also generators and motors for railway service. The generators and motors now manufactured for power purposes range through all the sizes up to 100 H. P. and are adapted to all classes of stationary work, and are also employed to a considerable extent for the operation of electric launches. These machines are constructed with a single coil, with wrought iron field cores, and are designed to conform to the natural direction of the lines of force about a bar magnet. The fields are supported on a heavy base arranged to slide on ways for the adjustment of the belt tension. The armature shafts are made of the best crucible steel, and are mounted on self-aligning, self-oiling boxes with phosphor bronze bearings, the boxes having capacity for holding a large quantity of oil.

Another particular feature of the Jenney machines are the sectional brushes in which small carbon points are employed, each backed by a spiral spring which insures good contact with the minimum amount of friction, and allows of the brush adjusting itself to the surface of the commutator.

The company is named for Charles D. Jenney who devised the motor in 1886, having had considerable previous experience in electric work. Mr. Jenney was associated with Van Depoele when he manufactured his first generator at Detroit, and also studied at the University at Ann Arbor, Mich., under Prof. J. W. Langley, where he experimented along electrical lines and laid the foundation for his subsequent success in the electrical field. Mr. Jenney organized the original Fort Wayne Electric Company, and the Jenney Electric Motor Company, of Indianapolis, both of which companies were subsequently absorbed by the Thomson-Houston Electric Company, and later he organized the present Jenney Electric Motor Company, of which he is the secretary and treasurer.

The Columbia Telephone.

The expiration of the fundamental Bell telephone patents has enabled a number of companies to put on the market some excellent instruments for telephone communication. We present herewith engravings of the transmitter and receiver of the Columbia Telephone Manufacturing Company, of 136 Front Street, New York. Telephones have shown their value in a number of street railway plants for despatching cars, and now that the possibility of purchasing instruments outright at a low figure is certain, they will enter much more largely, we believe, into street railway service.



COLUMBIA TELEPHONE TRANSMITTER AND RECEVIER.

The long distance telephone transmitter of the Columbia Telephone Manufacturing Company resembles the ordinary type. It is of the microphone pattern, without any metal contacts or adjustable springs. The speaking diaphragm is made of a layer of thin veneer, and forms a portion of the top of the box. The receiver is very compact, being three and five-eighths inches long, and two and three-fourths inches at the broadest end. It is made of hard rubber, and all the connections are made inside, so that there are no thumb screws in sight.

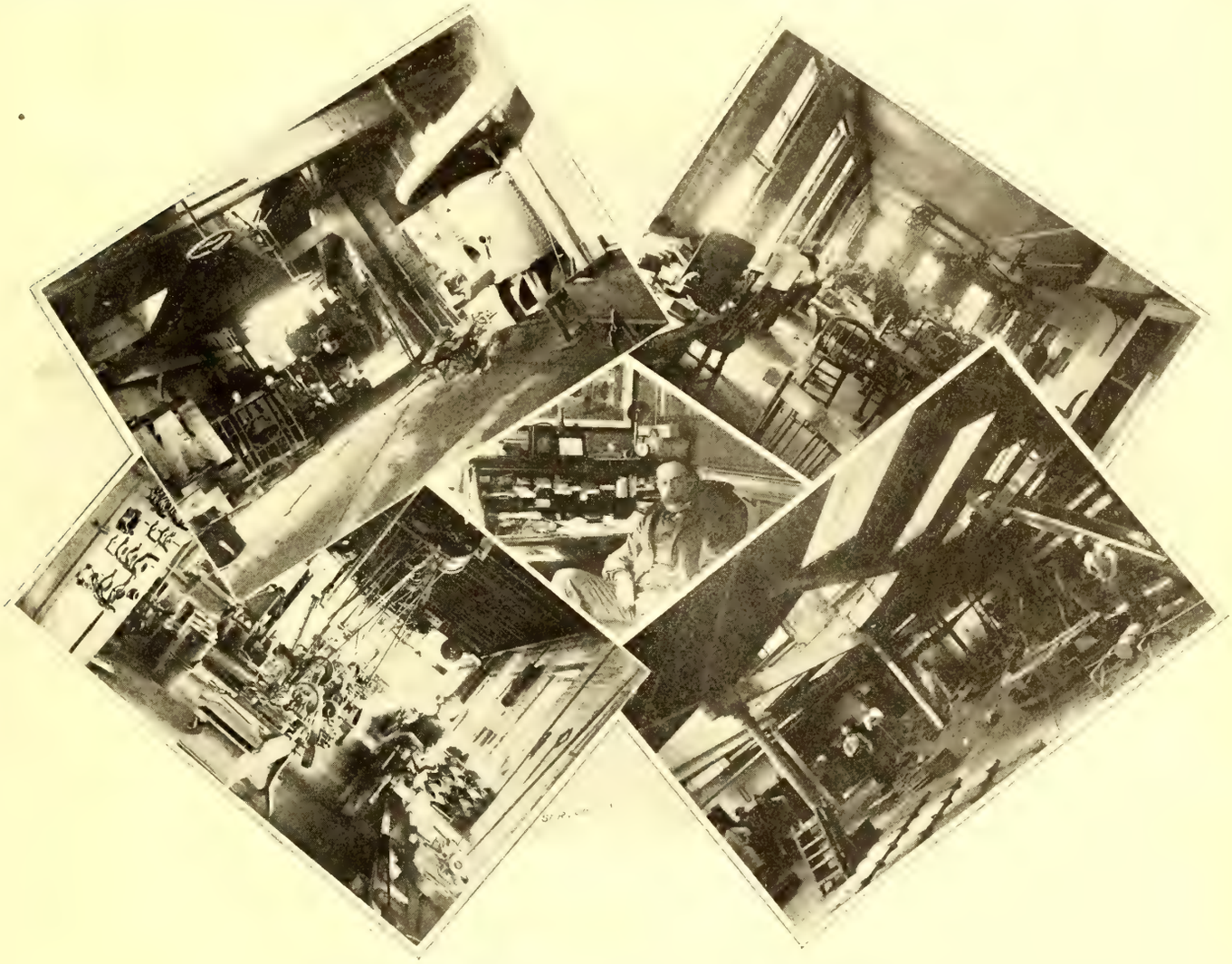
This company has also on the market an automatic switchboard for central stations, by which all operators are dispensed with. This device especially recommends itself to all places where, as in street railway work, a private exchange would be used. By this switchboard a user of any telephone can put himself in direct and immediate communication with the user of any other telephone. This is accomplished by providing each telephone with several keys by which one can call the number of the telephone he desires. Thus, if he should wish to call up telephone No. 142, he goes to his telephone, presses once on the 100 key, four times on the tens key and twice on the unit key, then rings his magneto bell which sounds the alarm bell of telephone No. 142. When the receiver is placed on the hook, automatic disconnection is immediately made, and the instrument is ready for another call. All this is done absolutely automatically, and no additional wires are required with the system.

THE West End Street Railway Company, of Boston, Mass., will build a new power house in East Boston.

The Works of the Fulton Foundry & Machine Company, Brooklyn.

The group of views given herewith shows a few of the different departments of the Fulton Foundry & Machine Works, of Brooklyn, N. Y. The works were founded in 1870, and the numerous departments are provided with the latest improved machine tools and appliances for turning out a finer grade of foundry and machine work for which this company is noted.

The works are located on Furman Street, near Fulton Ferry. The main building is a four story brick structure having a frontage of 100 ft. on Furman Street, and extending through the block to Columbia Heights. A view of the main foundry is shown in the lower right hand corner of the group of views. This department is 100 × 200 ft., and



WORKS OF THE FULTON FOUNDRY & MACHINE CO., BROOKLYN.

is equipped with all the necessary appliances for floor and bench work and the heavier castings. Large skylights are provided, affording abundance of light and ventilation. A part of the foundry annex with cone room and cupola is shown in the upper left hand view.

The machine shops, which are four in number, are 25 × 70 ft. each, and are fully equipped with the most improved types of machine tools, together with a number of machines designed by the company for the finishing of special work. One of these departments is shown in the lower left hand view in the group.

The needle room, shown in the upper right hand corner, is located in the third story of the building fronting on Columbia Heights. The dimensions are 30 × 100 ft., and it is provided with large windows on three sides, furnishing sufficient light for the delicate work required in this department.

One of the specialties of this company is the manufacture of electrical machinery, and facilities have been provided for turning out all kinds of power and lighting appliances from the drawing to the finished machine.

In addition to the above mentioned shops, there are numerous other departments, including the draughting room, wood working and pattern shops, with facilities for making wood and metal patterns. There are also shops for silver and nickel plating, enameling and japanning, and a complete brass foundry, with buffing rooms and the necessary machinery tools for finishing the work.

The company also makes a specialty of experimental model work, an important feature being the facilities for finishing the work complete on the premises.

The works are under the supervision of the proprietor, E. B. Wilcox. Mr. Wilcox was one of the founders of the Wilcox & Gibbs Sewing Machine Company, and has had long experience in the manufacture of high grade machinery. A view of Mr. Wilcox's office forms the center of the group.

An Improved Electric Snow Sweeper.

The Brooklyn Railway Supply Company, of Stamford, Conn., which has been prominent in the sweeper business for a good many years, has placed a new electric sweeper on the market. This machine is designed to meet all the requirements of the electric roads, and is claimed to have a very high efficiency, owing to the manner in which it is constructed and the way the broom is operated. The frame is of the best Eastern white oak thoroughly seasoned, and is made especially heavy and strong to fully stand any strain that may be put on it. It is a regular double ender. There is a broom at each end of the machine, and each broom is long enough to sweep the entire track to a width of eighteen inches outside of each rail, a distance wider, it is claimed, than any other machine. Only one broom is in operation at the same time, which makes it very easy to operate, and avoids the necessity of employing experienced men in its use.

One especial advantage in using this machine is that it can be used on any standard truck that is now on the market. It can be put on and taken off the truck like any car body; so if anything should happen to the truck or motors, the sweeper can be changed to another truck without interrupting the work.

The nearness of the sills to the rail (twenty-three to twenty-eight inches, depending on the height of the truck) gives, it is claimed, double the strength and stability of other types of snow sweepers that are forty inches from the rail.

A Handsome Publication.

The Portland Railway Company, of Portland, Me., has sent us a handsome souvenir, being essentially a guide to the points of interest on the line of the street railway company in that city and the suburban branches. The pamphlet gives a history of the city, a description of the interesting points, picturesque and historical points about the city and a large number of handsome illustrations.

The Walker Standard Generator.

In placing upon the market a line of direct current generators especially designed with a view to the very exacting requirements of railway work, it has been the aim of the Walker Manufacturing Company, to avoid as fully as possible the introduction of novelties and untried features, and to produce a type of machine which should combine all the long tried and well proven elements of dynamo-electric machinery that the best engineering experience could suggest. It is confidently believed by the company that this aim has been accomplished in the apparatus now being put upon the market.

In general these machines are notable for their beauty and strength of design and their commercial efficiency. The frames, excepting the largest sizes, are cast in only two pieces—the upper half of the yoke and the poles, and the lower half of the same with the standards for the bearings.

The armature is proportionally of large diameter, is of very low resistance with ample cooling surface, and will stand an overload of 50 per cent., without the least injury or sparking for as long a time as the emergencies of railway practice would ever be likely to demand.

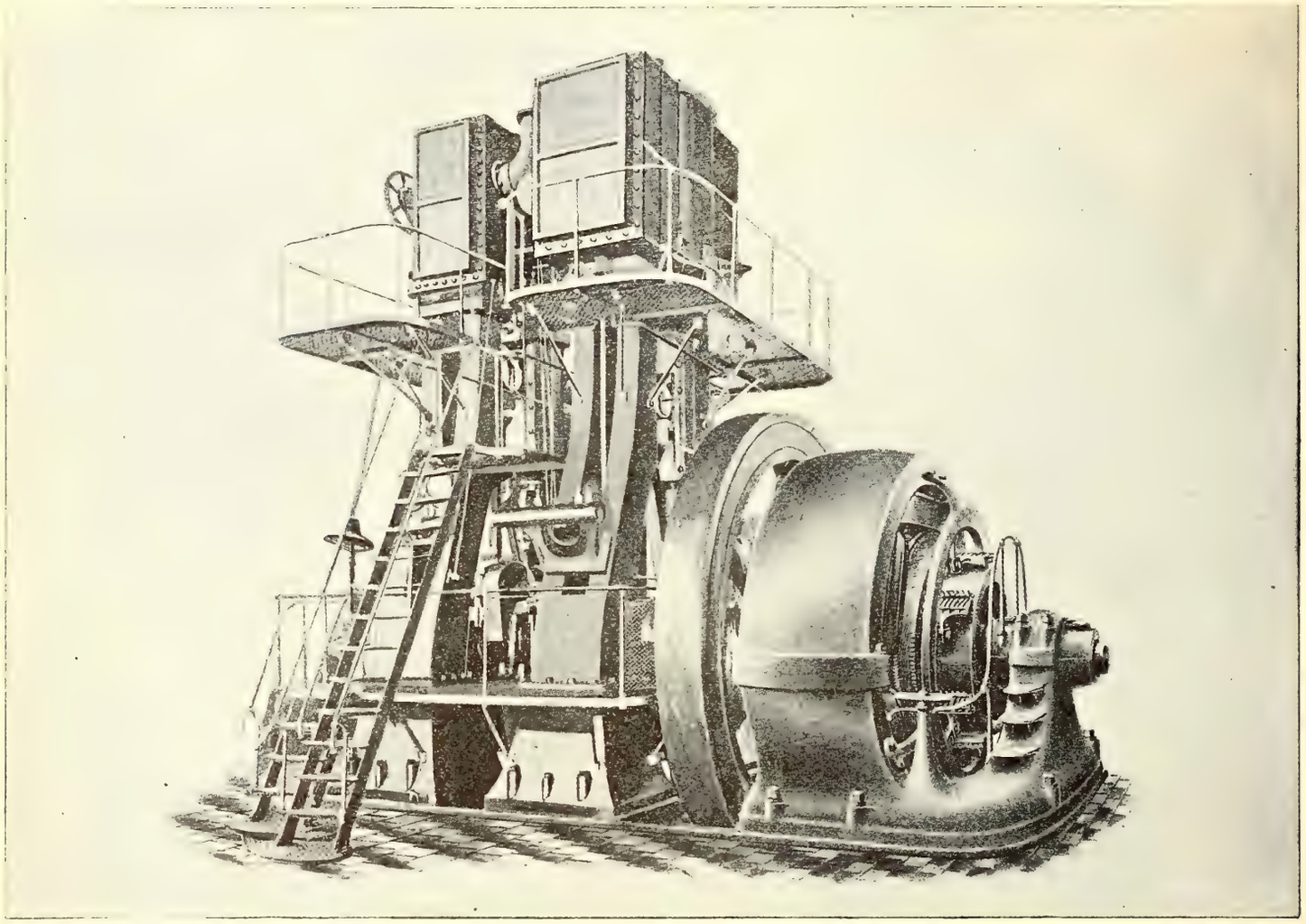
It is of the iron clad, drum type, built up of the best quality of annealed armature iron. The plates are again annealed after being punched, and then insulated with a thin coating of enamel. They are compressed into a solid core under a hydraulic pressure of 100 tons. The foucault and hysteresis losses are reduced to a very small amount.

In the smaller machines the windings consist of heavy copper wires so arranged that no wires cross within an inch of one another, and there are no joints except at the commutator bars. In the larger generators flat bars are used, but here again they are bent to shape before being applied in such manner that there are no joints except at the commutator end. The resistance being very low, the heat loss is small and the armature runs cool under all conditions. The winding is the two-path type, and the pole shoes and armature teeth are so shaped that there is absolutely no sparking at any load, and no shifting of the brushes required.

The insulation is most thorough, and will readily stand ten times the normal pressure. The insulating material is a combination of mica with a fibrous material of great toughness and durability, and it is everywhere tested to 5,000 volts alternating. This type of winding lends itself admirably to the most perfect insulation. The armature body is strongly keyed to a heavy cast center, and is so constructed that when running both it and the armature have a strong current of air circulating through them. The teeth are of such shape that they effectively hold the windings in place and no binding wires are required or used.

The shaft is heavier than is customary in usual practice, and its journals are exceptionally long and large in diameter, thus, at the same time, both reducing the pressure per square inch and providing a larger cooling surface, and in practice they have been found to run cool and give absolutely no trouble.

The magnets are of the well known iron clad type. The coils are machine wound, the shunt series being made up in separate, independent bobbins, and encased in the same manner as the motor coils, with a moisture proof covering. This method renders the insulation especially effective and durable, as there are no metallic washers or spools, which, being very difficult to insulate properly, have consequently often given trouble in machines of other makes through the grounding of the coils. The coils are held firmly in position by means of brackets bolted to the pole pieces. Their inside dimensions are such that a space between coil and pole on all sides allows of a good circulation of air. By this means in these machines a lower running temperature with a given amount of copper is attained than is possible with the metallic spools used by other makers.



DIRECT CONNECTED VERTICAL ENGINE AND WALKER GENERATOR.

The poles are made of soft laminated iron cast into the yoke. With this laminated form of construction, together with the particular form given the armature tooth, and the special shape of the polar face adopted after much experimenting, as being the most effective, all heating of the poles from eddy currents in the iron, and all sparking and shifting of the neutral point has been entirely overcome. On all sides of generators the magnet yoke is cast in two pieces, and the top half can be readily lifted off, when it is desired to remove the armature. These railway generators are compound wound, and can be made to overcompound any amount desired up to 20 per cent. They are provided with a hand regulator for adjusting the shunt coil, this regulator being of the well known enamel type, occupying a very small amount of space on the switchboard.

The bearings are of the ball and socket, self-oiling type. The frame being cast in one piece and all the boring being done in one setting, the armature is always necessarily truly concentric with the field bore. The oil rings are made to run in the opposite direction to that of the shaft. By this means a more efficient deposition of the oil is obtained. The boxes are lined with the best quality of babbit metal and where a good quality of oil is used no trouble need be feared from heating. In the smaller machines, which have two and three bearings, the oil wells are all connected together by half inch piping, so that in renewing the oil it is all drawn off from one tap, and in refilling the

filling of one reservoir fills all. Sight gauges indicating the oil level are provided. Special precautions are also taken to prevent any leakage along the shaft.

The brushes are held against the commutator in a manner that prevents the chattering and singing noise of the carbons, and causes them to wear smoothly and evenly. They may be easily and quickly removed for inspection, or dressing. The commutator is large enough to allow of ample brush area, thus permitting the brushes to run with a low current density and with a light tension. Coolness in running is in this way assured, and this feature is also aided by the current of air which constantly circulates through the interior of the commutator shell. The field and armature cables are brought out to heavy, substantial terminal blocks, and massive clamps are provided for the switchboard leads. The pulleys provided for the smaller belt driven machines are very heavy and strong, and a sub-base is provided with belt tightening mechanism.

The standard switchboard is of the panel type, each panel containing all the necessary instruments switches, etc., corresponding to one generator.

New Motor and Controller.

Engravings are shown on this page of the improved type "C" motor and series parallel controller, manufactured by the Steel Motor Company, of Cleveland, O. This company has been engaged for a number of years in supplying repairs for all types of motors, and is therefore in a position to observe the undesirable features of the various types, which were naturally avoided in the designing of its own. The aim of the designers has been to produce, first of all, a substantial, well built motor of few parts, simple in construction and easily understood, with all parts requiring renewal so made as to have great wearing surface, and replaceable at small cost.

The motor of this company, shown herewith, is claimed to possess, not only these desirable features, but to also be high in electrical and mechanical efficiency, and to be the lightest motor per unit of actual horse power delivered to the axle on the market.

The armature is of the drum type, and contains ninety-nine coils wound in slots, the wire being carried well below the surface of the core; ample provision is made for perfect insulation. The fields are wound on metal shells, thoroughly insulated, and by an ingenious arrangement of the pole pieces, the armature or either of the fields can be removed independent of the others.

The type "C" controller (Fig. 2), used with this equipment, is designed to have all the advantages of existing types of series parallel controllers, is simple, and provided with a device whereby a single motion of the reversing lever to a point indicated, makes it a straight multiple controller. In connection with the double fuse box (contained in the controller), either motor can be cut out in an instant, and without leaving the platform.

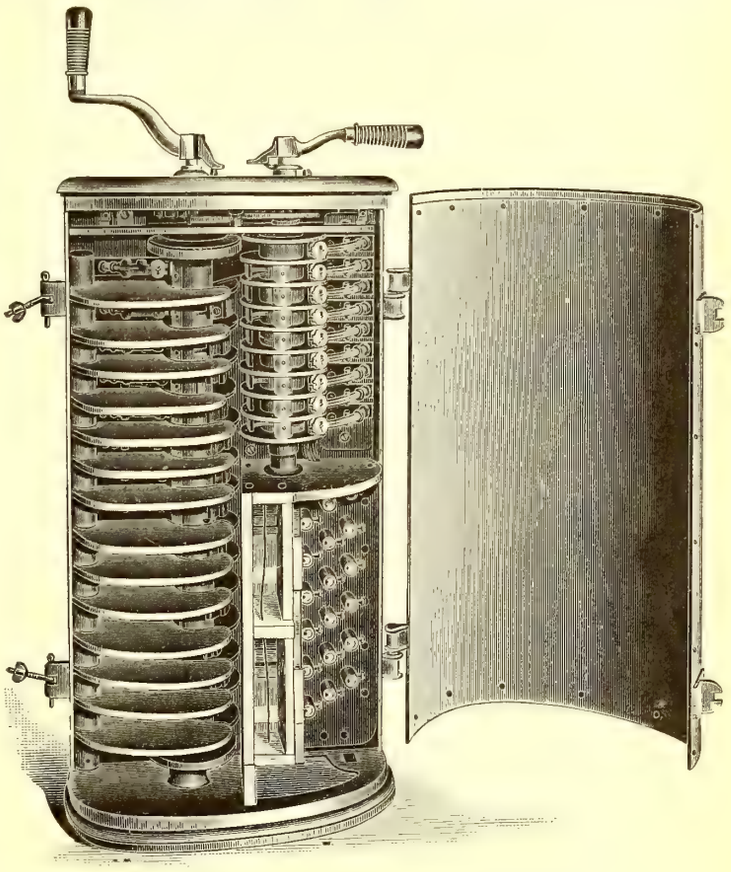


FIG. 2.—CONTROLLER—STEEL MOTOR CO.

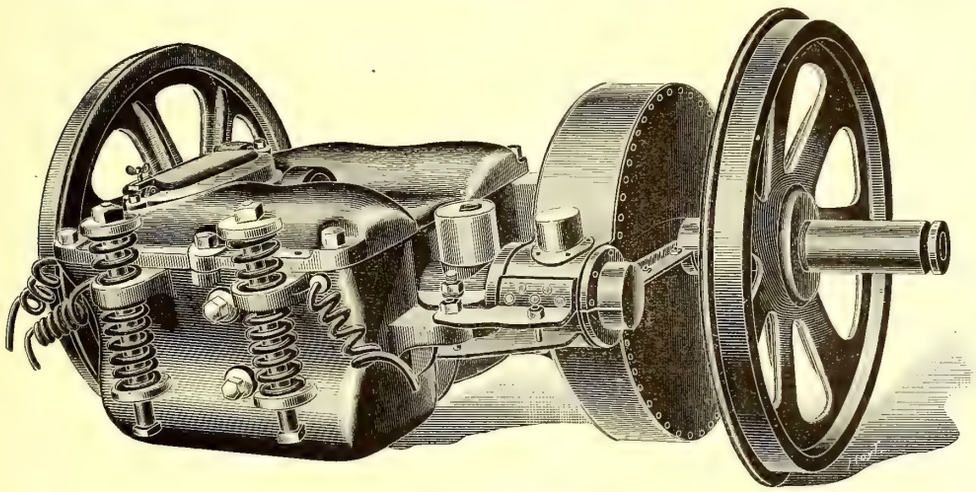


FIG. 1.—MOTOR—STEEL MOTOR CO.

In addition to the regular disks separating the contacts, vulcabeston guards are inserted between them, effectually preventing an arc from forming. These guards are hinged at the side of the controller, so as to be readily thrown back when the jacket is opened. The resistance coil used in starting the car gradually is simple in construction, entirely protected from water, and practically indestructible in ordinary service. A unique feature of this equipment is the substitution of a very simple and inexpensive device for the cutting out of the loop in the field when the highest speed is desired; the device is isolated from the motor proper, and so arranged in connection with the field that most of the danger of the field burning out by an overcharge of current is eliminated. The manufacturers have not, until recently, pushed this motor to the front, preferring to await the test of actual service before advertising it extensively, but now, after two years' operation under various conditions on some of the most difficult roads in the country, in which the motors have won unstinted praise, they offer their equipment for the consideration of the street railway fraternity. Among other equipments this company has filled two orders, aggregating 100 motors, for the Cleveland Electric Railway Company, and has just completed its fourth order for the Allentown & Lehigh Valley Traction Company. The company is now working on 120 motors for the Nassau Electric Company, of Brooklyn, N. Y., as well as on a number of smaller orders for different parts of the country.

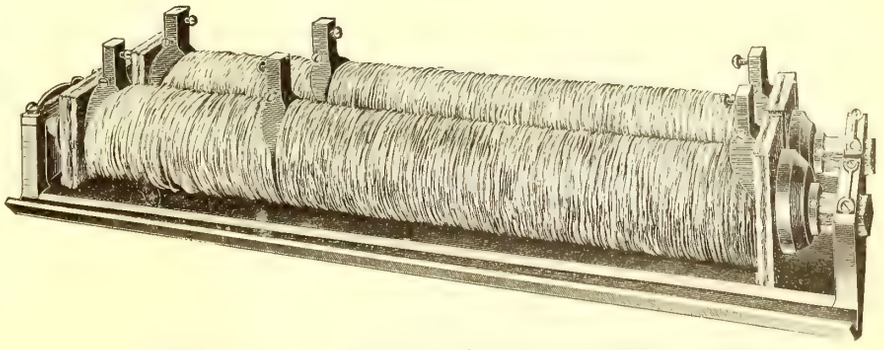


FIG. 3.—RESISTANCE COIL WITH COVER REMOVED—STEEL MOTOR CO.

THE Delaware Valley Railway Company, of Stroudsburg, Pennsylvania, with a capital of $1,000,000 was chartered June 28. The officers of the road are: Ellicott Fisher, of 343 South Front Street, Philadelphia, president; Michael W. O'Boyle, secretary; Simon Friedberger, treasurer. Mr. Friedberger, who is treasurer, is also treasurer of the Wakefield Electrical Engineering Company, of Philadelphia. Among the other incorporators are G. H. Lang, Joseph S. Pottsdamer, and Louis Lang. The company will construct and operate forty miles of road, from Port Jervis, N. Y., to Stroudsburg, Pa.; a large force of men will commence to equip the work at both ends of the line at once, and at least twenty-five miles of track, it is asserted, will be built before the end of the present year.

Automatic Oiling System.

A new system of automatic lubrication for central station machinery has recently been placed upon the market by the Wilson-Whiting-Davis Oiling Company, of the Mutual Reserve Building, New York. The system insures a proper delivery of oil under air pressure to all moving parts, and does away with manual labor required where hand feed cups are used. The saving in oil has been found to be from 20 to 40 per cent. There is also manifestly a great saving in attendance for a varying amount, depending on the number of attendants employed. The system is also positive in its action, there being no danger of neglect in filling the cups and no danger of the spilling of oil about the floor.

Fig. 1 shows a tank into which the oil is pumped from a supply tank, barrel or filter, as the case may be. It is forced from this tank by means of air pressure generated by a Westinghouse, or other, air pump, to the various points to be served, the oil first passing through filters below the tank and then into the main line of piping. The oil cups, into which the oil is delivered at points of consumption, are shown in Fig. 2. They are of brass or nickel plated, and are tested to stand any strain which can be brought upon them. Each cup is controlled by a separate valve, and may be adjusted by a screw at the top, so as to exactly regulate the feed while permitting the instant flooding of any bearing if required. Each branch of piping and each separate machine is also controlled by a separate valve; hence, when a machine is idle only the one valve requires closing and all cups on its line cease feeding.

The waste, which is very small in amount, can, if required, be returned to the reservoir by the gravity pipe system.

Two filters are provided on the main supply pipe so as to admit the use of one in case of the other needing repairs or cleansing. This main outlet, inside the tank, extends several

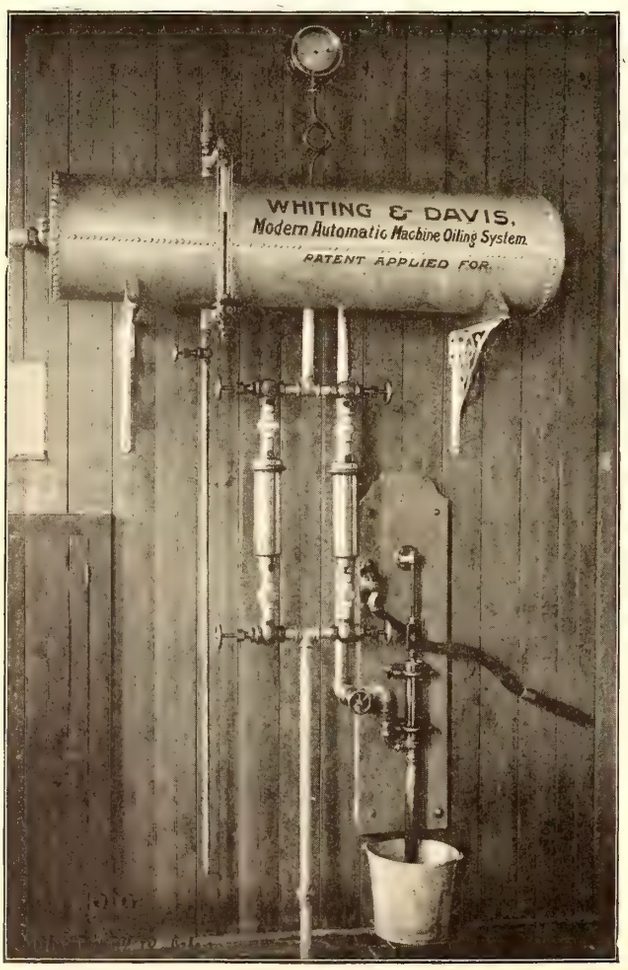


FIG. 1.—RESERVOIR—AUTOMATIC OILING SYSTEM.

inches above the bottom, to prevent the entrance of any foreign substance into the main feed line; when the gauge indicates the presence of substances or water, the same may be drawn off by sediment cock and branch shown below the tank.

The company has also applied the system to cylinder lubrication to replace the ordinary method of lubrication in which the oil passes through water. The system employed is similar to that already described except that a greater pressure is employed, it being necessary to more than counterbalance the steam pressure in the pipes.

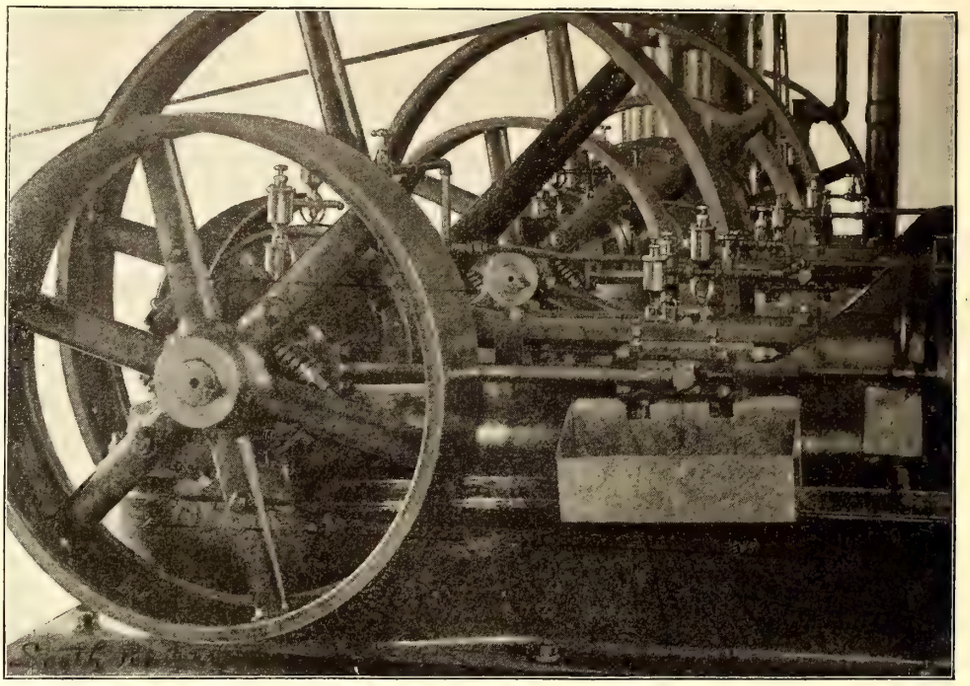


FIG. 2.—ENGINE EQUIPPED WITH AUTOMATIC OILING SYSTEM.

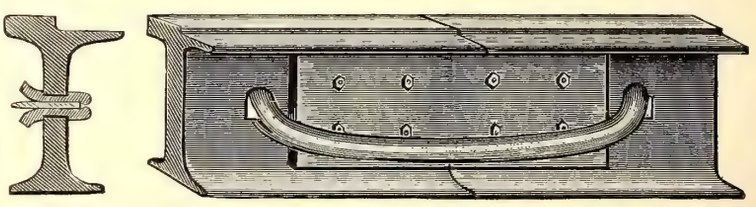
If the latter is sixty pounds, the air pressure used in the oiling system would be about sixty-five pounds and the oil fed to the cylinder as through an ordinary oil cup.

The system has been installed in a number of stations with very successful results. Among other places where it is in use can be mentioned the lighting plant in the Equitable Building, 120 Broadway, New York. Here a marked saving has been noticed in oil, and the system is giving excellent satisfaction.

The officers of the company are: President, William Wilson, Jr.; first vice-president and general manager, Morton E. Davis; second vice-president, James M. Wilson; treasurer, Charles H. Wilson; secretary, Louis A. Chandler.

An Improved Rail Bond.

We illustrate in the engraving herewith a bond which is intended to carry the same amount of current as triple lacing with channel pins. At the same time it is claimed to require less labor and be more reliable in its results. It is made out of soft copper rod of the same diameter as the hole in the rail, and is bent and slotted at each end. After being inserted in the rail a hardened steel wedge, somewhat larger than the slot, is driven into the bond at the bend. It is forced in sufficiently far so that the soft copper can be closed over it, preventing the wedge from slipping out. The action of the wedge is to spread the



IMPROVED RAIL BOND.

bond over the edge of the hole in the rail, and to force apart the split ends as well.

As shown in the cut, the web of the rail has been distorted so that the work which the wedge does can be more clearly seen. In this way the bond is practically riveted, and a perfect and permanent contact, unaffected by any vibration of the rail, is obtained. The bond can also be made of No. 0000 wire, effecting the same purpose as double lacing. The bond is manufactured by the Technic Electrical Works of Philadelphia.

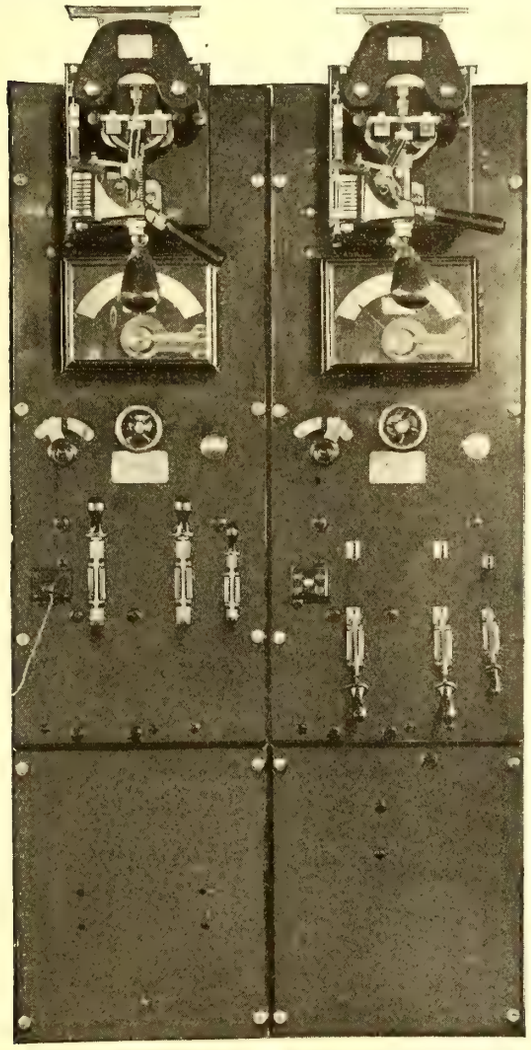
The work of bonding, as stated above, can be done very rapidly, and only a hammer and a cold chisel to open the slot at the bend are necessary.

New Type of Switchboard.

The General Electric Company has recently brought out a new type of panel switchboard, shown herewith, for which a number of special advantages are claimed.

Briefly, the system of the switchboard construction, while becoming greatly simplified, is rendered very compact and convenient. All the instruments necessary for the control of each generator are mounted together on an incombustible base, and are electrically connected before leaving the factory. Each panel may be erected in position without difficulty or delay. Being of uniform size, it may be bolted by the side of other panels already in place, and the switchboard extended as the capacity of the station increases, without taking away from its uniformity.

These new standard panels are known as type "K," and are constructed in capacities of from 200 to 3,000 amperes, corresponding to the generator outputs of from 100 to 1,500 K. W. The controlling de-



NEW TYPE OF SWITCHBOARD.

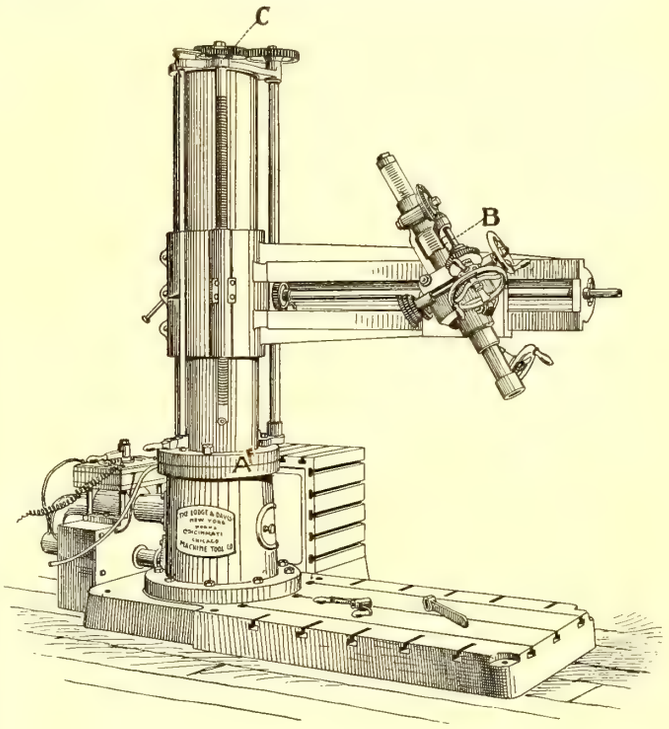
vices mounted upon each panel are the circuit breaker, current indicator, rheostat, main field and lighting switches, together with the lightning arrester and cut-outs required for the protection of generator and instruments. A double pole, plug switch allows of connection with either a portable or station voltmeter placed in some convenient position. The panels of from 200 to 1,000 amperes capacity are of the same width and height, and, in the latter dimension, are similar to the feeder panel. The illustration shows two panels of 400 amperes each.

The automatic circuit breaker is intended to relieve the generator of the severe strain caused by short circuit. The tripping armature is fitted with an adjustable spring whereby the circuit breaker can be set to open at any desired point within the range of the instrument. The current is nominally carried through a main contact in shunt to a contact operating within a magnetic blowout. Thus, when operating no arc occurs at the main contact. This circuit breaker will effectually rupture any short circuit, however severe. The armature is provided with a scale eighteen inches long, which may be easily read at a distance. The positive and negative main switches, and the station lighting switch, all of the quick break type, are mounted on the panel, the equalizing switch being mounted on a pedestal near the generators. In the lightning arrester the special feature is an iron clad electric magnet, in the field of which are two carbon points slightly separated, the line and ground each being connected to one of these points. The magnetic blowout principle, as in the automatic circuit breaker, is here employed with unvarying reliability. The incombustible controlling rheostat is placed behind the board, and is operated by a hand wheel shown on the front. The generator terminals are connected by a small four-point plug switch with an illuminated dial voltmeter mounted on an adjustable bracket fastened near the top of the panel.

The panels are supported by vertical angle irons, tie rods and brackets. They are wired complete, and after setting in place it is only necessary to connect the leads from the generators and bolt in place the bus bars which run horizontally back of the switchboard.

Motor Driven Radial Drill.

The accompanying illustration is of a new half radial drill, designed to be driven by a direct connected motor. The motor is of the iron clad type, entirely covering the armature, pole pieces and field coils, with commutator and brushes extending outside of the motor housing. It is free from external magnetism, which is necessary in order to keep small particles of steel and iron from adhering to the drill. The armature is mounted on a bronze spider which is attached to the cone pulley. The controlling lever is arranged on top of the motor, and by a semi-circular movement of the same all forward and backward speeds may be instantly obtained. This, together with the back gears at the rear of the swinging arm, gives, not only a much wider range of speed than can be obtained by a cone pulley, but a much more finely graduated speed.



MOTOR DRIVEN RADIAL DRILL.

The column swings around an internal stump, and rests, at its lower flange, A, on balls to insure easy movement. The thrust on the elevating screw at C, and the drill spindle at B, is also taken up by ball bearings. The drill head is moved on the arm by a hand wheel, rack and spiral pinion, which is always within reach of the operator. The spindle is spring balanced, and fed by a rack and pinion in connection with the quick return, which can be instantly released, a valuable feature for tapping. The feed is obtained by pin gearing, and can be changed while the drill is running. This tool is built by the Lodge & Davis Machine Tool Company, of Cincinnati, O.

High Insurance Rate on a Car House.

An extraordinarily high rate of insurance has been fixed by the New York Tariff Insurance Association upon the new car house of the Brooklyn City Railroad Company, at Third Avenue and 58th Street. The structure is the largest of its kind in the country, and covers a block 700 × 200 ft. Cars are stored on three floors, and it contains several miles of tracks. The rate fixed for insurance on the building is 6 per cent. per year, and on the contents 5.55 per cent.

For the last three years the City Railroad Company has insured its own property, but six weeks ago it was decided to seek insurance from the regular companies. The rate expected was 1.5, which had been what was charged when the company sought insurance before. But the advanced rate was fixed upon the excuse of an increased danger of fire from the use of electric traction. At the office of the Tariff Association, in New York, it was said that the rate had not been advanced, for there had been no rate for the building until the one recently fixed. It was decided upon from experience with like property in other parts of the country. There have been large losses in the last few years where electricity was used as a motive power.

The Mather Improved Generator.

The generator shown in Fig. 1, and which has recently been put on the market by the Mather Electric Company, of Manchester, Conn., is of an entirely new design and contains a number of important features. The railway generators are wound for a nominal voltage of 500, but, having a rheostat in the field circuit, the potential can be raised to 600 volts without undue heating, and even 50 per cent. overloads will be borne for short periods without injury to the machine.

Automatic alignment is secured by the use of ball bearings, which adjust themselves and can never bind on the shaft. The supports for the bearings and the entire bed plate are cast in one piece, a construction which gives great strength and rigidity to the bearings, and secures the greatest possible freedom from vibration. There are four sets of brushes used, each brush being held in an independent holder.

The armature core is built up with thin disks of soft iron which are forced together under pressure and rigidly keyed to the shaft. All washers used are first treated to an improved annealing process, with the result that the armatures when revolving in the most intense magnetic field will only heat up to a few degrees above the surrounding temperature. The greatest care is taken in the insulation of these armatures. Before winding, there is fitted into each slot a carefully made mica duct, through which the wire is wound, and nothing but the very best mica and insulating material is used throughout the whole construction.

The winding is of the simplest form possible; the simplicity being particularly noticeable at the ends, where the wires, instead of being overlapped and bunched together, stand out from the core and from each other, thus allowing free circulation of air around every conductor. No wires having a large difference of potential are adjacent to one another.

The necessary voltage is secured by revolving a comparatively small number of coils of wire in a powerful magnetic field, rather than by using a large number of coils and weak field, as is the usual practice. The small amount of wire on these armatures results, in great measure, in the absence of sparking at the brushes.

The field consists of four steel castings which are rigidly bolted together, and which, in turn, are bolted to the cast iron frame, or bed plate. The exciting coils are compound wound on metal bobbins, which can be readily slipped on or off by loosening a few bolts and raising one of the field castings. The winding is so compounded that, as the current supplied to the circuit increases, the voltage rises sufficiently to make up for the loss of drop in the circuit, or for a variation in the speed.

One peculiar feature is the employment of cast steel in the fields, which increases the efficiency and gives nearly double the magnetic field possible where cast iron is used. Another advantage in the use of cast steel in the fields lies in the fact that the motion of the armature is practically powerless to disturb the lead, and consequently the machine may be operated under full load within the limit of its capacity, and even under a load considerably exceeding its normal capacity, without shifting the brushes and without sparking at the commutator.

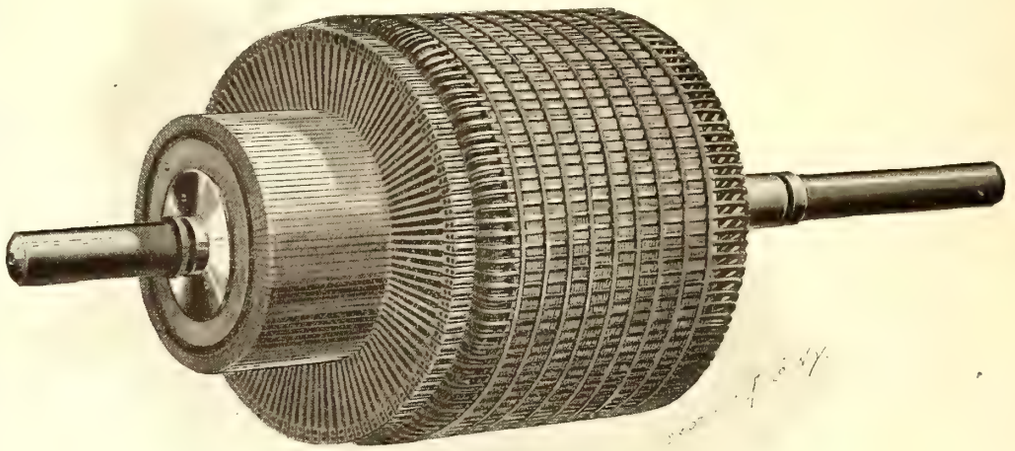


FIG. 2.—ARMATURE—MATHER ELECTRIC RAILWAY GENERATOR.

The commutator is of exceedingly massive and substantial construction. Drop forged, pure lake copper bars and the best mica are used throughout. By a peculiar construction of the commutators, it is an absolute impossibility for any bar to work loose while the commutator is on the shaft.

The Mather Company writes us that it is also prepared to furnish complete station equipments, including marble or slate switchboards and the latest improved station appliances of its own manufacture, such as switches, ammeters, voltmeters, lightning arresters and automatic circuit breakers.

After a series of careful experiments, the company has placed on the market an improved automatic circuit breaker, for which the claims

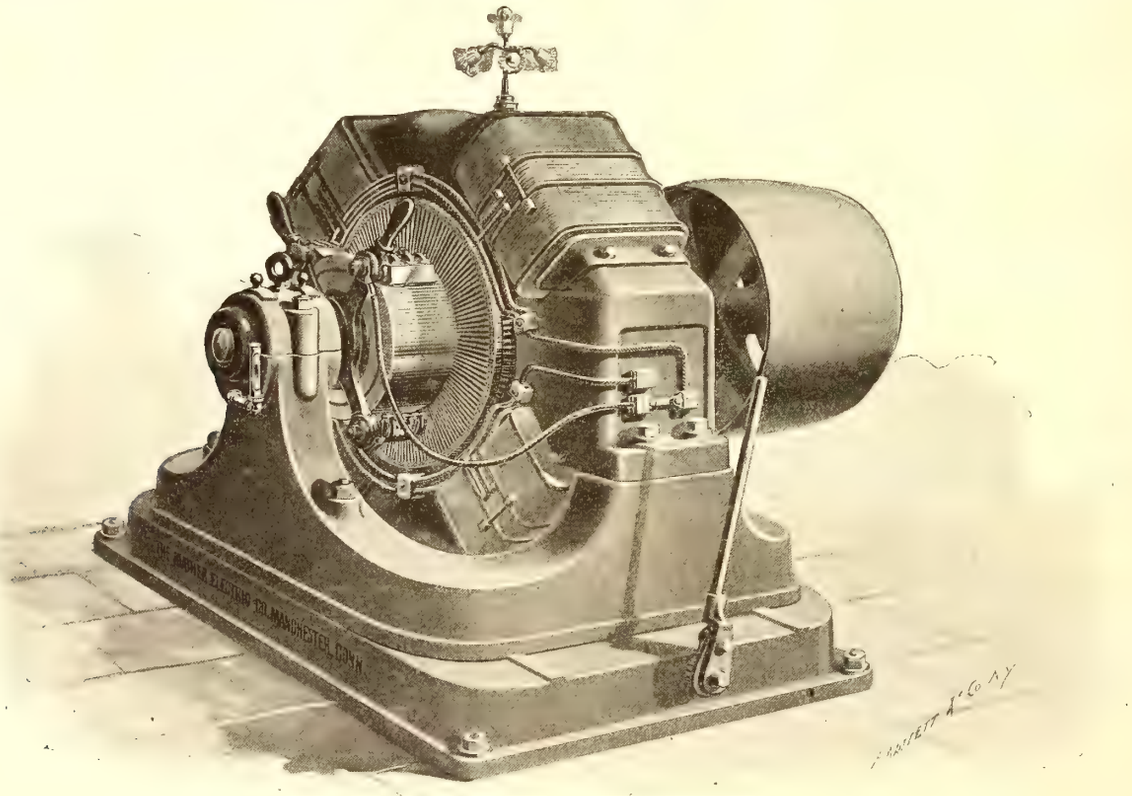


FIG. 1.—MATHER ELECTRIC RAILWAY GENERATOR.

of simplicity and reliability are made. It consists of an electro-magnet in series with a double break switch. When the current exeeds a certain predetermined limit, the electro-magnet releases a trigger or latch, and the switch is opened by a powerful spring. The circuit is not entirely broken at the moment when the contact terminals attached to the lever arm leave the jaws of the switch, two carbon pencils carried by the lever arm still making contact with carbon plates connected to the jaws of the switch. The final break occurs between the carbon pencils and plates, and the metal jaws of the switch are thus protected.

Adjustments for different currents are secured very readily with little trouble.

These automatic circuit breakers are equally well adapted for use on lighting as well as railway generators, and the company earnestly recommends their use as a reliable safeguard against overloading of machines.

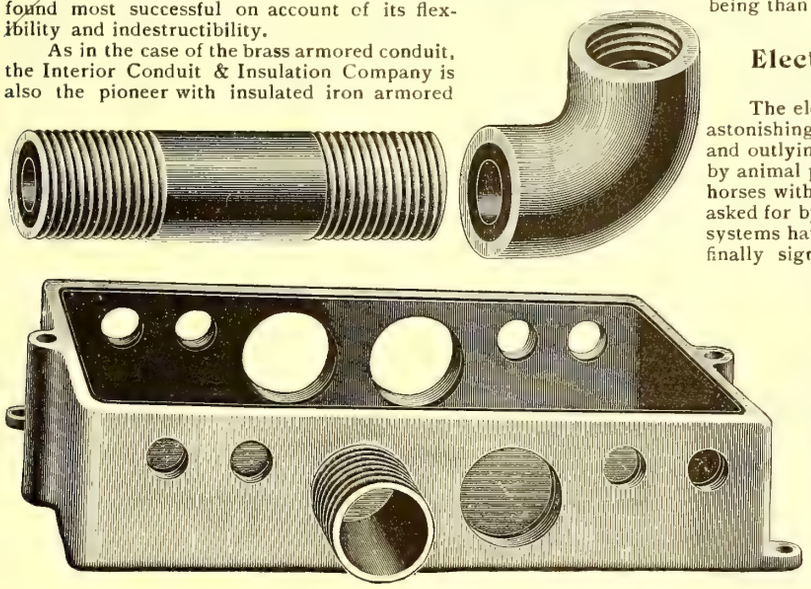
The company is prepared to furnish lightning arresters of improved form, which, in actual practice for a long time, have proved themselves absolutely reliable.

The company's plant, covering a number of acres of ground, is situated in Manchester, Conn., on the main line of the New York & New England Railroad, allowing the best of shipping facilities. The company has recently completed an extension to its plant in the form of an iron building 300 × 50 ft., for an erecting shop, constructed by the Berlin Iron Bridge Company, and fitted with an electric traveling crane and extra heavy machinery, especially adapted for expeditious handling of large generators up to 500 K. W. in capacity. The entire plant is operated by electric motors, thus giving an exceedingly satisfactory and practical demonstration of the advantages of this system of power distribution.

Iron Armored Insulating Conduit.

A system of iron armored insulating conduits has been brought out by the Interior Conduit & Insulation Company, of New York. The system is designed for the interior wiring of buildings, and has been found most successful on account of its flexibility and indestructibility.

As in the case of the brass armored conduit, the Interior Conduit & Insulation Company is also the pioneer with insulated iron armored conduit. The latter consists essentially of plain insulating tubing placed within a lap seamed, wrought iron pipe, one eighth of an inch in thickness. The conduit possesses all the qualities of gas and water pipe, and by means of tools for cutting, threading, etc., the iron insulated junction boxes, elbows, couplings, etc., can be installed with equal ease. We present herewith a few views of the conduit.



IRON ARMORED CONDUIT, ELBOW AND JUNCTION BOX.

The Prizes Awarded in the Car House Competition.

The prizes in the competition for the best design for a car house, offered in our June issue by J. G. White, the electrical engineer, were awarded last month as follows:

First prize, $100, to D. M. Pratt, engineer Pennsylvania Steel Company, Steelton, Pa.

Second prize, $50, to D. B. Banks, engineer Baltimore Traction Company, Baltimore, Md.

Third prize, $25, to J. H. Bickford, Salem, Mass.

Fourth prize, $5, to F. J. Tone, Pittsburgh, Pa.

Fifth prize, $5, to William P. Anderson, Baltimore, Md.

Sixth prize, $5, to W. Nelson Smith, New Orleans, La.

Seventh prize, $5, to A. S. Krotz, Springfield, O.

Eighth prize, $5, to J. S. Hill, Lafayette, Ind.

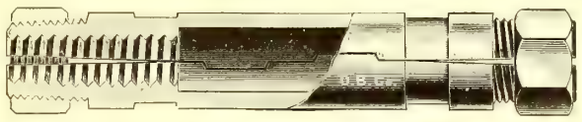
The committee of award consisted of three gentlemen, including Edward E. Higgins and two others experienced in street railway construction, but who do not, for business reasons, wish to have their names known. G. W. Davenport, who was to have been one of the judges, was unable to act on account of illness. The committee wishes to state, in connection with this matter, that the plan and specifications of J. H. Bickford were presented in better shape than those of any other competitor, as they included complete working details. The design however, submitted by Mr. Bickford, was for a car barn larger than was called for by the advertisements for the competition, and as his plans did not, therefore, strictly conform to the requirements of the competition, the third prize was awarded him for the general merit of the plans submitted by him.

A decision in regard to the second series of prizes offered by Mr. White for an article on the best method of operating parks in connection with street railways has not yet been reached.

Feeder Wire Splicer.

This device was brought out last year by the Ohio Brass Company, of Mansfield, O., and has met with almost universal approval from construction men. Besides making a practically perfect joint in the feeder wire, it saves enough time over the ordinary way of splicing to more than pay for its first cost. It can be used as a permanent or temporary connector.

In making a splice the insulation is first removed and the halves of the splicer are placed over the abutting ends of the bare wire. The



FEEDER WIRE SPLICER.

nuts are then screwed on the tapered ends of the splicer which is slightly corrugated on the inside, thus securely clamping the wire. Solder can be poured through a slot provided for this purpose.

A joint made in this way is but a trifle larger than the wire, and is of low resistance and great strength, the average electrical resistance .02 of an ohm and the mechanical strength of the joint being more than being than the wire itself.

Electric Railway Construction in Chicago.

The electric roads in Chicago are going forward at a pace that is astonishing. Not only are new lines projected in many of the suburbs and outlying districts of the city, but the older roads formerly operated by animal power are making extensive preparations to replace their horses with electric motors. Almost without exception the franchises asked for by the companies operating the North, West and South Sides systems have been granted, and the necessary ordinances have been finally signed by Mayor Hopkins, although the stipulations in some instances are rather burdensome to the street railway companies. In less than two years Chicago will have a system of surface electric roads that in the extent of territory covered will surpass anything yet constructed. In addition to this there is every probability that at least three, and perhaps four, of her elevated railroad systems will in the same period be equipped with electricity. The Chicago City Railway Company has been granted the right to equip with the overhead system nearly all of its existing horse car lines, including the Indiana Avenue line, and construction work will begin at once.

During the month the control of the Lake Street elevated has passed into the hands of Mr. Yerkes and his friends. The board of directors now includes Mr. Lauderbach, of the Northwestern elevated road, Mr. Furbeck, the general manager of the North Chicago road, and Mr. Parsons, the general manager of the West Chicago lines. This deal practically consolidates the Northwestern and the Lake Street elevated roads, and the construction work on these lines will now be carried on without interference with each other. Both roads will be equipped electrically, and the presence of B. E. Sunny on the board of directors of the Lake Street elevated makes it quite certain that the equipment of the lines will be similar to that used on the Intramural road at the World's Fair.

Street Railway News.

New Roads.

Ambler, Pa.—The Ambler Electric Railway Company was incorporated June 19, with a capital stock of $12,000. Jas. W. Shepp, of Philadelphia, is the president of the company. Others interested are N. H. Lazelere, of Norristown, Pa., and Wellington B. Krick, of Reading, Pa.

Argentine, Kan.—At a recent meeting of the Argentine City Council, Ernest L. Engeren and others made application for a franchise for an electric road, beginning near the Southern Bridge, crossing the wagon viaduct and running on Silver Avenue.

Bath, Me.—The Bath Street Railway has proved so successful that there is talk now of another line to be put in by an entirely new company. The idea is to connect with the present system at the southern end and run to Phippsburg Center, a distance of three or four miles.

Belleville, Ill.—An ordinance has been presented to the City Council granting a franchise to the St. Louis & Belleville Railway Company to construct an electric railway through West Belleville, and

over Franklin Street to Illinois Street, in this city. The company proposes to build an electric line from East St. Louis to Belleville over the St. Clair turnpike.

Bluff City, Ill.—Bluff City Electric Street Railway Company was incorporated June 28, with a capital stock of $200,000. The incorporators are Dewitt L. Jones, S. D. Talcott and Chas. Whitney.

Broad Ripple, Ind.—The Town Board has granted a fifty year franchise to the Indianapolis & Broad Ripple Rapid Transit Company. The company may use any motive power but steam.

Cincinnati, O.—O. B. Brown, of Dayton, recently appeared before the County Commissioners for the purpose of securing the right of way over the Paddock Road for the Cincinnati, Middletown & Dayton Traction Company, which proposes to build and operate an electric road between this city and Dayton.

The Commissioners of Hamilton County have granted the Cincinnati, Middletown & Dayton Traction Company, which was recently incorporated for the purpose of building an electric railway between Cincinnati and Dayton, the right to construct and operate the road from Avondale to Carthage. Construction must be commenced by January 1, 1895, and be completed not later than January 1, 1897.

Cleveland, O.—The Cleveland & Elyria Railway Company was incorporated recently by Benjamin F. Phinney, Jay Comstock, J. M. Gasser, H. D. Coffinberry and Dallas Bebe. The capital stock is $100,000. The company proposes to build a railway line to be operated by electric or other motive power between Cleveland and Elyria, for the purpose of conveying passengers, freight, express matter and the United States mails between the two points named.

Columbus, O.—It is reported that a company of New York capitalists has been organized for the construction and maintenance of an elevated railroad in Columbus. It is to be operated in connection with the Columbus and Johnston and the Columbus and Harrisburg lines, and the plan includes an electric road to be built to the Licking reservoir and Zanesville.

Defiance, O.—The Defiance Light & Railway Company, of Defiance, has been incorporated by Samuel L. Nelson, Charles E. Miley, Alvaro S. Krotz, Lawrence L. Minor and Oscar T. Martin. The capital is $100,000.

Duluth, Minn.—Articles of incorporation have been filed by the Duluth & Superior Traction Company, the incorporators being Frank Bergen, of Elizabeth, N. J.; Edward J. Douglas, of Philadelphia and John H. Davis, of New York. The capital stock of the company is $2,000,000. Its object is to construct and operate a system of electrical street railways in Duluth, Minn., and Superior, Wis.

Essex, Conn.—There is a movement under way to construct an electric railway from Essex to Ivoryton.

Fort Dodge, Ia.—The City Council has granted a franchise for twenty-five years to S. T. Meservey for a street railway and electric lighting plant.

Homestead, Pa.—A contract for building the new line of the Homestead Street Railway Company, between Homestead and Pittsburgh, has been let to the New York Electric Construction & Engineering Company. The work is to be commenced by October 1.

Kansas City, Kan.—The Stock Yards & Northwestern Railway Company has asked the City Council for a franchise for a street railway running from the stock yards to the northwestern part of the city.

Newark, N. J.—A certificate of incorporation of the North Jersey Street Railway Company has been filed. The incorporators are James K. Corbiere, of Caldwell; Daniel V. Harrison, William H Power, of Montclair; James C. Beach, Samuel M. Barrett, of Bloomfield, and others. It is capitalized at $5,000,000. The company will operate in Newark.

Philadelphia, Pa.—The Aramingo Avenue Passenger Railway Company, and the East Aramingo Avenue Passenger Railway Company were incorporated June 21, with a capital stock of $12,000 and $18,000 respectively. Henry C. Moore, 624 N. 22d Street, Philadelphia, is president of both companies. Others interested are Henry M. DuBois, David C. Golden and Hyland C. Murphey, all of Philadelphia.

Phillipsburg, Pa.—With Charles A. Bragg, of Philadelphia, as one of the incorporators, the Clearfield Traction Company, of Phillipsburg, was chartered Jluy 18. Its capital is $10,000.

Plainville, Conn.—The Bristol & Plainville Tramway Company has made application to the Selectmen of this place for right to lay tracks in the streets.

Rutland, Vt.—A new street railway company has been organized here, to be known as the City Electric Company. The following are the officers: President, E. A. Morse; secretary, James Carruthers; treasurer, H. O. Edson. The capital stock of the company is $100,000. The company will begin the construction of the road as soon as the city will grant permission.

Scranton, Pa.—The Scranton North End Street Railway Company was incorporated July 10, with a capital stock of $20,000. Lemuel Amerman, of Scranton, is president of the Company. Other stockholders are Plummer S. Page, Henry H. Archer, Robert C. Adams and Louis A. Watres, all of Scranton.

There was chartered, July 20, the Lackawanna Valley Traction Company, of Scranton; capital, $400,000. Lieutenant Governor Watres and ex-Congressman Amerman are two of the incorporators.

Skowhegan, Me.—The Skowhegan & Norridgewock Street Railway & Power Company has organized by the election of W. H. Wildes, of Skowhegan, president; I. C. Libby, of Waterville, treasurer; A. R. Bixby, clerk; A. F. Gerald, of Fairfield, manager. The capital stock is $50,000. The building of the road is let to the Worcester Construction Company, of Massachusetts, and the company expects to have the road running early in September.

Stillwater, Minn.—The Stillwater Electric Railway Company has been organized here. The new company is organized with a capital stock of $75,000, and succeeds the Stillwater Street Railway Company. J. C. Nethaway, of Stillwater, is secretary, and Allan Curtis, of Boston, president.

Tonawanda, N. Y.—Mr. West, contractor for the electric railroad from Tonawanda to Sanborn, a distance of six miles, is reported to have said he intends to commence the work shortly.

Washington, D. C.—A project for an electric railroad between Washington and New York has been brought before Congress in a bill for the incorporation of the National Rapid Transit Railway Company. Ex-Representative Hemphill, of South Carolina, and Washington capitalists are interested in the road.

Wilmerding, Pa.—The Pitcairn, Wilmerding & Braddock Street Railway Company was incorporated July 19, with a capital stock of $21,000, to construct and operate an electric railway at Wilmerding, Allegheny County. The president of the company is W. J. K. Kline, of Greensburg; and others interested are H. L. Castle, of Pittsburgh, and S. A. Taylor, of Wilkinsburg.

Yonkers, N. Y.—The North & South Electric Railway Company has been incorporated to construct a street surface road, about five miles in length, in Yonkers, the northern terminus to be in the vicinity of Shonnard Place and North Broadway, and the southern terminus to be the southern boundary of the city of Yonkers on South Broadway. The capital is $50,000. The directors are William Delavan Baldwin, S. T. Hubbard, John C. Shotts and T. H. Silkman, of Yonkers, and others.

New Publications.

The Best Light for City Railway Cars. Published by the Safety Car Heating & Lighting Company, New York.

This is a handsomely printed and tasteful circular issued to present the advantages of gas lighting for street cars. The success of the Pintsch gas as an illuminant, as our readers well know, has been phenomenal, and that the system is equally well adapted for street railway cars, the well lighted cars of the Broadway, Third Auenue and other roads using this system show. The circular presents views of the cars on a number of lines using this system, and gives extracts from the daily press and opinions of users as to its desirability and value.

Electricity One Hundred Years Ago and Today. With copious Notes and Extracts. By Edwin J. Houston, Ph. D., New York. The W. J. Johnston Company, Limited, 253 Broadway. 199 pages, illustrated. Price $1.00.

This book gives a brief review of the advance in electrical science made during the last century, and contains the text of a lecture originally delivered before the Electrical Section of the Brooklyn Institute. In its present form the text is amplified by foot notes containing much interesting historical data. Professor Houston throws much new light on the date of electrical discoveries, and shows among other points that Davy was not the inventor of the carbon voltaic arc, but was anticipated by many others.

The Railway Surgeon. Vol. 1. No. 1; $5 a year. The official organ of the National Association of Railway Surgeons. Published every other Tuesday. Monadnock Block, Chicago, Ill.

The National Association of Railway Surgeons is one of the most successful of the many organizations connected with the railway service. Railway surgery forms a distinct branch of the science of surgery in general, and there are many classes of injuries which pertain particularly to this department. There are also many other questions which come up in railway service, such as the proper sanitation of railway cars, which are peculiarly within the province of the railway surgeon. We welcome this latest publication, and particularly recommend it to the heads of the medical departments of our street railway companies.

General Information in Regard to Electric Installations. Published by *Allgemeine Elektricitäts Gesellschaft*, Berlin.

This is a very handsome catalogue of over 200 pages, printed in two colors, and giving a good deal of valuable information, with illustrations of the machines and other appliances supplied by this company, which manufactures apparatus for all branches of electrical work. The book is bound in white ivory celluloid, and bears upon the front cover the name and trademark of the company. On the four inside cover pages of the book are printed handsome colored maps of Europe, Germany and the two hemispheres. This company, whose work abroad we have had frequent occasion to describe and commend, has recently decided, we understand, to engage in the electric railway business in America.

The Report of the Eleventh Annual Meeting of the Street Railway Association of the State of New York.

The annual report of the Rochester meeting of the New York Street Railway Association has been received. It is uniform in size with the other reports, and contains in addition to the proceedings of the convention several notes by Mr. McTighe, whose paper on return circuits of electric railways was read at the convention, upon certain points brought up during the discussion. A copy of the constitution and by-laws of the Association is also printed, together with the special committees for 1894, which consist of Major George W. McNulty, who will present a paper on "Recent Improvements in Cable Practice," and J. B. Craven, of Buffalo, who will present a paper on "Economy in Electric Power Stations."

Electrical Engineering Leaflets. By E. J. Houston, and A. E. Kennelly. Published by the *Electrical Engineer*, 203 Broadway, New York.

We are in receipt of the first four numbers of three series of leaflets prepared by Messrs. Houston and Kennelly for the use of students of electrical engineering. There are three grades, the elementary, intermediate and advanced, so that each student can select whichever is most suited to his requirements. Each grade is designed as a complete course in itself. The subscription price is $3 for each series of thirty-five issues.

We consider this work an important one from an educational standpoint, and believe that it will be found a valuable aid to the acquisition of knowledge of the underlying principles of electricity and magnetism.

Personal.

Mr. George E. Pratt, of the Jackson & Sharp Company, Wilmington, Del., was in New York last week.

Mr. M. G. Hubbard, Jr., chief engineer of the McGuire Manufacturing Company, of Chicago, was in the East last month on a business trip.

Mr. Henry Elliott, of the Elliott Frog & Switch Company, of St. Louis, has gone abroad on an extensive trip, and will be absent about five months.

Mr. Benjamin Frick has been elected secretary and treasurer of the Atlantic Avenue Railway Company, of Brooklyn, *vice* Mr. William J. Richardson, resigned.

Mr. W. J. Richardson, secretary and treasurer of the American Street Railway Association, sailed for Europe July 21. Mr. Richardson will be gone about seven weeks, and will attend the meeting of the International Street Railway Association in Cologne during the early part of September.

Mr. Edward Caldwell, well known to our readers as an experienced journalist, has taken a position on the staff of the STREET RAILWAY JOURNAL, with headquarters at New York. Mr. Caldwell was for a long time one of the editors of the *Electrical World*, and more recently the editor of the *Street Railway Gazette*.

Mr. W. S. Rogers, special agent for the Sperry Electric Railway Company, of Cleveland, O., is in the East at present, making his headquarters at the Imperial Hotel, New York. Mr. Rogers tells us that the Sperry motor equipments are meeting with more and more favor, and that the demand for these motors is good. The first of the large order of 125 equipments of Sperry equipments for the People's Traction Company, of Philadelphia, was put in operation last month.

Mr. E. J. Wessels, formerly of the Short Electric Railway Company, has been appointed general manager of the Genett Air Brake Company, with offices at 33 Wall Street, New York. Mr. Wessels reports business as being very promising. The company has just closed a contract with the New Orleans Traction Company to equip a number of its cars with its air brake. The matter of braking is receiving unusual attention at this time, owing to the numerous accidents which have recently occurred. Mr. Wessels predicts that the Genett air brake is destined to become in street railway practice what the Westinghouse brake has become on steam roads.

Equipment Notes.

The Gleason & Bailey Manufacturing Company, of New York, will build for the town of Port Chester, N. Y., an elaborate steel frame city truck.

E. F. Dewitt & Company, of Lansingburgh, N. Y., report, among other recent orders one with the Electric Traction Company, of Philadelphia for the equipment of 200 cars with their "Common Sense" sand box.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., mentions among its recent orders, an additional order for fifty fenders from the New Orleans Traction Company, which has already a number of the Crawford fenders in use.

The East River Gas Company, of Ravenswood, Long Island, N. Y., is building, in connection with its new works, an exceptionally large coal pocket, designed to hold 11,000 tons, and is equipping it with C. W. Hunt Company machinery.

The Manhattan General Construction Company, of New York City, has been appointed by the Buckeye Electric Company its agent for New York and vicinity and for Massachusetts, Rhode Island and Connecticut, in addition to the territory already covered.

The Pettingell Andrews Company, of Boston, Mass., has opened an office at 39 and 41 Cortlandt Street, New York, in connection with their Boston street railway business and general electrical supplies. Frank X. Cicott, manager of the railway department, will be in charge.

The Billings & Spencer Company, of Hartford, Conn., has made an arrangement with the Pettingell Andrews Company of 72–4 Federal Street, Boston, by which the latter company is to act as agent for the sale of the Billings & Spencer Company's patent drop forged commutator bars to street railway companies in the United States and Canada.

M. T. Davidson, Brooklyn, N. Y., builder of the Davidson steam pumps, finds business good. A recent order from the United States Government authorities at Washington calls for a 10,000 lb. pressure pump of the latest Davidson type, which will be used in the Bureau of Engraving and Printing. Other large orders are also under way at the works.

Carleton & Kissam, of New York, have lately added to their extensive list of street cars in which they control the exclusive advertising privileges, all the cars of the Pleasant Valley Traction Company, Allegheny, Pa., and the Suburban Traction Company, in Pittsburgh. Carleton & Kissam now control the advertising privileges in all but four lines in Pittsburgh and Allegheny.

The Fiberite Company, of Mechanicsville, N. Y., is making large sales of the Medbery insulation. Among the roads which this company is now supplying are the Montreal Street Railway Company; Montreal Park & Island Company; Union Street Railway Company, of Providence; Middletown-Goshen Traction Company; Philadelphia Traction Company; Buffalo Street Railway Company, and the Wissahickon Railway Company.

The Knott Manufacturing Company, of 796 Seventh Avenue, New York City, has placed upon the market a commutator lubricating compound intended as a substitute for either machine oil, glycerine, vaseline or any paraffine preparations used on commutators. The company has issued a pamphlet giving a number of reasons why this compound should be used on electrical machinery, and presenting a number of testimonials from those who have used it in their stations.

H. Ward Leonard, of New York, has just had issued to him patent No. 522,718, of July 10 1894, for an electric heater which is likely to mark a very distinct advance in that line. The invention is quite radical, and the patent obtained by him contains very broad claims. The first claim reads as follows: "A device in which electrical energy is converted heat, having a thinly insulated conductor embedded in, and completely surrounded by, a closely applied mass of metal substantially as set forth."

The Bemis Car Box Company, of Springfield, Mass., reports large increase of orders. P. T. Pullen, of the company, tells us that among the recent orders the company has received an order for fifty trucks from the Electric Traction Company, of Philadelphia, and twenty-five trucks from the Hestonville, Mantua & Fairmount Avenue Railway Company, of the same city. The company has also supplied thirty trucks for the Fairhaven & Westville Street Railway Company, of New Haven, Conn., and 180 trucks for the Third Avenue Railway Company, of New York.

The Mather Electric Company, of Manchester, Conn., has just issued a new catalogue of its street railway apparatus. The company has on hand a number of orders for new multipolar generators, of the type described elsewhere in this issue, for both belted and direct connected work. The company reports that it has had even more success in putting this new apparatus on the market than had been anticipated. It has contracted and closed for the equipment of a number of electric roads both in the East and West. The Western business of the Mather Electric Company is controlled by J. Holt Gates, of 1140 Monadnock Building, Chicago.

George Cradock & Company, of Wakefield, England, write us that the Lang lay rope, which was removed from the tunnel line of the North Chicago Street Railway Company after making a record of ninety-eight days, and which was put to work on the South Clark Street line on May 12, was taken out June 9, after having run twenty-nine days on this line. The record on the tunnel line was wonderful in itself considering the great wear, and it was removed from this line only because it had worn too small for the grips to take hold of it. The fact that it was useful, however, for further service speaks volumes for the durability of the Cradock ropes.

The Composite Brakeshoe Company, of 620 Atlantic Avenue, Boston, Mass., writes us that it has made arrangements with the Pennsylvania Iron Works Company, of Philadelphia, for the manufacture of its composite brakeshoe. Shipments with bills of lading will be made directly from the factory, but all orders should be sent to the Boston office. The company has also made arrangements with the Kinzer & Jones Manufacturing Company, of Pittsburgh, Pa., for the manufacture of its composite brakeshoes in that section of the country. This brakeshoe is becoming the standard on many street railways, especially for electric service, and has superior braking and wearing qualities.

The Harrison International Telephone Company, of New York City, is meeting with excellent success in the sale of its telephones in all sections of the country. On August 1, the company will commence the sale of the Ford automatic switchboard, by the use of which the need of a central station will be avoided and connections can be made at any instrument with any other. Owing to the large demand for Harrison telephones the construction department of the company, organized as the Harrison International Construction Company, has moved its general offices to Chamber of Commerce Building, Chicago, where all correspondence with reference to the establishment of exchanges, the construction of the same, and the purchase and lease of telephones should be addressed.

Allan, Whyte & Company, of Rutherglen, Glasgow, Scotland, is the title of a new firm organized some time ago, as already mentioned. The firm has commenced the manufacture of wire ropes for cable railways, mines, transmission of power, suspension bridges etc. Both the principals of this company are well known in cable work. Alexander B. Allan has been lately connected with George Cradock & Company, of Wakefield, England, and has spent a considerable time in this country representing those manufacturers. The other principal, Robert M. Whyte, was formerly connected with Messrs Thomas and William Smith, of Newcastle-upon-Tyne, England, the prominent English cable builders. The personal knowledge of these gentlemen of the manufacture and application of wire ropes makes them especially competent to advise with cable railway managers as to the type of

rope to use, and insures a high degree of excellence for the product of their works.

The Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., recently sold to the South Jersey Street Railway Company, of Point Pleasant, N. J., five open cars complete and ready for operation, including an equipment of Lewis & Fowler fare registers. These cars are to be mounted on Peckham trucks, and will be equipped with Westinghouse motors. This is a new road, having been opened July 20. The Q. N. Evans Construction Company, of New York, was the builder and contractor for equipment of every description. The Lewis & Fowler Company reports that the demand for its Acme car jack, recently described and illustrated in the JOURNAL, has resulted in large sales. The company is constantly receiving very complimentary letters regarding its merits. This car jack is intended for use in repair shops, and is equally adapted for use anywhere along the line, as it is capable of quick adjustment and action. It is sufficiently powerful to lift the heaviest cars that are built, and two men can operate it with very slight effort.

The John Stephenson Company, Ltd., of New York, is doing an excellent business, and the factory of the company presents a very busy appearance. The company has recently delivered fifty-five closed cable cars to the Broadway & Seventh Avenue Railway Company, in addition to the other extensive orders which have been filled for this company, showing that the Stephenson car is felt to be the standard in this company's work. The Stephenson Company has also delivered 100 open cars to the Metropolitan Traction Company. Among the orders on which the Stephenson Company is busy at present is one for fifty cars for the Consolidated Traction Company, of New Jersey; eight cars for the Bridgeport Street Railway Company, of Bridgeport, Conn.; ten cars for the Dartmouth & Westport Railway Company, of New Bedford, Mass.; eleven open cars for the Steinway Railway Company, and sixty twenty foot cars for the Nassau Electric Railway, of Brooklyn, N. Y. The Stephenson Company reports the usual foreign demand, and among other foreign orders filled recently was one for a number of horse cars to be used in St. Petersburgh.

The Standard Paint Company, of New York, has recently been awarded a decree in the United States Circuit Court for the District of New Jersey, establishing the validity of the United States patent under which this company has manufactured its paper. The case was that of The Standard Paint Company *vs.* Henry J. Bird and James L. Reynolds, and the decision was that the assignors of the Standard Paint Company were the first persons to produce a paper coated with the solid residuum of petroleum, and combining the characteristics of an odorless, water, acid, alkali and air proof paper, and that the patent under which this company has hitherto manufactured was valid, and had been infringed. The court, by Hon. George M. Dallas, circuit judge, holds that any paper possessing the same essential characteristics and produced by the coating with any material similar to that employed by this company, by whatever name it may be called, is an infringement of the patent, and that patent is good and valid in law. Having now obtained an injunction in the courts, the company will, of course, seek to fully protect its rights, and cautions the public against the use of any sheathing, building or insulating papers which falls within the decision.

The Berlin Iron Bridge Company, of East Berlin, Conn., has received an order from the St. Louis Railway Company, of St. Louis, Mo., for the construction of that company's new car barn. The building will be sixty-four feet in width, and 185 ft. in length, with brick walls, the roof being of iron covered with the Berlin Iron Bridge Company's patent anti-condensation, corrugated iron roof covering. It is the intention of the railroad company to make this station absolutely fireproof and thereby save insurance. There will be no woodwork used in the construction of the building, and it will not be necessary to carry any insurance whatever, as the danger from fire is entirely eliminated. The United States Projectile Company at Brooklyn, N. Y., is making extensive additions to its machine shop, and has placed the contract for this work with the Berlin Iron Bridge Company. Another contract received by this company is for a new electric light and power station for the Bradford Electric Light & Power Company, Bradford, Pa. The building is 65 × 160 ft., with brick side walls, the roof being of iron, covered with the company's patent anti-condensation, corrugated iron roof covering. When completed, this will be one of the finest and most complete stations in western Pennsylvania, and also so constructed as to be absolutely fireproof, there being no woodwork about the building to take fire. The Berlin Company has also received the contract from M. C. Henry & Company, of New York, to cover their stone yard with an iron roof, and also for a traveling crane. The building will be 50 × 100 ft., constructed entirely of iron, the whole space to be controlled by the traveling crane.

The Altoona Manufacturing Company, of Altoona, Pa., manufacturer of the M. A. Green engine, is meeting with a large demand for this popular machine. Edward F. Austin, of Pittsburgh, Pa., the energetic agent in that city for the Green engine, has just completed the installation of one of the fifty horse power, improved, automatic cut-off engines to drive a 500 light Westinghouse dynamo in Christ's M. E. Church of the East End of Pittsburgh. As this is the first engine installed in a church in that section, it makes an especially interesting installation. The M. A. Green engine has been largely adopted in Western Pennsylvania largely through the untiring efforts of Mr. Austin, who from his first examination of the engine felt assured of its success, especially for electric lighting work and for street railways. It is designed and constructed particularly for this line of work. Mr. Austin has also made the following sales in his section: One 80 H. P. M. A. Green improved, automatic cut-off engine to the New Castle Car Manufacturing Company, of New Castle, Pa.; one 150 to 180 H. P. M. A. Green engine to Jones & Laughlin, of Pittsburgh, to run the electric cranes with which they have recently equipped their mills; two 60 H P. M. A. Green engines to the McIntosh-Verner Buildings, of this city; one 12 × 14 M. A. Green engine to the Lorch-Eble Machine Company, of Pittsburgh, and one 150 H. P. M. A. Green engine to the Watson Mining & Manufacturing Company, of Monongahela City, Pa. Other recent orders are as follows: One 280 H. P. engine for the Akron Street Railway Company, of Akron, O., to be direct coupled to a 250 H. P. generator built by the Walker Manufacturing Company, of Cleveland, O.; one 65 H. P. enclosed type, self-oiling engine for the Lyceum Theatre, Philadelphia; one 175 H. P. standard, center crank engine for the Freeport Electric Company, Freeport, Ill.; one 65 H. P. enclosed type, self-oiling engine for Knights Brothers, Fayette County, Ia. There is considerably more inquiry, and with a settlement of the railroad strike it is believed that a substantial improvement in business will be the result.

WESTERN NOTES.

The American Car Company, of St. Louis, has just taken an order for twenty-five cars from the Union Depot Railroad Company of that city. These will be equipped with Mr. Sutton's new truck.

The Central Electric Company, of Chicago, is now getting into shape to do a large business in street railway supplies. The managers of the company tell us that the demand for their street railway appliances is growing, and that they are increasing in popular favor.

The American Carbon Company, of Dayton, O., is now experimenting on motor brushes, and hopes soon to be in the market with a superior carbon brush for street railway and stationary motors. Mr. Dickey is the general manager of the company, which has an unusually large plant, and is already doing a good business in the manufacture and sale of carbon specialties.

The Lodge & Davis Machine Tool Company, of Cincinnati, O., has just been awarded a contract by the United States Government for one of its improved screw machines to work stock up to one and one fourth inches, to be shipped to the Norfolk navy yards, Norfolk, Va. The company is also erecting a repair shop for the Silver King Mining Company, of Salt Lake City, at the Park City mines of the latter. The equipment will include special engine lathes, planers, drill presses, shafting, pulleys, etc.

The McGuire Manufacturing Company, reports doing an excellent business, having just closed a contract with the Electric Traction Company, of Philadelphia, Pa., for 140 Columbian trucks. The company also has a contract from the Cincinnati Street Railway Company, of Cincinnati, O., for ninety Columbian trucks, and an order for forty Columbian trucks to go to the Los Angeles Consolidated Electric Railway Company, Los Angeles, Cal. Large sales of the new Columbian car heater are also reported.

The Card Electric Company, of Mansfield, O., is busy filling orders for its single, thirty-five horse power, street railway motors. This company has found that its medium weight motor gives very good results on practically level roads, showing, it is claimed, that it is not necessary to have two motors on a car except where heavy trailers are used. The motors that have been running at Mansfield and Fremont, O., for some months have given entire satisfaction. J. Holt Gates, 1139 and 1140 Monadnock Block, Chicago, Western agent, reports numerous inquiries and a good outlook.

The Electrical Installation Company, Monadnock Block, Chicago, of which L. E. Myers is secretary and treasurer, has a large amount of important work under way. It has a contract with the Englewood & Chicago Electric Street Railway Company to build forty-seven miles of overhead work, furnishing all material. It also has a contract for the complete equipment of the Fox River Electric Railway Company, of Green Bay, Wis., which consists of six miles of track, all electrically equipped. Westinghouse equipment will be used here. It is also building five miles of track and overhead construction for the Freeport Street Railway Company, of Freeport, Ill. As in the other cases, it furnishes all the material, and here the Walker Manufacturing Company's electrical equipment will be used. It has just completed several miles of heavy cable work, and installed one G. E. multipolar generator in the power house of the Alley Elevated road. It has also just completed an electric light plant for the city of Le Roy, Ill., and a large central station at Racine, Wis.

The Standard Railway Supply Company, of Chicago, is busy filling orders for overhead line material, steel gongs, and Standard stoves. The company has had some excellent orders for these three lines of supplies. Although the agency for the Nuttall Company, of Allegheny, Pa., was taken only recently, some very satisfactory orders for gears and pinions, trolley bases and trolley wheels have been received. This company, of which Garson Myers is manager, has been building up during the past two years a substantial street railway supply business. Mr. Myers has given his attention especially to the Standard car stove and the "Gilt Edge" steel gongs. A number of Standard stoves are now in service in Germany and Canada in addition to their extensive use on the street railways in the United States. Another and an entirely new stove has just been made by Mr. Myers' company, and this will be placed on the market in a short time. It will be known as the Myers self-feed car stove. It is entirely of cast iron, will contain sufficient coal to operate it for eighteen hours, and is so constructed as to deliver the coal to the fire without waste. It is intended to be placed either on the car seat or upon the floor. No cutting of the seat is necessary. When placed upon the floor a coal box compartment forms part of the stove. The company will guarantee that it will heat a twenty-five foot car at a cost not exceeding ten cents for eighteen hours.

J. G. Gustin & Company, of Chicago, report that orders for the Hercules trolley clamp are coming in thick and fast. A particularly gratifying feature about the orders is that a number of them are duplicates from companies who first ordered a few for trial. Street railway contractors are also recognizing the fact that the Hercules trolley clamp has a very strong hold on the wire, and is so inexpensive to install, that by using it they are enabled to employ an excellent article, and at the same time to figure their contracts to a very close figure.

The Hooven, Owens & Rentschler Company, of Hamilton, O., has sent us the report of a test of its engine in the power plant of the Lynn & Boston Railroad Company, at Salem, Mass., made July 7, 1894, by J. H. Bickford and G. H. Davis. The engines used are three tandem compound with cylinders, 18.125 × 34 ins. by 48 ins. stroke, and run condensing. The average indicated horse power of the engine was 385.21, and the showing made was excellent. The average cut-off per cent. of stroke was: High pressure 26, low pressure 21.36, average M. E. P. high pressure 49.25, low pressure 11.66. Pounds dry steam per indicator horse power per hour 14.87; pounds dry coal per indicator horse power per hour 1.603; pounds combustible per indicator horse power per hour 1.519.

List of Street Railway Patents.

U. S. STREET RAILWAY PATENTS ISSUED MAY 29, 1894, TO JULY 10, 1894, INCLUSIVE.

MAY 29.

ELECTRIC RAILWAY TURNTABLE—Rudolph M. Hunter, Philadelphia, Pa. No. 520,527.

In an electric railway, the combination of a turntable operated by the electric railway current through the car motor.

CABLE RAILWAY—Charles W. Hunt, West New Brighton, N. Y. No. 520,644.

The combination in a cable railway of sheaves around which the cable passes and which are located so that portions of the cable are parallel to each other along a straight portion of the track, from the respective ends of which straight portion of the track, the cable descends and is acted upon by the driving drum whereby the cars can be disconnected from the cable at any part of the straight portion of the track, and then reconnected to the adjacent parallel portion of such cable.

TROLLEY WIRE SUPPORT—Budd J. Jones, Sioux City, Ia. No. 520,737.

In a trolley wire support, the supporting piece of an approximately triangular form, adapted to fit a bend in the trolley wire, with its outer surface on a plane with the surface of the trolley wire, in combination with a bridge piece, a stirrup strap, and means for adjusting the stirrup strap.

CONDUIT RAILWAY TROLLEY—William Lawrence, New York. No. 520,758.

A contact plate formed in parts fitted one against the other, insulating material around said parts, a casing binding said parts together, and arms pivoted to one of said parts, said arms having contact wheels journaled therein.

JUNE 5.

ELECTRIC MOTOR TRUCK—John C. Henry, Westfield, N. J. No. 520,780.

An electric car truck having a frame comprising horizontal side bars of magnetic metal, axles journaled in each end of the side bars, and pole pieces lying in a horizontal plane and projecting from cross bars joining the side bars between the axles, whereby the magnetic connection between said pole pieces lies through the cross bars and side bars. The electric motor has its field coils wound with a multiplicity of parallel conductors, the strand through which the circuit is first completed and last broken being of higher resistance than the others. A switch is located on the positive side of the field magnets, and is adapted to close the circuit through one or more of the conductors.

ELECTRIC LOCOMOTIVE—Walter H. Knight, Lynn, Mass., assignor to the General Electric Company, Boston, Mass. No. 520,787.

Covers the combination in a vehicle with two or more trucks, each having a plurality of separately driven axles mechanically connected together, of means for simultaneously controlling all the motors used.

FARE REGISTER—Frederick C. Boyd and Charles E. Gurding, New Haven, Conn., assignors to the New Haven Car Register Company, of Connecticut. No. 520,912.

The first claim reads: In a fare register, the ratchet wheels secured to the side of the trip register disks, each provided on one of its sides with pins, means for turning the said wheels and disks, dogs for engaging the pins on the disk, the rockshaft by which the dogs are carried, a depending arm, and a reciprocating device for engaging said arm.

TROLLEY WIRE SUPPORT—Louis McCarthy, Boston, Mass. No. 520,937.

A trolley wire support comprising a supporting arm, an insulator, and jointed connectors extending upwardly in opposite directions from the insulator and suspending it from a bracket or span wire, leaving the insulator free to respond to the vibrations of the trolley wire.

CLOSED CONDUIT FOR ELECTRIC RAILWAYS—Paul Plodeck, Sr., Cleveland, O. No. 520,938.

In a conduit for underground electric railways, the combination with conduit provided with lids for covering the opening in the roadway, of an arm with an arched bar attached to the car truck, and adapted to lift the lids, and trolley wheels.

ELECTRIC RAILWAY OVERHEAD SWITCH—Miller A. Smith, Brooklyn, and William Clabaugh, New York, assignors to the New York Electrical Works, New York. No. 520,971.

This consists of the combination, in a switch, crossover, etc., of a rib having a substantially horizontal contact portion, an inclined groove, and a split key clamp at the outer end of said groove.

RAILWAY TRACK STRUCTURE—Edward Samuel, Philadelphia, Pa., assignor to William Wharton, Jr., & Company, Incorporated, same place. No. 521,004.

This covers the combination of two or more rails united together sidewise, each rail having a web perforated at intervals, with a continuous cast block extending through the perforations and overlapping the webs of the rails, thereby holding the rails rigidly in respect to each other.

RAILWAY SWITCH—Harry B. Büttel, Newark, N. J. No. 521,014.

This is an improved switch operating apparatus, consisting of a vertically movable rod mounted in suitable bearings secured to the car, and adapted to engage with and open the switch tongue; a lever fulcrumed on the platform of the car within reach of the driver or motorman, and means, connecting with said lever and rod, whereby the latter is operated.

JUNE 12.

CONTACT TROLLEY—Robert W. Hawkesworth, East Orange, N. J. No. 521,163.

The combination in a trolley bar of two arms, one at an angle to the other, and a support to which said bar is pivoted at a point between and above the ends of the arms.

TROLLEY—Henry Scheele, John P. Scheele, and Henry A. Rust, Milwaukee, Wis. No. 521,184.

The combination of a suitable head having pivotal levers provided with bearings, a trolley wheel loose on these bearings, and a spring under compression between the levers on that side of their pivots opposite said bearings.

CAR TRUCK—Edward Cliff, Newark, N. J. No. 521,205.

In a car truck, the combination, with a stationary frame supported upon the running gear, of a movable frame supported upon said truck, spiral springs located between the movable and stationary frames, and a half-elliptic spring suitably secured to each of the extended sections of the stationary frame and connected at one head by a shackle to the movable frame, and connected at the other head by a shackle to the stationary frame.

BOND FOR ELECTRICAL CONDUCTORS—John Herr, Philadelphia, Pa. No. 521,238.

The combination with an electrical conductor (or rail) of a tapered hole therein, a split bolt having a head and a conical shank externally threaded and a hole passing longitudinally through said head and shank, a nut adapted to be screwed up on said conical shank of said bolt, and a wire adapted to enter and be grasped by the sides of said bolt in said bolt.

SAFETY GUARD FOR STREET CARS—Stephen Norton and William H. Rice, Rochester, N. Y. No. 521,294.

The combination, with a car and truck, of a guard frame pivoted to the bottom of the car and provided with offset arms, springs interposed between said offset arms and the bottom of the car, and stay bars pivoted at one end to the guard frame and at the other to the truck.

PILOT OR GUARD FOR CARS—Robert A. Crawford, Allegheny, Pa. No. 521,307.

The combination of a pilot or guard, a support therefor, a sensitive spring acting between the pilot and its support, a swinging toe at the lower end of said pilot, and a powerful spring controlling said toe.

TROLLEY WIRE FINDER—Theophilus E. Gressle, Indianapolis, Ind., assignor of nine-twentieths to Frank Hittle, Baltimore, Md. No. 521,311.

The combination, with a trolley support and trolley, of directing bars or guides adapted to be elevated by movement upon the axis of the trolley, a double free-ended spring attached to one of said bars or guides.

CONDUIT SUPPLY SYSTEM FOR ELECTRIC RAILWAYS—Harry Alexander, New York. No. 521,326.

The combination with a slotted electric railway conduit, of a conductor supporting trough, having a side extending down from the conduit slot, and having a bottom and upturned side, and a working conductor supported in said trough.

JUNE 19.

SAFETY APPLIANCE FOR STREET RAILWAY CARS—Oswald R. Routh, Jersey City, N. J. No. 521,477.

This covers the combination in a fender of a pivoted scoop capable of a horizontal movement, a roller at the front of said scoop, a counterbalance at the rear of said scoop, pivotal movable bearings or supports for said scoop and means for normally holding suspended the said counterbalance and for releasing it to raise the scoop when the latter is moved backward.

CONDUIT ELECTRIC RAILWAY—Thomas Armat, Washington, D. C. No. 521,562.

This covers in an electric railway, the combination with an insulated supply conductor adjustably supported within a conduit and provided at intervals with contact points, of a series of frames arranged at each side and independently journaled and carrying longitudinally arranged metallic strips and transverse branches, leading from said strips inwardly toward the supply conductor and terminating in engaging

heads, and a current gatherer adapted for traveling over said longitudinally arranged strips thereby rocking the frames and bringing said heads of the transverse branches into engagement with the contact points.

Trolley Pole Catcher—Owen G. Cates, Jr., St. Louis, Mo. No. 521,602.

This covers the combination with the trolley pole and its means for holding the trolley in contact with the wire, in which means are included springs, of a bolt for holding the springs under tension, a bell crank lever connected to the bolt, a rod connected to the other arm of the bell crank lever connected to the bolt, a rod connected to the other arm of the bell crank lever, and projections on the rocker arms of the trolley pole for engaging and operating the arm when the trolley leaves the wire, whereby the bolt is actuated to release the tension of the springs.

Coupling for Electric Locomotives—Edward D. Priest, Lynn, assignor to the General Electric Company, Boston, Mass. No. 521,669.

A coupling for electric locomotives comprising a driving member normally concentric with an axle of the locomotive, a driven member consisting of a wheel keyed to said axle, and a float or independent connector mutually engaged by said members, whereby they are held in driving relation, but are permitted to move out of their normal concentric positions.

Safety Car Fender—Friedrich H. Reich, Baltimore, Md. No. 521,670.

In a safety fender for cars, the combination of the two side bars each made in two sections which are pivoted together; a cross bar connecting the lower front pivoted ends of the side bars, another cross bar connecting the back part of said side bars, springs attached by one of their ends to the car front and by their other ends to the lower front section of said side bars, said springs having an inclined position and adapted to draw up the pivoted section of the side bars, an inclined flexible curtain-like buffer, and a latch bar having one end attached to a cross bar of one section and its other end provided with a hook lip to engage a cross bar on the other section.

Fender for Tram Cars—Samuel J. Rosenfeld, New York, assignor, by direct and mesne assignments, to himself, Joseph A. Louchheim and Edwin S. Simon, Philadelphia, Pa. No. 521,672.

A rotary car fender, consisting of a shaft and arms rotating therefrom, the said arms being convexed upon ascending faces.

Supply System for Electric Railways—Thomas Harris, Detroit, Mich. No. 521,711.

In an electric railway system, the combination of a working conductor composed of insulated sections, a switch line and a return switch line extending along the working conductor from a stationary source of electricity, an electro-magnet for each section of the working conductor, the armature of which is adapted to connect the section with the power line and with the switch line, two energizing circuits for each magnet, one connecting the section of the working conductor with the return switch line through a normally open and a normally closed break controlled by the next adjacent magnets respectively, and the other connecting the two switch lines through the said normally closed break of the other circuit and a normally open break controlled by the magnet itself, and a contact on the car adapted to connect two adjacent sections of the working conductor.

Car Fender—James Tobin, Indianapolis, Ind. No. 521,741.

In combination with a car, a spring actuated bar connected to the car with an end extending in front of the same, and a triangular flexible fender supported at one of its corners on the projecting end of the bar and at the other corners attached to the car.

June 26.

Railway Car Truck—Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. No. 521,778.

The combination of a motor truck frame having side bars with pedestals thereon, axle boxes with side lugs, springs interposed between the side bars and side lugs, removable supports for said springs and means for clamping said supports in place.

Conduit Electric Railway—Charles J. Reed, Orange, N. J., assignor, by direct and mesne assignments, to the Reed Electric Company, Philadelphia, Pa. No. 521,891.

A pair of electrical conductors crossing each other at stated intervals and connected to the opposite poles of an electrical generator, in combination with a slitted conduit; the successive sections of the overlapping conductors lying in alignment with the slit of the conduit.

Conduit Electric Railway—Charles J. Reed, Orange, N. J., assignor to the Reed Electric Company, Philadelphia, Pa. No. 521,892.

Covers a trolley to be used with the previous invention, also combination of trolley with conduit system.

Safety Guard for Cars—August Soffel, Brooklyn, N. Y. No. 521,966.

The combination with the vertically movable cradle, of a U-shaped cradle operating spring and a rocking dog and lever engaged with the spring and with each other for manipulating the spring, whereby the cradle may be held suspended by the force of the spring and also forced downwardly by the spring.

Safety Appliance for Street Railway Cars—Frank W. Jenkins, Brooklyn, N. Y. No. 521,981.

The combination with a car having the platform rounded, of a wheel mounted loosely and in horizontal position below the platform, the wheel having a diameter equal to the gauge of a track on which the car runs, the front parts of the wheel circumference projecting slightly beyond the rounded edge of the car platform and an inclined guard extending from the car platform to the wheel.

Guard for Cars—Gustav Boehm, Long Island City, N. Y. No. 522,003.

The combination with a guard connected with the car platform, of an apron at the front end of the guard, springs for throwing up the apron, a sector and blocking lever for holding the apron in position, and means for disconnecting the blocking lever by the weight of the person upon the guard.

Trolley Stand—Eleazer F. A. Heastings, Avalon, Pa. No. 522,057.

A trolley stand, comprising a base, a bracket held to turn horizontally thereon, a second pole carrying bracket pivoted on the first bracket, and bow springs projecting from opposite ends of the first bracket and pivoted to opposite ends of the pole carrying bracket.

Means for Suspending Electric Motors From Cars—Robert Lundell, Brooklyn, assignor of two-thirds to Edward H. Johnson, New York. No. 522,067.

A car having a single propelling motor yieldingly sustained beneath its frame and the rotary part thereof connected at its opposite ends through sprocket wheels and sprocket chains to shafting which in turn is geared through speed reducing gearing to two of the axles thereof, in combination with a sliding support for the motor and means for compensating for undue stretching of the sprocket chains.

Car Fender—Marguerite Maidhof and Victor F. Maidhof, New York. No. 522,070.

In a car fender, the combination with a pivot plate attached to the car, of a fender comprising a platform, a back pivotally connected with the said platform, a vertically disposed pivot on the said back and engaging the said pivot plate, and wheels journaled on the front end of the said platform and adapted to travel on the track rails.

Automatic Switch Operating Mechanism—Cyrus P. Bachelder, Pawtucket, R. I. No. 522,096.

The combination with a car, a stationary transverse guide rod supported below the same, a block loosely mounted thereon, a vertically reciprocating, spring actuated pin arranged on the car and connected with the block, and a spring for supporting the block normally at a certain point upon the rod whereby it is adapted to operate a switch tongue.

Life Guard for Cars—Joseph J. Beals, Cambridge, assignor of one-half to Wallace L. Broadbent, Boston, Mass. No. 522,099.

A net is connected at its upper end with the car body, and the frame and stretcher connected with the lower end of the said net, and pivoted braces extending therefrom to the car body, combined with the lifting ropes for said stretcher and weight connected therewith.

Safety Guard for Cars—Joseph W. Betz, Brooklyn, N. Y. No. 522,100.

The combination, with a car and a car platform, of a fender frame hinged by its rear end upon the car below the car body, rollers on the lower side of the fender frame near its front edge, a spring pressed latch slidable from the platform, and a retractile spring engaging the car fender and frame.

Wheel Fender and Safety Attachment for Street Cars—Frank H. Homan, Patchogue, N. Y. No. 522,115.

A fender of netting for street cars inclosing the wheels and space beneath the floor, having an edge bar of pivotally connected sections provided with rolls and connected by a cross roll at each end of the car.

Flexible Belt Fender for Street Railway Cars—Richard B. Chambers, Chester, Pa., assignor to Crosby M. Black, same place. No. 522,147.

Flexible, traveling, endless belts are provided having the adjustable rollers arranged in a sliding bearing in slots, and swinging shields or frames with connecting rods and operating a pivoted table or semi-rotary yoke, and imparting its motions by rods to a friction clutch, and hand or foot lever and a stationary vertical bearing shaft arranged in different combinations.

Car Fender—Henri G. Chatain, New York. No. 522,149.

The combination with sections or lever and a spring, of a frame resting on one section and having its lower end set in advance of the lower end of the other section or lever.

Trolley Wire Hanger—Thomas J. McTighe, New York, assignor, by mesne assignments, to Frederick K. Fitch, same place. No. 522,180.

A trolley wire attachment consisting of an ear or casting of suitable shape having a slotted, screw threaded stud adapted to receive the trolley wire, a flat plug substantially filling the slot, and a screw cap adapted to fit the stud and press the plug against the trolley wire.

July 3.

Electric Railway Car Truck—Francis O. Blackwell, Lynn, Mass., assignor to Thomson-Houston Electric Company, of Connecticut. No. 522,189.

The combination with the driving axle of a railway truck and the motor shaft connected thereto through a flexible coupling and gearing, of the gear casing having a portion flexibly mounted to follow the movement of the motor shaft.

Car Fender—Alfred L. Clarke, Springfield, O. No. 522,194.

The combination with a railway car, of yielding arms secured directly to the front of said car, said arms each consisting essentially of a single piece of metal having a spring coil therein, and provided at

the lower end with a bearing portion or shoe, as described, and a guard or table arranged between the respective arms, and secured thereto.

WIRE SUPPORT FOR OVERHEAD ELECTRIC RAILWAYS—Arthur W. Jones, Boston, Mass., assignor to the Thomson Houston Electric Company, of Connecticut. No. 522,216.

The combination with a pole, of a bracket adjustably secured thereon, and having a socket provided with a watershed, and an eye in line with said socket, and having a watershed at each end.

TROLLEY CAR—Herbert J. Lycett, Bryn Mawr, assignor to John A. Brill, Philadelphia, Pa. No. 522,224.

A car having a movable platform upon its roof, supports for sustaining said platform in the raised position, and means independent of the supports and carried by the platform for holding said platform in the latter position.

RAIL JOINT AND BOND FOR ELECTRIC RAILWAYS—Julius Meyer, New York. No. 522,349.

The combination, with the rail ends, of a base plate provided with a trough and outwardly extending flanges, angle plates connected by bolts to the webs of the rail ends and to the outwardly extending flanges of the base plate, a bond or bonds connecting the base of the rail ends, and a filling of asphaltum or other plastic insulating material run into the trough of the base plate, so as to fully inclose the bond or bonds and serve as a projection for the same.

SUSPENSION CLIP FOR TROLLEY WIRES—William F. D. Crane, East Orange, N. J., assignor to the Johns-Pratt Company, Hartford, Conn. No. 522,362.

In a trolley wire clip, the combination, with a plate sloped backwardly toward the bottom of hooks projected downwardly at the ends of the plate, and a hook having the under side arched downward and its edge projected forwardly and upwardly from the bottom of the plate.

ELECTRIC RAILWAY SWITCH AND TROLLEY—Frederick S. Perrin, Lynn, Mass., assignor of three-fourths to William B. Baldwin, New York, and others. No. 522.388.

The combination with the trolley wheel, of side arms whose upper ends are arranged to extend over the trolley wire, and are movable toward and from each other, said arms carrying rollers at their ends.

SAFETY CAR FENDER—Daniel Harding, Townson, and William L. Fitzhugh, Baltimore, assignors to said Harding, and John I. Yellott, Townson, Md. No. 522,412.

The combination of a car axle provided with a clutch and clutch drum; means to keep the clutch disengaged from the clutch drum; a jack screw connected with the brake gear of a car to apply the brakes; and a swinging gate connected with the said means which keeps the said clutch disengaged.

CONDUIT ELECTRIC RAILWAY—John H. Tyrrell, New York. No. 522,440.

A conduit for electric railways, comprising a trough like structure provided with a longitudinal slot in its top, the upper portion of one of the side walls of said structure being inclined toward the said slot, a guard plate arranged on the opposite side of the slot, and a cover located on top of the structure between the guard plate and the other side wall of the structure.

CAR FENDER—William V. Cleary, New York. No. 522,449.

The combination, with a car, of connected oscillating shafts supported beneath the car, a vertically movable fender hung beneath the car, spring depressed arms carried by the shafts and engaging the fender, and a catch to hold the fender up.

ELECTRIC RAILWAY CONDUIT—Albert T. Fay, Minneapolis, Minn. No. 522,460.

The combination, in an electric conduit, of the cross ties and rails, with middle stringers resting upon said ties, surface plates arranged on said stringers, a space being left between the inner edges of said plates, an insulating strip extending parallel with said stringers and secured on the tops of the cross ties, a conductor wire or rail provided on said strip and a trolley arranged to travel in the conduit formed between said stringers and upon said conductor.

CONDUIT FOR TROLLEY ARMS—Albert T. Fay, Minneapolis, Minn. No. 522,461.

The combination with a car, of the track for the same, an underground conduit provided with a surface slot, a trolley arm having the thin flattened portion and the yoke to receive the trolley wheel, and a breakable section of weaker metal arranged between the top of the conduit and the car.

CAR FENDER AND BRAKE—Henry Maass, Jersey City, N. J. No. 522,530.

The combination of a movable fender, a spring actuated brake, a lock for the brake, and a trip operatively connecting the lock and the fender.

TROLLEY WHEEL—Charles E. Bostwick, DuBois, Pa., assignor of one-half to G. E. Grier, and others, same place.

In a trolley, the combination with a fork of the journal rigidly mounted in said fork, said journal having collars formed thereon intermediate at its ends, the outer faces of which are concaved, a wheel having a central opening, and a cylindrical casing located in said opening and through which the journal passes, said casing being integrally closed at one end and provided with an integral annular flange at said end, a cap for closing the opposite end, the said ends being concaved upon their interior faces, anti-friction balls held between said ends and the collars formed on the journal, and the bolts for securing the casing in the wheel.

JULY 10.

GEAR CASING FOR RAILWAY MOTORS—Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. No. 522,579.

A gear casing pivoted on the gear wheel shaft, and having a small removable section boxing in the pinion, said section being joined to the casing on a line between the pinion and the gear, whereby the pinion can be removed axially.

CONDUIT RAILWAY TROLLEY—John L. Creveling, Auburn, N. Y. No. 522,655.

An electric trolley, consisting of a depending plate in combination with trolleys, supported on either side thereof by a pair of pivoted arms.

CAR BRAKE—George W. Kramer, Peoria, Ill. No. 522,665.

A friction clutch cone mounted upon and rotating with a shaft, supported by the car in such manner as to be longitudinally movable on said shaft, a cup shaped bowl loosely mounted upon the same shaft, adapted to be engaged by said cone; and means for moving the cone longitudinally to engage said bowl; in combination with means for imparting the rotation of the car axle to the clutch cone, and means for transmitting the rotation of the clutch bowl to the brake stem.

CONTACT SHOE FOR ELECTRIC LOCOMOTIVES—John J. Green, Boonton, N. J., assignor to the Universal Electric Company, New York. No. 525,709.

A contact shoe for electric railways consisting of separate end pieces, side strips of flexible metal secured thereto, and a flexible or yielding central bar to which the insulated end pieces are loosely attached.

CONTACT BAR FOR ELECTRIC LOCOMOTIVES—John J. Green, Boonton, N. J., assignor to the Universal Electric Company, New York. No. 522,710.

Covers different forms of contact shoes or bars similar to the above.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS—John J. Green, Boonton, N. J., assignor to the Conduit Construction Company, New York. No. 522,711.

Covers a conduit adapted to be operated with the two preceding inventions.

CABLE RAILWAY—Charles W. Hunt, West New Brighton, N. Y. No. 522,713.

The combination with the cable and rollers in close proximity, and around which the cable passes in turning a curve, of a grip wider at the ends than in the middle, and having inner curved sides between which the cable is received, and exterior curved surfaces adapted to rest against the rollers around which the cable passes in turning a curve, and mechanism for clamping the cable within the grip.

TROLLEY EAR—Charles A. Lieb, New York, assignor to the General Electric Company, Boston, Mass. No. 522,844.

As a new article of manufacture, a trolley ear having a sheet metal portion with an upwardly-extending fin or fold and a cast metal bolt portion secured to the fin or fold.

TROLLEY WHEEL—Charles A. Lieb, New York, assignor to the General Electric Company, Boston, Mass. No. 522,845.

As a new article of manufacture, a trolley wheel having a central core of good conducting metal, as copper or bronze, and steel flanges secured to such core, such steel flanges being provided with radial corrugations.

SUBSTRUCTURE FOR BRACING AND SUPPORTING RAILROAD RAILS. James M. Price, Philadelphia, Pa., assignor to the Price Railway Appliance Company, of Pennsylvania. No. 522,852.

A rail support consisting of two chairs with a connecting bridge having openings for fastening bolts, and a grooved bed piece, and provided with a horizontal, inwardly projecting ledge.

CLOSED CONDUIT FOR ELECTRIC RAILWAYS—Charles I. Greer, Washington, D. C., assignor of one-half to Charles B. Peirce, same place. No. 522,894.

The combination of a conduit for electric wires, of a slot cover composed of rigid plates having central depending webs, and sectional filling blocks having channels in which said webs lie, the ends of the latter being lapped upon and pivotally linked to each other.

CAR FENDER—Lucius Q. C. Lamar, Oxford, Miss. No. 522,905.

A fender having its fending member projecting, when in action, below the other parts of the fender, and formed of material readily broken away in meeting unyielding obstacles, yet capable of resisting impact of the human body at any probable speed of a car.

TROLLEY POLE—Alexander S. McBean, Montreal, Canada. No. 522,915.

A trolley wheel support composed of a metal section rigidly secured to the trolley pole, an adjusting platform and a frame piece, the latter carrying the trolley wheel or runner, with a swiveling connection between the adjusting platform and the frame piece.

PILOT FOR CARS—Robert A. Crawford, Allegheny, assignor of one-half to Samuel D. Warmcastle, Pittsburgh, Pa. No. 522,932.

A pilot or guard adapted to fold back on the main portion thereof, a hinged section thereon, and fastening devices for holding said hinged section in position.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. THE STREET RAILWAY PUBLISHING COMPANY, HAVEMEYER BUILDING, NEW YORK.

Some Comments on Our Financial Supplement.

"American Street Railway Investments" has met with a most favorable reception. We publish below extracts from a few of the many letters which we have received in regard to the work, and from notices in the daily and technical press:

"The work as a whole is the best attempt to present these facts that has yet been made."—Philadelphia *Inquirer.*

John Dick, president and general manager Phœnix Iron Works Company, Meadville, Pa., says: "We are very much pleased with the general appearance of this work."

W. O. Page, secretary Jewett Car Company, Jewett, O., says: "Received your Financial Supplement, of which we feel very proud, and think it is just what we need."

A. D. Newton, treasurer Eddy Electric Manufacturing Company, Windsor, Conn., says: "We think this work will be of very great assistance to us, and think you have hit the mark you aimed for."

The J. G. Brill Company, Philadelphia, Pa., says: "We have looked over it with great interest, and think it fills a long felt want. You are certainly deserving of great credit for the bringing to the front of this matter."

R. H. Beach, Webster & Beach, New York City, says: "We will undoubtedly find it a very convenient reference. It is nicely gotten up, and so far as the writer's information goes it is the most complete thing in this line ever gotten out."

C. E. Newcomb, general manager Thiel's Detective Service, St. Louis, Mo., says: "Have not had time to fully examine this work, but its appearance stamps it as a good thing. It ought to be of immense benefit to investors and advertisers."

Benjamin F. Shaw, of Wilmington, Del., says: "I think it an extremely creditable work and one I shall always keep before me. I think you deserve great credit for the manner in which you have gotten it up, as it is certainly a very valuable book."

"The book is handsomely bound, and invaluable to those who are interested in street railways. The information is alphabetically arranged, and has been collected with great care. We shall expect to find it in all the investment offices.—*The Financial Record.*

W. J. Clark, general manager railway department General Electric Company, New York, says: "We do not wonder that you have a feeling of pride over your success in this direction, and we congratulate you most heartily for the success which is self-evident from the book itself.

Charles L. Henry, president of the Anderson (Ind.) Electric Street Railway Company, says: "Permit us to express satisfaction with map and letter press of our road as shown in "Investments," and also to compliment you on the high character of the publication which you have issued."

"'American Street Railway Investments' is the first publication giving in a comprehensive and systematic manner, data regarding the operation and management of the different properties, which will enable dealers and investors to judge of the relative merits of the securities described."—Philadelphia *Press.*

F. H. Stacey, secretary Hubley Manufacturing Company, Lancaster, Pa., says: "The book certainly presents a very handsome appearance, and is a beautiful production so far as the printer's art is concerned. I have not had time to examine same carefully, but from a cursory glance it is indeed a very valuable work."

Frank S. DeRonde, general sales agent Standard Paint Company, New York City, says: "Your pride in the success of this splendid edition is certainly pardonable. It is not often that we comment or write on publications of any kind, but we cannot help but congratulate you on this book. It is, in our opinion, ahead of anything of the kind before published."

J. G. McDuff, general manager American Electrical Advertising Company, New York, says: "From a hasty, casual glance we find it a very valuable compilation of the capitalization and other statistics of the different street railway companies, and otherwise full of valuable information for street railways and security and bond brokers or any one needing information for making investments or having the use of same."

George A. McKinlock, president and treasurer Central Electric Company, Chicago, Ill., says: "You are perfectly justified in your feeling of pride in the success of your efforts, as we entirely agree with you in reference to the pamphlet being far in advance of anything of the kind ever before compiled. It contains just the kind of information we have long felt the need of, and we are glad to have such a reliable reference book at hand."

"This is a most interesting, useful and valuable statistical work, compiled with much diligence and intelligence, and arranged in a manner that makes reference and comparison very easy. Not only is the fullest possible information given as to the financial status of the street railways of the country, but each section furnishes data as to the population of the place, its industries, its peculiarities, its rate of valuation, debt, taxation, etc., and other points likely to determine the value of a property operated under municipal franchise. In many instances the company's last balance sheet is presented.—*Electrical Engineer.*

"The Street Railway Journal has published a volume, entitled 'American Street Railway Investments,' which is aimed to occupy a a position in reference to street railway securities such as *Poor's Manual* does to steam railroads. The importance of street railway interests is brought to mind by the fact that more than 1,000 street railway companies have reported. The information is recent in date, and so far as can be judged by a casual examination, correct in character. A particularly valuable feature of the book is a large number of city maps showing street railway lines in detail."—Financial column, Chicago *Tribune.*

"There has been gathered together in this book a vast amount of detail relative to the street railways of the country. The information is of a very practical character, and is arranged for quick reference. The remarkable development in the building of street railways has brought such securities into greater popularity, and this compilation of the capitalization and other statistics of such properties is a timely one. It presents authentic information of value to the investor, giving one a very full acquaintance with the condition and operations of any particular line, and will prove a helpful aid to legitimate investments."—*Manufacturers' Record.*

"This undertaking of our contemporary is a laudable one, and should be cordially received by the public. The wild-cat financiering, which has been too much a feature of the electric railway business, would not have been possible if the railway men themselves, and those who have been buying their securities, could have been brought into closer touch, and known better how to get at each other. The financing companies which have grown fat by assessing both the public and the street railway men, would not have been able to get a foothold. We shall present a further review of this work, showing by tabulation some remarkable facts."—*Electricity.*

"This book is the first publication giving, in a comprehensive and systematic manner, detailed information regarding the operation and management of the different properties, and there is no doubt that there will be a large demand for it by railway and financial men. The cities and towns are arranged alphabetically, and particulars are given of the mileage, track, equipment, power plant, finances and statistics of operation of each railway. The population of each place is also given, together with particulars of the commercial interests and financial conditions in the case of the larger cities. The twenty-four maps show the street railway systems of several cities. The book is well printed, on good paper."—*Engineering News.*

The Car Equipment Company, of Philadelphia, writes: "We have received and carefully examined the copy of American Street Railway Investments ordered by us, and herewith express our sense of the obligation under which you have placed us in common with other manufacturers and investors, in the production of so valuable a manual. It is not only the most complete work of its kind which we have seen in this field, but contains a greater amount of information concerning the railways of the country than we supposed could have been possibly brought together, inasmuch as the development of the electric railway is yet in a somewhat transitory condition. The information is concise and to the point and is arranged in a manner that permits of instant reference."

"In this publication detailed information regarding the operation and management of the roads is given in a complete, yet condensed form. The population of cities and towns is given, and particulars as to the mileage, track, equipment, power stations and financial reports. Wherever the value of the property is affected by such details the tax rate, debt, etc., are also given, as well as general information about the commercial interests of the city. An invaluable feature of the book as a work of reference is the date, attached to the report of each road, that the information was received from its officers. The publishers have certainly succeeded in compiling a valuable book in regard to properties of which it has heretofore been almost absolutely impossible, with few exceptions, to obtain any definite and reliable information."—*Street Railway Gazette.*

"'American Street Railway Investments' is the title of a valuable manual which the Street Railway Journal, of New York City, has just issued. The work is comprehensive, giving a statement of the the leading street railways' capital stock, funded debt, character and extent of plants, executive officers and directors, and sketches of organization and development. To this is added information regarding the communities which they serve, business growth, municipal indebtedness and rates of taxation. Besides this there is a large number of maps. The presentation is concise and clear. With the tremendous expansion of these enterprises within the past half dozen years, the need of such a manual has been strongly felt by investors. For this reason it is a satisfaction to know that the present undertaking is to be continued each year, the publication hereafter to be March 15. The present issue is corrected to June 15."—Boston *Journal.*

G. Tracey Rogers, president of the Binghamton (N. Y.) Railroad Company, says: "I consider this book one of the most valuable in our library. We would not part with it for a great many times the amount of its cost, could we not secure another. I think the book will be of great service, not only to bankers and investors, but to all street railway companies, affording an opportunity which we have not heretofore had for comparing notes and getting insight as to what our neighbors are doing. I am satisfied that this publication will be of great assistance to all street railway companies in disposing of their securities. Hitherto investors have been groping in the dark more or less as to the relative value of different street railway securities which have not as yet a fair showing in the financial world. This class of investments is comparatively new, and entitled to a higher standard than has been given them. I think your book will materially assist in giving them the position that they deserve."

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., July 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.	100	750,000	Q Feb.	1½	1890	115	116
Watervleit Turnpike & R. R. Co.	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort...	1865	40,000	J. & J.	5	1905	101½	.....
" " " 2d Mort....	1873	20,000	M. & N.	7	1893	101½	.....
" " " 3d Mort....	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort...	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort...	1888	50,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102½	.....
" " " Debenture..	1891	200,000	M. & N.	6	1901	111	.....
Watervliet Turnpike & R. R., 1st Mort.	1889	350,000	M. & N.	6	1919	111	112
Watervliet Turnpike & R. R., 2d Mort.	1889	150,000	M. & N.	6	1919	110	113

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., July 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	2,500,000	Sem-an	4	.....	56	57
City & Suburban Ry. Co.	50	3,000,000	.....	1	.....	33	35
Central Pass. Ry. Co.	50	300,000	.....	...	.....	60	65
Balto. Traction Co. (Cable)..	25	5,000,000	Quart.	1	.....	13¾	14¼

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort..	1892	500,000	.....	5	.....	110	110½
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	104¾	105
Balto. Traction Co. (Cable)..	1889	1,500,000	M. & N.	5	1929	105½	106
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D.	5	1942	99	99¾
" " "	1891	1,250,000	M. & S.	6	1901	100	101
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	113	113½

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange, July 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.	50	$6,400,000	J. & J.	4	1887	76	76½
West End Com'n.	50	9,085,000	J. & J.	3	1890–1892	45	45¾

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, July 23. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	.....	170
Brooklyn Traction Co., pref..	100	3,000,000	.....	...	1893	67	.....
" " common.	100	6,000,000	.....	...	1893	15	.....
Coney Island & Brooklyn R. R. Co.	100	500,000	Oct. 1.	4	.....	147	.....
Long Island Traction Co.	100	30,000,000			1893	14	15

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co.	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	102	.....
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	.....	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	104	.....
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	112	115

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., July 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.	50	$100,000	J. & J.	0	.....	.....	65
Enterprise Ry. Co.	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co.	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 108 LaSalle Street, Chicago, Ill., July 25.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City.	100	$9,000,000	Q.—J.	3	.....	307	315
Chicago Passenger.	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City.	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street.	100	5,500,000	J. & J.	4	.....	240	241
West Division City.	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street.	100	13,189,000	Q.—F.	1½	.....	135½	136

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City.	.....	4,619,500	J. & J.	4½	.....	101⅛	101¾
Chicago Passenger.	1883	400,000	F. & A.	6	1903	105	110
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	....	101
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	.....	103½
West Chicago Street.	.....	4,100,000	M. & N.	5	.....	102½	103
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	100	101½
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	103	103¾

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, July 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati.	50	$7,500,000	Q.—J.	5	.....	105½	106
Mt. Adams & Eden Park.	50	1,600,000	Q.—J.	5	.....	106¾	107
Mt. Auburn Cable.	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry.	100	500,000	.....	...	.....	59¾	60
" " " Pref.	100	100,000	.....	6	.....	98	99
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....		.....	22⅛	24

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
" "	.....	50,000	J. & J.	7	July, 1895	101⅛	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	98¾	99½
	.....	150,000	J. & J.	5	.....	100¾	101¼
Mt. Adams & Eden Park.	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	110½	111½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	105¾	105¾
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	107	108
" " "	.....	300,000	J. & J.	6	Jan. 1914	105	106
Mt. Auburn Cable.	.....	200,000	J. & D.	5	June, 1907	.....	90
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati.	.....	250,000	M. & S.	6	Mar. 1912	114	115
S.Cov.& Cin. 2d Mort. gold 6's	.....	250,000	J. & J.	...	1932	113½	114½

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., July 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co	100	12,000,000	.....	....	1893	45⅛	46
The Cleveland City Ry. Co.	100	8,000,000	.....	....	1893	56	57½

BONDS.	Date of Issue	Amount Out-standing	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	100	102¾
" " City " "	1893	2,349,000	.....			100	102

DETROIT STOCKS.—Corrected by Cameron Currie & Co., Bankers and Brokers, 82 Griswold Street, Detroit, July 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. Mackintosh & Co., Bankers, Holyoke, Mass., July 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	200	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	125	150

LOUISVILLE STOCKS AND BONDS.—Corrected by Almstedt Bros Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., July 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$2,000,000	A. & O.	5	Jan. 1891	87	88
Louisville St. Ry. Co., com....	100	4,000,000	.....	...	Jan. 1891	37	38

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	100	101
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	116	117
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	116	117
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. Warren & Co., Bankers and Brokers, New Haven, Conn. July 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$600,000	J. & J.	4	.....	45	47
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	...	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Bridgeport Horse R. R. Co.....	100	140,000	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

Bonds.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
New Haven Street Ry. Co.....	1894	600,000	J. & J.	5	Jan. 1919	.....	100
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Horse R. R. Co....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by George Le Sassier, 188 Common Street, New Orleans, La., July 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.	100	1,200,000	Quart.	1½	1867	124	127
Crescent City R. Co.....	100	1,150,000	"	3	1866	75	90
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	38	40
New Orleans City & Lake Co.	100	1,500,000	Quart.	2½	1860	99	103½
Orleans R. R. Co.....	50	185,000	"	2	1868	34	.....
St. Charles Street R. R. Co ..	50	600,000	"	2½	1863	55	57

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	100	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	.....	.....
do do	1893	2,000,000	J & J	6	1943	85	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	114	115
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	87	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	.....	.....
St. Charles Street R. R. Co...	1881	105,000	J & D	6	'95-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by Gordon Strathy & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, June 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (old stock)	50	$2,000,000	M. & N.	4	May, '91.	149	149¾
" " (new stock)	50	2,000,000	.....	...	May, '94.	144½	145

Bonds.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by James McGovern & Co., 6 Wall St., New York, July 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	.....	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	185	188
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	150	155
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	150	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	132	135
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4½	.....	300	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	50	55
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q.—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	132	135
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	200	206
Third Avenue.....	100	5,000,000	M.—N.	4½	.....	182	184
23d St.....	100	600,000	Q.—F.	2½	.....	290	.....
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	139	.....
Union Railway Co.....	100	2,000,000	.....	...	.....	145	150

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	108	111
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	106	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	106	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	106	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	103	.....
Broadway Consolidated.....	.....	7,650,000	J. & J.	5	 1943	109⅞	110
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	115	120
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	105	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	99	100
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	53	.....
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue.....	.....	7,000,000	J. & J.	5	Jan., 1937	115	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	.....

PHILADELPHIA SECURITIES.—Corrected by Huhn & Glendinning, 143 South Fourth st. (Bullitt Building), Philadelphia, July 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	260	265
Continental.....	50	1,000,000	J.—J.	6	1873	124½	126
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	310	312
Germantown.....	50	1,500,000	Q.—J.	2¾	1858	111	112
Green & Coates...	50	500,000	Q.—J.	3	1858	123	125
Hestonville...	50	2,050,000	.....	...	1859	35	40
Lombard & South.....	25	500,000	A.—O.	8	1861	90	90
People's Traction Co.....	50	10,000,000	.....	...	.....	45	46
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	155	160
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	80	85
*Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	96	96½
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	227	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	207	210
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	225	230
Union.....	50	1,250,000	J.—J.	9½	1864	199	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	200	210
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	117	117¼
Baltimore Traction.....	25	5,000,000	.....	1	1889	14	14¼
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co. *Ex. Allotments.	50	3,000,000	J.—J.	...	.....	12⅛	12¾

Bonds.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	107¾	108¾
" " Imp.	1892	1,250,000	M.—S.	6	1901	101	102
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100¾	102
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	103½	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., July 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 306 Times Bldg., Pittsburgh, Pa., July 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	..	.....	19¼	20
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	59⅜	59½
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	12⅞	12¾
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	.....	6⅜
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	...	.....	19⅝	20⅛
Pittsburgh, Allegheny & Man	50	3,000,000	.....	1	.....	35	38½
West End R. R. Co.	50	200,000	J. & J.	...	.....	.....	20
Second Avenue R. R. Co.	50	300,000	J. & J.	3	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	26	26½
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O	5	1927	107	110
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	106	110
Pitts. & Birmingham Traction Co.	1892	.....	.....	5	.....	93	93¼
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	104¾	104¾
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	101¾	101½
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	...	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.	1887	75,000	J. & J.	5	1922	101	102
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	.....
Suburban Rapid Transit.	.....	.....	.....	6	.....	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incl'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	250,000	J. & J.	6	1919	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS Bankers, Providence, July 24.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	..	.....
BONDS.	Date of Issue	Amo'nt Out-stand'g	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	95	100
Newport St. Ry. Co.	.....	50,000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, July 23.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	27	31
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	57	59
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	13	20
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	37	40
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	65	75
do do Common.	100	4,000,000	.....	...	1892	18	20
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	68	80
do do Common.	100	3,000,000	.....	...	1892	15	20
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	35	38
BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	93	95
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	100	102
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	87	95
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	99	100
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	90	95
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	86	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., July 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	...	.....	.....	100
Geary St., Park & Ocean R.R.Co	100	1,000,000	Monthly	...	.....	.....	107
Market Street Cable Co.	.....	18,750,000	.....	..	.....	39¼	39½
Metropolitan Electric.	.....	1,000,000	Monthly	...	.....	.....	27⅜
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	14½	.....
Sutter St. R. R. Co.	.....	2,000,000	Quart'ly	...	.....	90	.....
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	J. & J.	5	.....	103½	.....
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	106½	.....
Geary St., Park & Ocean.	.....	671,000	A. & O.	5	.....	104	.....
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	118¾	119½
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	115½	116½
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	112	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	.....	100⅜
Powell Street R. R.	.....	700,000	M. & S.	6	1912	111½	112½
Sutter St. Cable Co.	.....	900,000	M. & N.	5	.....	104½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., July 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	55	60
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue.	100	112,000	Dec. '88	2	1885	125	135
Lindell	100	2,500,000	.....	...	1890	90⅛	91½
Missouri.	100	2,000,000	Q.—J.	2	1891	200	210
People's.	50	1,000,000	Dec. '89	50c	1899	20	25
St. Louis.	100	2,000,000	J. & J.	3½	1890	148	151
Fourth Street & Arsenal.	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban.	100	2,500,000	.....	...	1891	13	15
Southern, Pfd.	.....	800,000	Jan. '94	3	.....	80	85
" Com.	.....	700,000	.....	...	.....	15	25
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	98	100
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	105	107
Fourth St. & Arsenal	1888	50,000	J. & J.	6	1898-1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895-1910	101	102
Missouri Cable	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	99	100
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable	1889	800,000	J. & J.	6	1889-1914	90	95
St. Louis Cable	1890	1,500,000	M. & N.	5	1900-1910	101	103
Union Depot	1890	4,000,000	A. & O.	6	1900-1910	104	105
Southern	1884	200,000	M. & N.	6	1904	103	105
Southern	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban	1891	1,400,000	F. & A.	5	1921	84	86
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	70	80

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., July 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	280	300
Metropolitan R. R.	50	750,000	Q. J.	2	1864	94	96
Columbia R. R.	50	400,000	Q. M.	1	1870	60	65
Belt R.R.	50	500,000	Q. J.	...	1875	25	30
Eckington & Soldiers' Home	0	352,000	.....	...	.....	31	35
Georgetown & Tenallytown.	0	200,000	.....	...	.....	...	85
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'tn & Geo'tn conv't. 1st.	'83-'99	3,000,000	J. & J.	6	1899-1929	130	138
" " " 2d.	.....	500,000	J. & J.	6	1903-1943	130	138
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	100	103
Belt	1921	240,000	J. & J.	6	1921	85	90
Metropolitan R. R. convert.	1901	200,000	J. & J	5	1901	101½	106
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

Financial.

THE York (Pa.) Street Railway Company paid a dividend of 2½ per cent. on July 20.

$ $ $

GEO. W. JONES has been appointed receiver of the Schenectady Street Railway Company, *vice* John Muir, resigned.

$ $ $

THE Raleigh Springs Railroad plant of Memphis, Tenn., was sold by order of the court last month to J. T. Fargason for $101,000.

THE Citizens' Street Railway Company, of Indianapolis, reports that June net earnings were $42,000, an increase of $14,000 over June, 1893.

$ $ $

THE Cleveland (O.) Electric Railway Company paid a dividend of three-fourths of 1 per cent. on July 5, to the stockholders of record June 30.

$ $ $

THE Chattanooga (Tenn.) Electric Railway Company has been put in the hands of a receiver upon application of the St. Louis Trust Company. W. T. Adams, president of the company, has been appointed receiver.

$ $ $

AT a monthly meeting of the directors of the Worcester Traction Company, held July 13, a semi-annual dividend of 3 per cent. on the preferred stock was declared. The report of the treasurer showed the transportation last month was greater than ever before.

$ $ $

THE gross earnings of the West End Street Railway Company, of Boston, for June show an increase of business over 1893, being, in round numbers, $643,000, against $618,000 in 1893. The 1893 figures were the largest on record to that date, and set against $598,000 in June, 1892. The pleasant weather has stimulated travel. The net gain over June, 1893, was over $50,000.

$ $ $

THE following is a comparative statement of the operations of the Worcester Traction Company for the month of June:

	1894.	1893.	
Gross earnings,	$36,233.56	$32,607.49	Inc., $3,626.07
Operating expenses,	16,523.79	20,463.78	Dec. 2,939.99
Net earnings	19,709.77	12,143.71	Inc. 7,566.06

$ $ $

NOTICE has been given that a special meeting of the stockholders of the Winnipeg (Man.) Street Railway Company would be held at the office of the company, on July 25, for the purpose of authorizing the sale of the company to the Winnipeg Electric Street Railway Company. A special meeting of the stockholders of the Winnipeg Electric Street Railway Company was also held on July 25, for the purpose of authorizing the purchase of the Winnipeg Street Railway Company.

$ $ $

THE Long Island Traction Company, it is said, contemplates the issue of collateral trust notes to the extent of $2,000,000 or over. The notes which it proposes to issue are redeemable in one year or five years, and they are to be offered first to the Long Island Traction Company's stockholders. Those which the shareholders take are to be underwritten by a syndicate, composed, it is said, by Brooklyn trust companies and banks, and the Mutual Life Insurance Company, of New York.

$ $ $

THE following is a comparative statement of the operations of the Buffalo Railway Company for the month of June: Gross earnings, 1894, $133,486.15; 1893, $133,133.28; increase, $352.87. Operating expenses, 1894, $74,054.33; 1893, $76,146.84; decrease, $2,092.51. Net earnings, 1894, $59,431.82; 1893, $56,986.44; increase, $2,445.38. For the six months ending June 30: Gross earnings, 1894, $727,167.01; 1893, $687,662.77; increase, $39,504.24. Operating expenses, 1894, $425,134.13; 1892, $453,223.19; decrease, $28,089.06. Net earnings, 1894, $302,032.88; 1893, $234,439.58; increase, $67,593.30.

$ $ $

THE agreement on the consolidation of the Watertown Street Railway Company and the Watertown & Brownville Street Railway Company, forming the Watertown & Brownville Street Railway Company, has been filed with the Secretary of State. The basis of consolidation is share for share of the capital stock. The capital of the first named company was $40,000 and of the latter $60,000, and the capital of the newly formed corporation is $100,000. The directors are: Byron B. Taggert, Joseph Mullin, Hiram F. Englehart, Edward S. Goodale and Samuel F. Bagg, all of Watertown, and John B. Thompson and Charles A. Starbuck, of New York City.

$ $ $

THE following is a comparative statement of the operations of the North Shore Traction Company, of Boston, for the month of June:

	1894.	1893.	
Gross earnings....	$128,437 10	$116,050,88	Increase $12,386.22
Operating expenses	60,878.22	58,999.41	Increase 1,878.81
Net earnings.....	$67,558.88	$57,051.47	Increase $10,507.41

For the nine months ending June 30, the earnings and expenses of the company were as follows:

	1894.	1893.	
Gross earnings.....	$802,319	$766,176	Increase, $36,143
Operating expenses...	538,947	607,894	Decrease, 68,947
Net earnings.....	$263,372	$158,282	Increase, $105,090

$ $ $

THE following is a comparative statement of the operations of the Columbus Street Railway Company for the month of June: Gross earnings, 1894, $50,355.82; 1893, $49,979.40; increase, $376.42. Operating expenses, 1894, $21,288 89; 1893, $30,740.73; decrease, $9,451.84. Net earnings, 1894, $29,066.93; 1893, $19,238.97; increase, $9,828.26. For the six months ending June 30, 1894, the earnings and expenses of the company are shown by the following report: Gross earnings, 1894, $264,272.30; 1893, $260,561.85; increase, $3,710.45. Operating expenses, 1894, $128,280.07; 1893, $171,138.30; decrease, $42,858.23. Net earnings, 1894, $135,992.23; 1893, $89,423.55; increase, $46,568.68.

$ $ $

THE following is a comparative statement of the operations of the North Shore Traction Company for the month of May:

	1894.	1893.	
Gross earnings....	$104,569.84	$102,845.17	Increase, $1,724.67
Operating expenses	63,906.67	62,524.68	Increase, 1,381.99
Net earnings.....	$40,663.17	$40,320.49	Increase, $342.68

For the eight months ending May 31 the showing made by the company is as follows:

	1894.	1893.	
Gross earnings.....	$673,882	$650,126	Increase, $23,756
Operating expenses...	478,069	548,895	Decrease, 70,826
Net earnings.....	$195,813	$101,231	Increase, $94,852

$ $ $

WE are just in receipt of a statement of the earnings for the month of June of the companies operated by the Brooklyn Traction Company:

Gross earnings Atlantic Avenue Railroad.....	$88,347.35
" " Brooklyn, Bath & West End Railroad.....	17,279.67
Total.....	$105,627.02
Operating expenses Atlantic Avenue Railroad.....	$52,814.75
" " Brooklyn, Bath & West End Railroad	9,664.91
Total.....	62,479.66
Net earnings.....	$43,147.36

The gross earnings of the above systems show an increase of $13,847.16 on the corresponding month of 1893.

$ $ $

THE receiver who was appointed for the Richmond Railway & Electric Company, of Richmond, Va., June 11, at the request of certain stockholders of the Richmond & Manchester Railway Company, was removed two weeks after his appointment, upon a hearing upon the ground that there was no reason for even a temporary receivership. John H. Davis & Company, of New York, bankers, refer to this case in their monthly financial circular for July, 1894, as follows:

"In Richmond, Va., a contract was entered into in 1893 by which certain street railway and other property was to be transferred to a new ownership under certain conditions, no fixed time being set for the consummation of the trade. It was one of the provisions of the contract that after this transfer should have been made the Richmond Railway & Electric Company—not one of the contracting parties, but under the management of the proposed purchaser—would place its guarantee upon certain new bonds to be issued upon the property in question. There was delay in executing the transfer, the purchaser claiming that the vendors had not as yet met their obligations as to free land and clear title, etc., and that whenever this should be done, to the satisfaction of counsel, he was ready to do his part. The vendors claimed that they had done and were ready to do all they had agreed. It was a question of business and legal interpretation, and if any suit of any kind was necessary, it would manifestly be one for specific performance of a contract, at which both sides should have a hearing. The courts were open in Richmond, the United States District Court being in session, presided over by one of the oldest judges on the bench. Ignoring this court upon the spot, the vendors went before another judge of the same court in South Carolina, presented a complaint and asked for a receiver, not only of the property in question, but also of the Richmond Railway & Electric Company. Incredible as it may seem, the request was granted, and the latter company, without notice, and a solvent concern in every sense of the word, found itself in the hands of a temporary receiver, with all the inconveniences and the discredit attaching thereto. It is needless to say that the company itself and its friends lost no time in making a determined effort to have this gross injustice remedied, and the court was asked to give a hearing at the earliest possible moment. That hearing was had on Monday and Tuesday last before the Federal Court judge in Richmond who had been ignored in the former proceedings, and resulted in an instant discharge of the receivership of the Richmond Railway & Electric Company in the following unequivocal words:

"'After full argument of counsel, the court being of opinion that the Richmond Railway & Electric Company is *entirely solvent* and that there exists no ground for the appointment of a receiver of its property, the motion to appoint a receiver of the said company is denied, and it is ordered that the temporary receiver appointed in this cause do forthwith surrender and deliver unto the Richmond Railway & Electric Company, its officers and agents, all of the property in his hands or under his control, including all moneys remaining in his hands realized from the operations of said company.'"

We are further informed that during the first week that the receiver was in possession he took in over $10,000 from the operation of the lines, and that for the two weeks he took in from the railway and turned over to the officers of the company when the receivership terminated over $20,000, while his total payments had been less than $500. These facts seem to be in themselves abundant refutation of any charge that the Richmond Railway & Electric Company was an insolvent concern.

Electric Snow Sweepers.

From the first of August on is generally recognized as the time to consider winter equipment. The summer season by this time is half over, and only three, or at most four, months must intervene between it and the arrival of cold weather. Inquiries at the offices of a number of the supply companies show that winter orders are now being placed, and that many companies are already providing for the coming cold weather.

The Lewis & Fowler snow sweeper promises to be more popular this year than ever before. This sweeper was brought out during the year 1891, and attracted much attention at the Pittsburgh Convention, where it was exhibited for the first time. It was illustrated and described in our issue for September, 1891.

The sweeper has been found to be so well fitted for the purpose for which it was designed that snow has ceased to have any terrors for the average railway manager, and the sweeper has come to be regarded as a necessary portion of the equipment of every railway. The Brooklyn *Eagle* quotes General Manager Bogardus of the Brooklyn Heights Railway, as saying in a recent interview, "They go far ahead of anything I ever saw for cleaning streets. All we have to do for an ordinary storm is to run the sweeper back and forth over the tracks, and they are kept as clean as in summer."

A list of the railway companies using the Lewis & Fowler sweepers is an interesting one, showing, as it does, the wide adoption of the sweeper. It includes the following roads: Baltimore City Passenger Railway Company; Baltimore Traction Company; Baltimore & Curtis Bay Street Railway Company; Bangor Street Railway Company, Bangor, Me.; Brooklyn Heights Railroad Company, Brooklyn, N. Y.; Camden Street Railway Company, Camden, N. J.; Citizens' Street Railway Company, Indianapolis, Ind.; City & Suburban Railway Company, Baltimore, Md.; Chicago North Shore Street Railway Company; Columbus Consolidated Street Railway Company, Columbus, O.; Consolidated Traction Company, Newark, N. J.; Cleveland City Railway Company; Detroit Citizens' Street Railway Company; Duquesne Traction Company, Pittsburgh, Pa.; Easton Transit Company; Erie Electric Motor Company; East Harrisburgh Passenger Railway Company; Elizabeth Street Railway Company, Elizabeth, N. J.; Federal Street & Pleasant Valley Railway Company, Pittsburgh, Pa.; Fort Wayne Electric Railway Company; Hamilton Street Railway Company, Hamilton, Ont.; Jamestown Street Railway Company, Jamestown, N. Y.; Lindell Railway Company, St. Louis, Mo.; Milwaukee Street Railway Company; McKeesport & Reynoldtown Passenger Railway Company, McKeesport, Pa.; North End Street Railway Company, Worcester, Mass.; Omaha Street Railway Company; Ottawa Electric Railway Company, Ottawa, Ont.; Oswego Street Railway Company; Pittsburgh, Allegheny & Manchester Traction Company, Pittsburgh, Pa.; Rochester Railway Company; Sioux City Street Railway Company; Second Avenue Passenger Railway Company, Pittsburgh, Pa.; South Chicago Street Railway Company; Toledo Electric Street Railway Company; Terre Haute Electric Railway Comwany; Trenton Passenger Railway Company; Third Avenue Railway Company, New York; Toronto Railway Company, Toronto, Ont.; Utica Belt Line Street Railway Company; Woodland Avenue & West Side Railroad Company, Cleveland, O.; Wilmington City Railway Company, Wilmington, Del.; West Chicago Street Railway Company; Worcester Consolidated Street Railway Company.

Utica Belt Line Reorganized.

After a series of unsuccessful efforts extending over a long period, the Utica Belt Line Street Railroad Company was reorganized July 13, and within a short time the road will be taken from the receiver's hands and the new organization put in possession.

At the meeting 1,500 shares of stock were represented and out of this number voted, 1,454½ were voted for the following board of directors: Charles W. Mather, John W. Boyle, Edward Bushinger, William B. Putney, of New York, James T. Gardiner, of Albany, Camile Weidenfeldt, of New York, Robert G. Young; inspectors of election, John H. Grant, Thomas P. Weston, John Weston.

After the election the directors met and elected the following officers: President, John W. Boyle; vice-president, James T. Gardiner; treasurer, Charles W. Mather; secretary, Edward Bushinger; executive committee, John W. Boyle, Charles W. Mather, James T. Gardiner.

It is understood that by the agreement of the organization, it is provided, among other things, that money is to be furnished and expended upon the property in order to put it in proper condition for economical operation. The board of directors elected by virtue of the order of the court and the notice sent out to stockholders is to be made up, so far as the three interests now represented are concerned, in the same way that it is now made up; the Utica interests are entitled to four directors; the New York interests to two directors; and the Thomson-Houston or General Electric interests to one director. This arrangement is to continue for a period of years.

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LINE CONSTRUCTION MATERIAL.

Map of the United States.

A large handsome Map of the United States, mounted and suitable for office or home use, is issued by the Burlington Route. Copies will be mailed to any address on receipt of fifteen cents in postage by P. S. Eustis, General Passenger Agent, C., B. & Q. R. R., Chicago, Ill. ***

The Lake Shore Route.

The Lake Shore Route, between Buffalo and Chicago, is celebrated all over the world as affording the embodiment of luxury in travel. Its new Day Coaches are sixty feet in length, and will seat fifty-eight people, comfortably. They are fitted with the Gould platform and automatic coupler, Westinghouse air brakes and signal, heated with steam taken from the locomotive, and at night are brilliantly lighted with Pintsch gas, for which purpose five elegant bronze chandeliers depend from the roof of the car.

The interior of the coaches is finished in mahogany, highly polished and paneled. Each coach has a nice lavatory and toilet. The latest models contain separate toilet rooms—one for ladies and one for gentlemen. The car seats are of the style known as the Mason tilting, with high spring backs and broad seats. They are richly upholstered in crimson plush. The windows, which are of plate glass, are large, and each is fitted with a spring-roller curtain, in shade to blend with the interior finish, and every feature is of the best.

The dining cars in service on the trains of the Lake Shore & Michigan Southern Railway are operated by the company. The cars are neat and tasty in all their appointments. Great care is exercised to provide the patrons of the Lake Shore Route with a service which shall prove satisfactory. As a result, dining on the trains of the road is accomplished in a very satisfactory and comfortable way.

The sleeping cars in service on the Lake Shore Route are of Wagner build. Ordinarily, they contain twelve sections, a state-room, a smoking apartment, and toilets for ladies and gentlemen. In some instances, however, there are cars containing sixteen sections, the state-room being omitted. Every valuable device is embodied in their construction.

The Lake Shore operates a most perfect sleeping car service between the cities of Chicago, Cleveland Buffalo, New York and Boston, in connection with the New York Central and Boston & Albany Railways. This is not only the direct, best and only double track route between the cities mentioned, but the Lake Shore is the only line from Chicago conveying passengers into New York City without a ferry transfer. ***

Special Train to the Atlanta Convention.

We are in receipt of the following letter from Mr. L. J. Ellis, the eastern passenger agent of the Norfolk & Western Railroad Company, the famous Shenandoah Valley Route, which will be of interest to all street railway men who contemplate a trip to Atlanta to attend the October convention. Our representative has been over the route outlined for the special train, and we can endorse the statements made as to the attractive scenery along the line and the excellent facilities offered. Mr. Ellis says:

Dear Sir:—Please do me the kindness to call attention editorially to the arrangements we have made to carry the delegates and visitors to the National Street Railway Convention to convene in Atlanta October 17, as shown in the advertisement I enclose for insertion in the Street Railway Journal.

A canvass among the street railway men has satisfied us that we are justified in making these arrangements. The fact that a part of the programme for those attending the Atlanta convention is to visit Lookout Mountain makes our route the only practicable one, as it is the only direct line to Atlanta via Chattanooga from the East. As you have been over the entire route, you can speak with the courage of conviction as to its attractiveness, its equipment and management, and our ability to take the best of care of those who go with us on this occasion.

Very truly yours,
(Signed) L. J. Ellis, E. P. A.

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"Teck" Splice for Trolley and Feed Wire.
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Trolley Wheels.

Bronze, Brass or Iron. The special bronze has a record of 10,000 miles and still running. All have Patent Graphite Bearings.

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Bearings

For Dynamos and Motors. Guaranteed 20 per cent. more life than any other anti-friction metal on the market.

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Electric Lighting Material. Regulating Sockets, Pendants, Cutouts and Switches, of our own design and Patents.

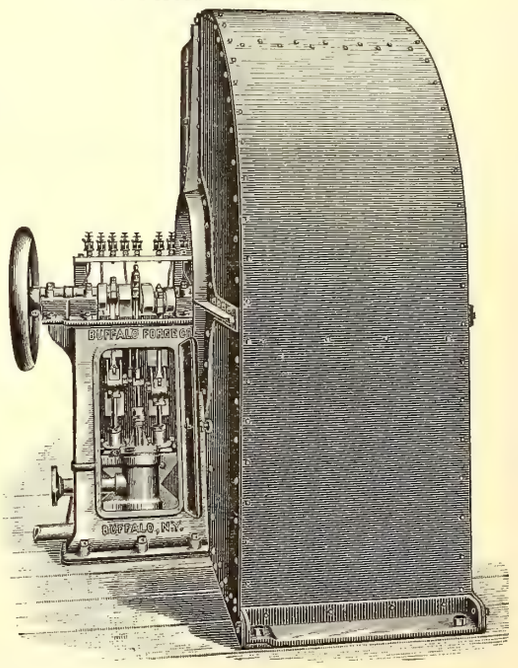
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THE STREET RAILWAY JOURNAL

Vol. X. *NEW YORK & CHICAGO, SEPTEMBER.* *No. 9.*

Twelfth Annual Meeting of the New York State Street Railway Association.

The twelfth Annual Meeting of the New York State Street Railway Association, as already announced, will be held at Syracuse on Tuesday, September 18, 1894. The place of meeting is Yates Hotel, and the Association will be called to order at 10.30 A. M. A number of street railway and supply companies have signified their intention of being represented, and an excellent meeting may be expected.

Two papers are to be read at the meeting, both of which are by engineers who are recognized as authorities upon the subjects on which they will treat, and both promise to be very interesting. The first paper will be by Maj. G. W. McNulty, at present chief engineer of construction for the work of the Metropolitan Traction Company, the subject being "Recent Improvements in Cable Traction." Major McNulty was for a long period chief engineer of the Broadway & Seventh Avenue Railway, occupying this position during the entire period of the the road's construction. We understand that Major McNulty will describe some of the new features in cable practice which have been introduced on the Broadway system with excellent results.

The second paper will be upon "Economy in Electric Power Stations," by J. B. Craven, electrical engineer of the Buffalo Railway Company. Mr. Craven has been identified with the Buffalo Railway for several years, and is conversant with the problems of station economy and management. His paper will, undoubtedly, contain many valuable and interesting facts.

The officers of the New York State Street Railway Association are: President, Daniel B. Hasbrouck, vice president of the Metropolitan Street Railway Company, New York City; first vice-president, G. Tracy Rogers, president of the Binghamton Railroad Company, Binghamton; second vice-president, James H. Moffitt, superintendent of the Syracuse Consolidated Street Railway Company, Syracuse; secretary and treasurer, William J. Richardson, secretary of the American Street Railway Association, and until recently secretary and treasurer of the Atlantic Avenue Railway Company, Brooklyn. Executive Committee: John N. Beckley, president of the Rochester Railway Company, Rochester; Daniel F. Lewis, president of the Long Island Traction Company, Brooklyn; Charles Cleminshaw, president of the Troy City Railway Company, Troy.

According to our custom, we take pleasure in presenting on this page a portrait of the president of the Association. Mr. Hasbrouck is a veteran in the street railway business, and few men are better known among the street railway managers of the State. He has been a regular attendant of the State Association meetings, and has also attended many meetings of the National Association, where his opinions when expressed have been listened to with such attention and respect that he has been termed the Nestor of the street railway business in New York. He has served in a number of official capacities with the New York State Street Railway Association during its history, and last year when vice-president, acted as chairman of the meeting in the absence of the president, C. Densmore Wyman.


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DANIEL B HASBROUCK,

PRESIDENT NEW YORK STATE STREET RAILWAY ASSOCIATION.

Daniel B. Hasbrouck is a native of New York State and a resident of the city of Brooklyn. At the organization of the Houston Street, West Street & Pavonia Ferry Railroad Company, some twenty years ago, Mr. Hasbrouck was elected secretary and treasurer of the company, an office which he held continuously until the absorption of that company into the Metropolitan Street Railway Company, the operating company of the Metropolitan Traction Company's street railway system in New York. At the organization of the Metropolitan Street Railway Company, Mr. Hasbrouck was elected its vice-president, which office he now holds.

THE South Jersey Street Railway Company, of Point Pleasant, N. J., put its line in operation August 21. The work of track laying was accomplished, it is said, in nine days. The line will connect with Bayhead and Lakewood.

The New Electric Equipment of the Baltimore City Passenger Railway.

The Baltimore City Passenger Railway Company, one of the oldest and most important lines in that city, has recently completed an extensive electric equipment which has been installed under the direction and supervision of the company's engineer, A. N. Connett. The electric cars take the place of horse cars on the old Green, Yellow and Hall Springs lines of the company. The latter two lines have been merged, and both run now to the ferry terminus in South Baltimore. The Green line has been extended via McCullough Street to Druid Hill Park, where its terminus is at the Madison Avenue gate. From this park it runs to Paterson Park and then on to Canton. The Yellow line runs from Clifton Park to Ferry Bar, the extreme limit of South Baltimore; a branch of this line also extends to Northeast Baltimore. Both lines use on Baltimore Street the cable tracks of the Red and White lines. The use of both motive powers on the main artery of the city, it is thought, might be found useful if anything should happen to either motive power, as the operating cars can clear the street by pushing the disabled cars. In this way a bystander would hardly know that anything was the matter.



FIG. 1.—LIGHT STREET ELECTRIC POWER STATION—BALTIMORE CITY PASSENGER RAILWAY CO.

The power station, which is a very handsome structure of brick and iron with stone trimmings, is located at the corner of Light and Heath Streets, and is shown in Fig. 1. The part of the building occupied by the engines and generators is provided with a monitor roof supported by iron trusses. In the roof are a number of large windows, which furnish plenty of light and ventilation.



FIG. 2.—BOILER ROOM—BALTIMORE CITY PASSENGER RAILWAY CO.

The engine room is shown in Fig. 4, and measures 72 × 90 ft. In addition to the windows in the monitor roof, the room is lighted on the sides by twelve large windows and two semi-circular windows over the doors. On the Light Street front the engine room floor is elevated about six feet above the street level, and is reached by a double step. The side street gradually rises as it extends back to the level with the engine floor at the rear of the building. The engines are three in number, of the high pressure, non-condensing E. P. Allis, Corliss type, with cylinders thirty inches in diameter with sixty inch stroke. The flywheels are twenty-six feet in diameter and weigh 70,000 lbs. each. Each of the engines is belted direct to a Westinghouse 500 K. W. generator by two-ply belts. These belts are fifty-four inches wide and 137 ft. long and were manufactured by the Bradford Belting Company.

As will be seen in the illustration, the engine room presents a very neat appearance. The arrangement of the machinery is such as to utilize space and at the same time afford plenty of room on all sides for the attendants. All steam piping and wiring is under the floor, which greatly facilitates the moving of the machinery in case repairs are needed. The generators and engines are tastefully decorated and numbered, and each generator is provided with a handsome brass stand containing a group of incandescent lamps. The rooms are also lighted by arc lamps.

The switchboard, which is a very attractive affair, is shown in Fig. 3, and is located in the center of the Light Street end of the upper room between the doors. It is about ten feet in height, and fourteen feet in length, and is built of white marble with polished brass ends and panel divisions. The instruments are of the Westinghouse make. There are six circuits, and each circuit is provided with an ammeter, circuit breaker and lightning arrester. An alarm gong is also provided, which sounds when any circuit breaker drops. The board is placed about three feet away from the wall of the building, which allows plenty of room for the examination of the connections.

The engine room is spanned by a seventy-two foot traveling crane of ten tons capacity, manufactured by the Maryland Steel Company. In the large additional space unoccupied in the engine room the company has located a large number of modern machine tools, this portion being separated from the engine room by a partition; space is left, however, between the top of this partition and the roof to permit the passage of the crane so as to serve both engine and machine room.

The boiler room is located in a one story building attached to the main power house. The room measures 112 × 46 ft. and is lighted by windows in the roof. The plant has a capacity of 2,000 H. P. and consists of eight 250 H. P. Campbell water tube boilers arranged in four batteries of two each. They are provided with Roney mechanical stokers which are operated by two Westinghouse engines. The front of the boiler room is on a level with the street, and as the ground gradually rises toward the rear of the building, the rear of the boiler room is considerably below the surface of the ground. Here is located the coal vault. A scale is provided for weighing the coal.

The feedwater heaters are of the Berryman make. Two De Ruycke separators, Worthington duplex pumps and Perfection purifiers complete the equipment of the boiler room. The pipes are covered with Magnesia sectional coverings, and Crosby gauges, and Pratt & Cady valves are employed.

The total length of electric track now equipped is thirteen miles of double track. The maximum grade is 5 per cent.

The rails used are a seventy-two pound Johnson girder rail section 219 on four and one-eighth miles of double track, and a ninety pound, nine inch Johnson girder on the remainder. The former is mounted on three

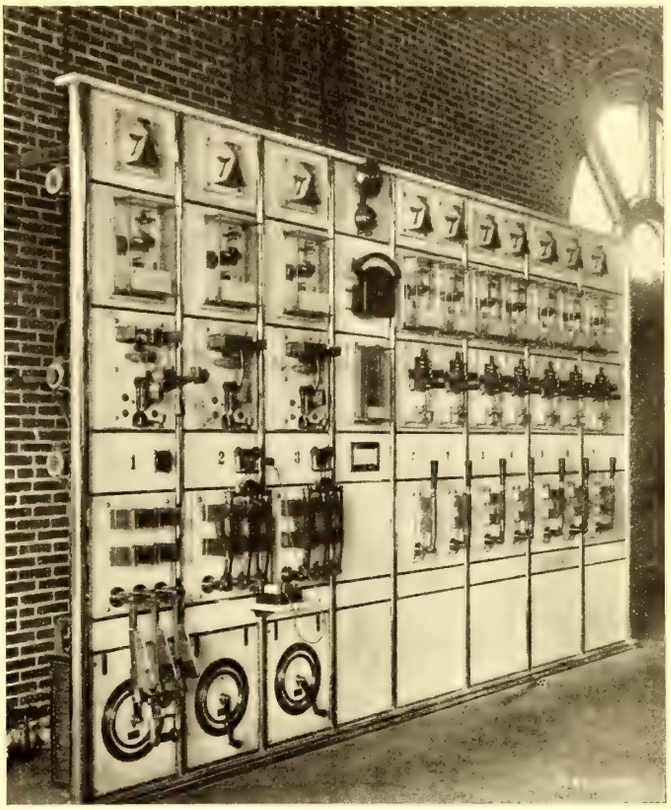


FIG. 3.—SWITCHBOARD—BALTIMORE CITY PASSENGER RAILWAY CO.

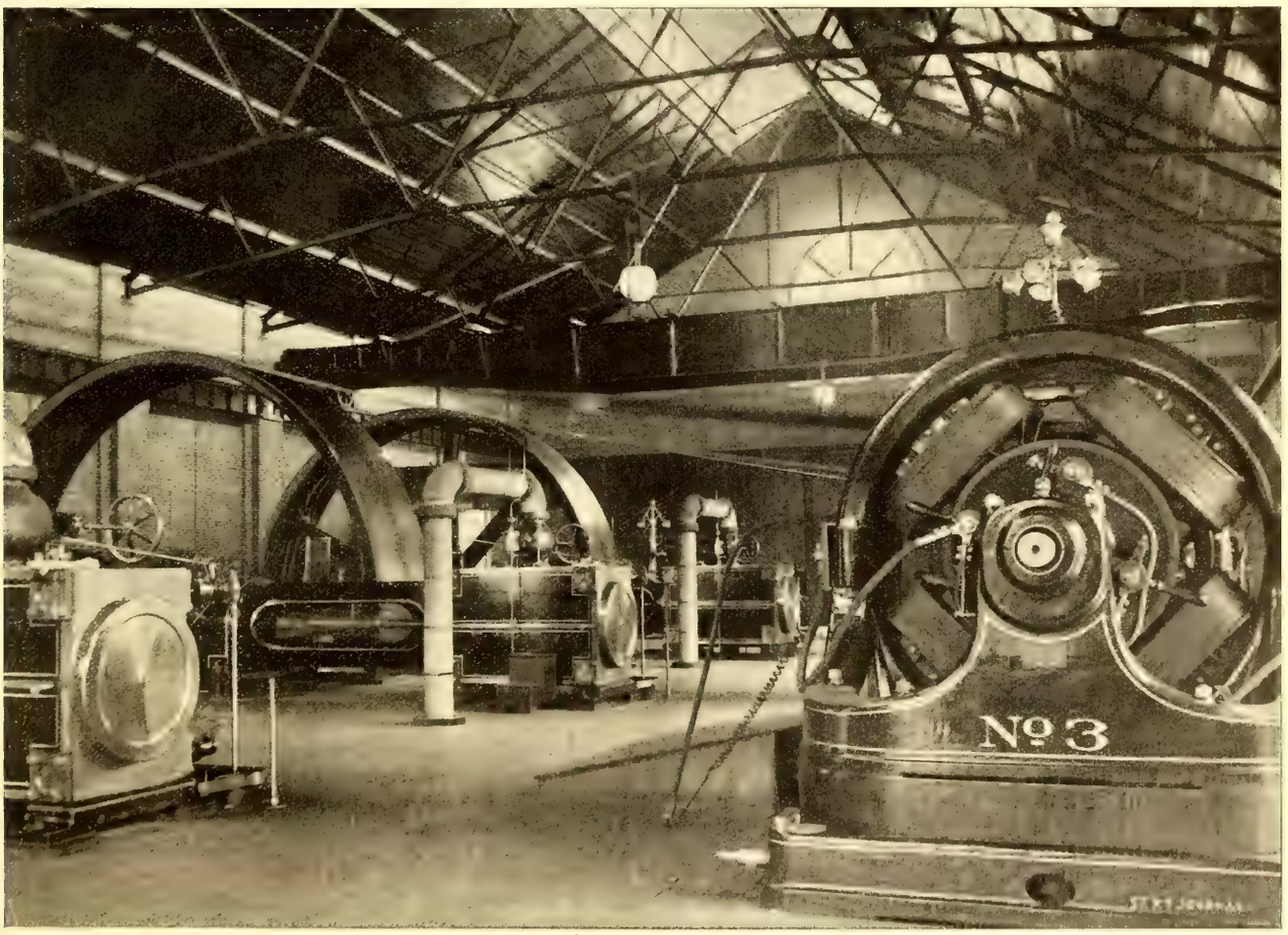


FIG. 4.—ENGINE ROOM—BALTIMORE CITY PASSENGER RAILWAY CO.

inch chairs; the latter spiked directly to the ties. Twenty-four inch joint plates are used with the seventy-two pound rail, and thirty-two inch joint plates with the ninety pound rail. The ties are 6 × 8 ins × 8 ft. and are laid thirty inches between centers. The return circuit is provided by double bonding the rails and connecting

with a supplementary of 500,000 circular mills capacity. Channel pins with tin No. 0. wire are used for bonding.

The trolley wire employed is No. 0. The feed wire consists of eighteen miles of 500,000 circular mills wire, and six miles of No. 0000 wire, both supplied by the John A. Roebling's Sons Company. The line appliances



FIG. 5.—ENTRANCE TO DRUID HILL PARK, SHOWING CABLE AND ELECTRIC SYSTEMS—BALTIMORE CITY PASSENGER RAILWAY CO.

were supplied by the New York Electrical Works. Tubular poles of six, five and four inches diameter and weighing 725 lbs. each, are used. Near the power station heavier poles, weighing 1,600 lbs. and thirty-four feet in length, are employed. The pipe sections of these poles are respectively nine, seven and six inches, and with the lighter poles were supplied by the National Tube Company.

The rolling stock of the company consists entirely of motor cars, no trail cars being employed. The cars have eighteen foot bodies with four foot platforms, and are extremely tasteful in finish. The seats are of slats covered with Wilton carpet, and Stanwood steps are employed. The cars are from the works of the J. G. Brill Company, of Philadelphia, which also supplied the trucks. Westinghouse No. 3 motors are used, with Nuttall gears and trolleys. The cars are equipped with Baltimore sand boxes, St. Louis registers, and Whitney thirty-three inch wheels. The fender in use is that known as the California type, consisting of a horizontal board tipped with rubber, and carried at the base of a vertical board. The company also has two Brill sweepers for clearing the tracks of snow in winter, and two tower wagons of its own make.

The car houses of the company for housing the electrical equipment are two in number. The principal one adjoins the power house, and measures 227 × 50 ft. There are five tracks in the building to which easy access is provided by a Hathaway transfer table. The company is about to commence the erection of another car house for the Green line, at the corner of Pennsylvania and North Avenues. The building will be 325 × 75 ft., and will contain seven tracks.

Cars for New Orleans.

The accompanying illustration is taken from a photograph of one of 226 cars which the J. G. Brill Company is building for the New Orleans Traction Company, Limited, of New Orleans, La., of which H. M. Littell is general manager.

The car body is twenty feet long over the end panels, and is seven feet eight inches wide at the belt rail. They are built with twin operating doors with drop sash. The inside finish is in cherry throughout. The decoration is known as the Italian finish, since it was designed especially for the Brill Company by an Italian artist. The window and door heads have a fancy curvature which gives the car a very attractive appearance. The decoration of the panel in a machine line and hand carved is new and distinctive. The head linings, ventilator glass, etc., are decorated to correspond with the same general style of inside finish, and the cars have an extremely handsome appearance.

They are mounted on Brill Eureka, maximum traction, No. 22 trucks, with thirty-three inch driving wheels, and equipped with Crawford fenders. Twenty-six out of the 226 cars are now in operation in New Orleans, and are giving excellent service, and fifty more will be in operation within the next month.

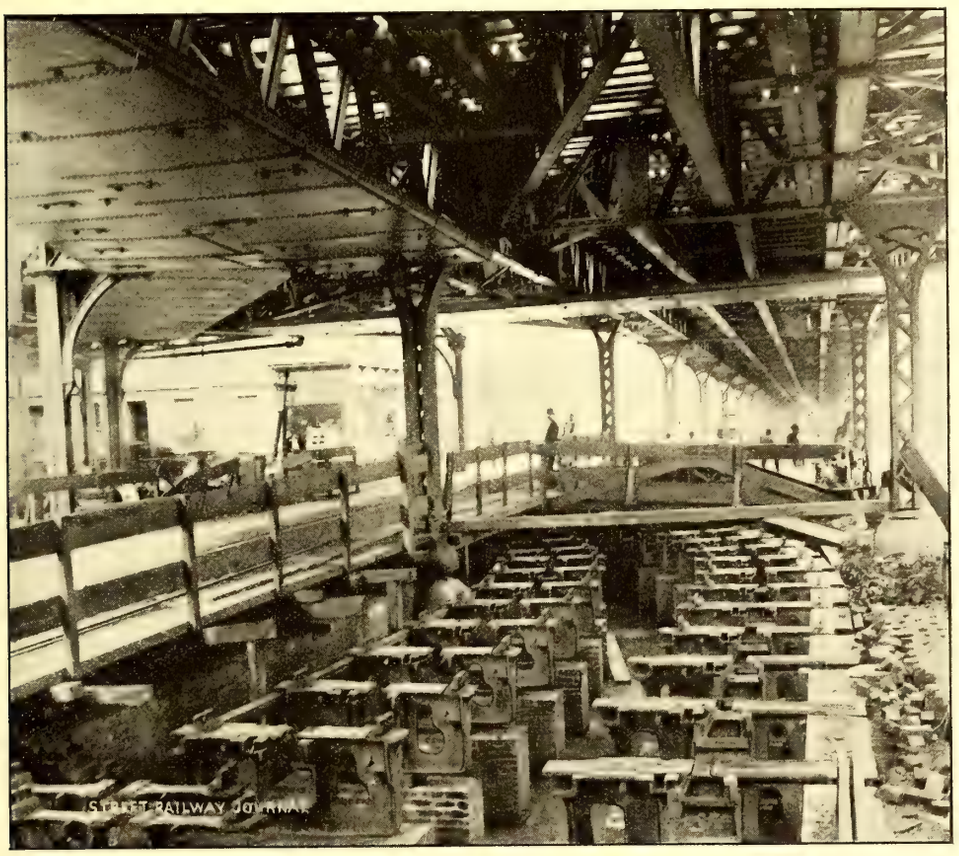


CLOSED CAR FOR THE NEW ORLEANS TRACTION CO.

The Peters Avenue and Dryads Avenue lines of the New Orleans Traction Company were put in operation August 14. Twenty eight-wheeled cars are used on these divisions. The Prytania Avenue line was to have been put in operation September 1, and the rest of the tracks of this company are being completed as rapidly as possible.

The Progress of the Columbus Avenue Cable Railway, New York.

The work on the Columbus Avenue cable extension of the Metropolitan Traction Company is progressing rapidly, and it is expected that the line will be in operation by Christmas. As already mentioned, the lower section of the line, extending from Seventh Avenue and 50th Street, through 53d Street to Ninth Avenue and along that thoroughfare to 98th Street will be operated from the 50th Street power station. The work of installing the extra cable machinery at the power station is being done by the Pennsylvania Iron Works Company and is about completed. The new driving drums are sixteen feet in diameter of the solid drum type with removable rims, and are mounted on the outside ends of the original driving shafts. They are of the overhanging type, and having no outboard bearings are provided with a strut for keeping the shafts in line. They are designed for operating the cable at twelve miles per hour. The drums for operating the upper section of the Broadway road are keyed to the shaft, but will be mounted on quills, so that they can be thrown in or out of connection with the shaft by means of jaw clutches.



VIEW AT 53D STREET AND 9TH AVENUE SHOWING CURVE CONSTRUCTION.

The tension device will be similar to those now in use. The run for the tension car is 100 ft. in length, and on the frame of the carriage is mounted a reel, about which the end of the tail rope is wound. The reel is operated by a hand wheel and worm gear, and the length of the tail rope may be varied to allow for the stretch of the cable. The tension tower will be forty-five feet in height and constructed of angle iron. The weights are made semi-circular in form with a radius of fifteen inches and weigh seventy-five pounds.

On account of the limited space for the tension run between the machinery foundations and the wall of the building, it was found necessary to temporarily support the roof during the construction of the tension run. The roof is supported independent of the side walls by wrought iron columns. A novel device for this purpose, invented by Albert Carr will be employed. It consists of two wrought iron brackets riveted to the columns. These brackets rest on short section girders, which in turn are supported by piers built up of of 14 × 14 in. shoring timbers.

The outgoing rope will pass around the deflecting sheaves in the vault on 51st Street, through a blind conduit to the vault at Seventh Avenue, and thence to 98th Street, returning and entering the power station from the 50th Street side. The cable will be supplied by the Hazard Manufacturing Company, and will be 1¼ ins. in diameter. The work of placing the yokes and rails is about completed, the only work remaining to be done being the curves at Seventh and Ninth Avenues and 53d Street, and the deflection vaults at the power station.

A view of the curve construction at 53rd Street and Ninth Avenue is shown herewith. The excavation is about 140 ft. long by twenty-three feet wide, a good part through solid rock. The yokes weigh 480 lbs. each, and are placed five feet apart. They are mounted on separate brick piers, sixty in number, sixteen inches wide by five feet six inches long. As will be seen in the illustration, the outside piers are let into the side wall, while those on the inside of the curve are separated from the wall by about two feet. The height of the vault from floor to roof is six feet. It will be seen by this arrangement that easy access can be had to any part of the vault for the inspection of the curve pulleys. There will be one cable turnout, which may be extended into the car barn if necessary. An exceedingly difficult and expensive portion of the work was at the corner of Seventh Avenue and 53d Street. The excavation at this point was through solid rock, the work being more difficult than at 53d Street and Ninth Avenue, as the tracks of the Broadway line had to be supported while the vault for the curve machinery was being blasted out.

The slot rails are of the Johnson No. 247 type, weighing sixty-seven pounds to the yard, and the tram rails are of the No. 249 type of the same company, and weigh eighty-five pounds to the yard.

The contractor for the street construction is John D. Crimmins, and all the work is carried on under supervision of Maj. G. W. McNulty.

Third Annual Meeting of the Pennsylvania Street Railway Association.

The third Annual meeting of the Pennsylvania Street Railway Association will be held at the Neversink Hotel, at Reading, Pa., on September 5 and 6. Papers and essays on the construction, operation and management of street railways will be read and discussed at the meeting. Street railway materials and supplies from manufacturers will be on exhibition and will be an attractive feature of the annual meeting.

Excursions will be taken over the Reading Traction Company's system and the gravity roads on Penn and Neversink Mountains. S. P. Light, the secretary of the company, writes us, extending to street railway companies of Pennsylvania and street railway supply and material men generally, a most cordial invitation to be present and to send representatives to participate in the meeting.

THE Hartford (Conn.) Street Railway Company is now at work equipping its line, and expects to have twenty-one miles in operation by the end of this season.

The Use of Storage Batteries in the Trolley Railway Plant at Zurich, Switzerland.

It seems rather strange that no electric trolley road in this country has yet tried the experiment of using storage batteries in its power station, in spite of all the advantages claimed in favor of the plan. C. O. Mailloux, who read a paper on the subject at the last convention of the American Street Railway Association, and who has been for several years a warm advocate of the plan, in various articles published in this journal, ascribes this want of enterprise to a feeling among railway managers, that each wishes "to let the other fellow try it first." If this be the case, then the hesitation of "the other fellow" may be lessened by the fact that the plan is now in use in Europe. The Oerlikon Machine Works, of Oerlikon near Zurich, have recently installed a plant upon this system in that city which is working very successfully. Some details of the road, from information supplied us by this company, will be of interest to our readers.

The central point of the street railway lines of the Zurich Electric Railway is at Circle V near the Burgwies in Hirslanden, where the power station of the company is also located. From this point the line extends through Forchstrasse to Kreutzplatz, where it divides into two divisions, one extending through Kreuzbühl and Gottfried Keller Streets, the Utoquai and Ramis Street to the Heimplatz, and the other through Klosback Asylum, and Hottinger Streets through the Heimplatz, where the two divisions connect. The total length of the line is 4.6 kilometers (2.36 miles). The grades are quite severe, the maximum of 6.48 per cent. extending a distance of 378 ft. The average grade is 1.1 per cent. The line is a single track road, with the exception of eight turnouts about thirty meters in length, as well as a short section of track upon which the cars of the Central Zurich Berg road run. The gauge is less than that of the Zurich Street Railway Company, which operates with horses—namely, one meter (39.4 ins.) instead of four feet eight and a half inches. The gauge of one meter is that generally adopted for new tramways, on account of its advantages over the other in narrow streets and on curves of short radius.

The type of rail used is the Phœnix 7 A, which has a weight of seventy-seven kilograms per running meter of complete track (seventy-eight pounds per yard). It is laid on a stone foundation without using the usual ties. The track was laid by T. H. Bertschinger, contractor of Lentzburg. The track of the Hottinger line for a considerable distance is macadamized.

The cars are from the works of the Swiss Industrial Company of Neuhausen, and are similar to those of the Zurich horse railway. They have a capacity for seating twelve passengers and standing place for from twelve to fourteen others without overcrowding. A total of twelve cars are operated, of which nine are in regular service, the other three being kept up as a reserve for use on special occasions. Each car is equipped with one four-pole Oerlikon electric motor of eighteen horse power, which is mounted on the truck in the usual way well known here in America. The gears run in grease. The engravings (Figs. 3 and 4) show the design and construction of the motor. The speed and direction of the car are controlled by a controller on each platform operated by means of a lever and gears. The two controllers have a common resistance box. The great disadvantage of the usual controlling apparatus consists in the fact that the arc, which in electric railways is usually caused upon the breaking of the current, acts very disastrously on the contact pieces, and in a short time occasions their destruction. This is remedied by making the apparatus in such way that the sparking occurs only at one place, where it is "blown out" by a small electro-magnet specially provided and arranged for the purpose. The equipment includes the usual fuses and cut-out switches familiar in American practice.

The total weight of the car, empty, with electrical equipment is about 4.19 (short) tons, or, including passsengers, about 6.19 tons (of 2,000 lbs.).

With nine cars it is possible to operate on a headway of six minutes. This requires an average speed of 10.6 kilometers (6.57 miles) per hour, including stops; in other words, about one and a half times the speed of the horse cars. This service is maintained for 12.9 hours per day, and during the early morning and late evening hours—that is for 1.9 hours per day—a twelve minute service is run. An entire round trip occupies fifty-two minutes, of which eight minutes are taken up by stops,

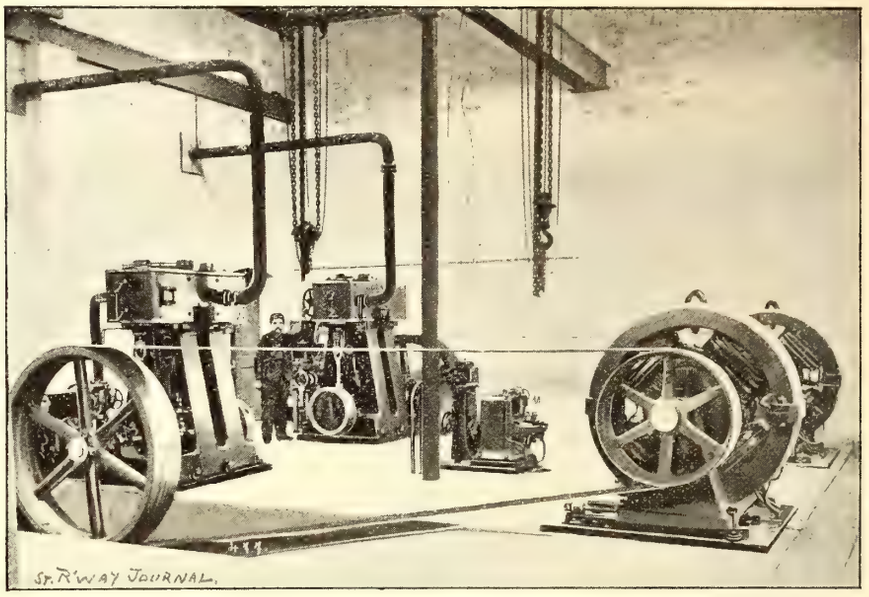


FIG. 2.—INTERIOR OF POWER STATION—ZURICH ELECTRIC RAILWAY.



FIG. 1.—VIEW AT THE KREUTZPLATZ—ZURICH ELECTRIC RAILWAY.

the stop made at each terminus consisting of one minute.

Very handsome iron poles, with or without brackets, are used within the city limits, consisting of three sections of pipe of 5, 4 and 3 ins. to 6, 5 and 4 ins. interior diameter, while on the outskirts of the city wooden poles are used. The trolley wire is of copper of seven millimeters (0.276 ins., about No. 1½ B. & S.) diameter, and is supported at a height of about five and a half meters (18 ft.) above the street, so that it does not interfere with even the highest vehicles. Span wire (steel) or bracket construction is employed, the use of each depending upon local conditions.

The trolley wire serves for the outgoing circuit, the rails being used for the return. The joints are bonded with copper bonds. A copper supplementary return of seven milimeters is laid between the rails and connected from time to time with the rail bonds, making a continuous return circuit. The outgoing circuit is divided into four insulated sections of about the same length, each supplied from the central station through a feeder of sixty square millimeters (about No. 00 B. & S.) cross section. Guard wires are also employed to protect the trolley wires from falling telephone or telegraph wires. Most of the telephone wires are run underground.

The power station, which is contained under the same roof as the car house and repair shop, is located at the end of the line in Hirslanden and is shown in plan in Fig. 5. The current is supplied, as has been already stated, by a generator and a battery of accumulators working in parallel, the batteries being located between the engine and boiler rooms.

To understand the arrangement of the storage batteries, it must be noted that the current load in stations of such small capacity undergoes uncommonly severe and quick fluctuations. It might happen, that, for a moment, namely, when perchance all the nine cars stop at one time, the current may fall down to zero, and possibly, in the next moment, it may jump to the maximum of 200 amperes. On the average the current required is around eighty to ninety amperes. It is evident that such a variable load, without the help of storage batteries, must have the most deleterious influence on the efficiency of the dynamo and engine. On the other hand, by using storage batteries, one can obtain the great advantage, that the engine and dynamo load remain almost uniform. If the power consumption on the line rises above the capacity

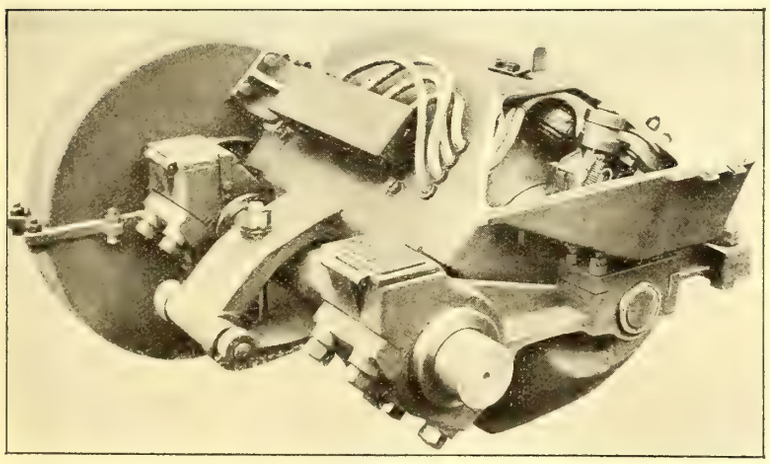


FIG. 3.—MOTOR WITH CASE CLOSED—ZURICH ELECTRIC RAILWAY.

of the generating plant, then the storage battery assists the plant; if, on the contrary, the consumption falls below the capacity of the latter, the surplus of the current produced by the dynamo flows into the storage battery and charges it. The plant, therefore, runs at its normal capacity, that is to say, under the most favorable conditions possible.

In regard to the advantages of using storage batteries in parallel with the generator, the Oerlikon Works Company submits the following computation:

"The average grade on the Zurich electric railway amounts to 1.1 per cent. The load of the car, including electrical equipment, amounts to about 3.8 (metric) tons. If we consider that the cars carry, besides the conductor and motorman, on an average one-third of their total carrying capacity, which is not estimating it too high, the average total weight per car reaches 4.4 (metric) tons. Assuming the traction co-efficient to be twelve kilograms per (metric) ton (twenty-four pounds per ton of 2,000 lbs.), the total round trip therefore requires $2 \times 4{,}600 \times 4.4 (11 + 12) = 931{,}000$ kilogrammetres. No account is taken of the reduced consumption on down grades.

"The complete trip with all stops on the way and at the end, requires fifty-two minutes; therefore with the allowance of 25 per cent. increase for starts and curves, this corresponds to an average output of $1.25 \times \frac{931{,}000}{54 \times 60 \times 75} = 4.75$ effective H. P. per car measured at the car axle.

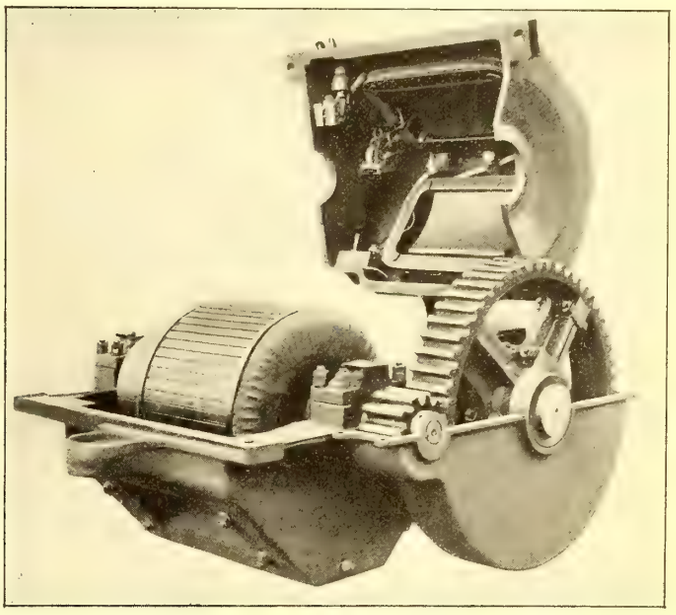


FIG. 4.—MOTOR WITH CASE OPEN—ZURICH ELECTRIC RAILWAY.

"The average loss from the steam engine to the car wheel can be taken at 35 per cent., and therefore the efficiency comes out 65 per cent.

"For a twelve minute run (five cars) we have therefore $\frac{5 \times 4.79}{0.65} = 36.8$ H. P.; and for a six minute run (nine cars) $\frac{9 \times 4.79}{0.65} = 66.3$ H. P., which is the power required at the engine flywheel; or, per day, $36.8 \times 1.9 + 66.3 \times 12.9 = 925$ H. P. hours, for which a daily consumption of 1,350 Kgr. (2,975 lbs.) of coal or 1.46 kilos (3.22 lbs.) per H. P. hour is required.

Power stations for electric railways without storage batteries consume for this output, as demonstrated by experience, 2.5 kilos (5.51 lbs.) of coal and more (per horse power hour). In fact, there will be not less than 440 tons of coal saved per annum; while the cost for the maintenance of the battery scarcely exceeds one-seventh part of this amount saved."

The power station is equipped with the following apparatus: Two vertical, compound steam engines, each of ninety horse power, operating at 240 revolutions perminute; two Oerlikon shunt generators of sixty-six kilowatts capacity (550 volts), operating at 450 revolutions per minute, belted to the engines. Of these two pairs one only is usually in service, the other being held as a reserve. The idle pair can be put in service to relieve the other without interrupting the service of the station. It is, however, apparent that in case repairs to the storage batteries should be necessary the battery must be disconnected for a given time; in which case the reserve plant takes the place of the battery, and both machines, by switching

in the compound coil, work as compound wound dynamos.

The storage battery is located in a special room, and consists of 300 Tudor elements No. 110, of 245 ampere hours and having a maximum current rate of eighty-one amperes. It is, however, possible, without shortening the life of the batteries, to double this current for a shorter time.

The regulation of the charge or discharge of the batteries is effected by switching cells in and out of circuit by an automatic arrangement, which is the common practice in Europe. In order to recharge these regulating cells and bring them up to the proper condition and make them uniform with the rest, a small, direct-coupled generating unit is used, having a capacity of about three kilowatts, or twenty amperes at 150 and thirty amperes at 100 volts. It is found by experience that this small unit need not be operated continuously, but is only required to operate for an hour or two each day.

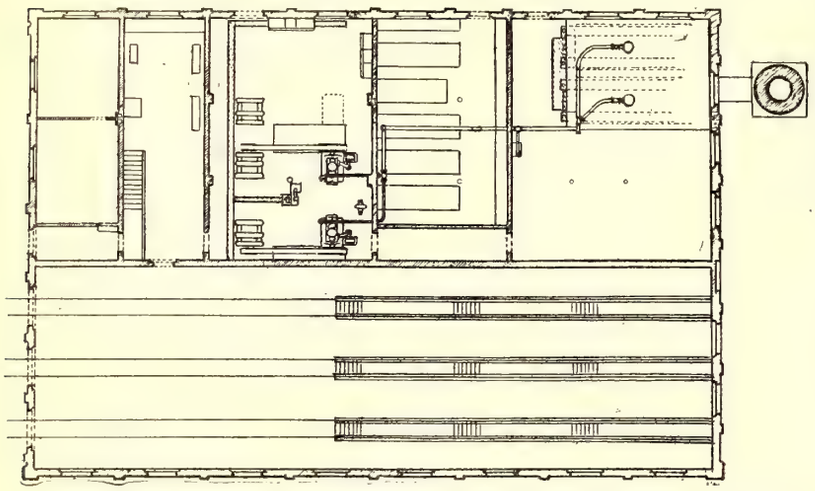


FIG. 5.—PLAN OF POWER STATION AND CAR HOUSE—ZURICH ELECTRIC RAILWAY.

The regulation, safety and control of the installation are secured by a large number of devices which are mounted on two elegant, polished marble switchboards, and so disposed that one serves for the dynamos and the other for the batteries. The steam for the plant is produced by two Galloway boilers each fifty-eight square meters (625 sq. ft.) heating surface, with two feedwater heaters; both are usually in operation, but one can carry the whole load for a short time.

A Model Electric Railway Patrol System.

The North Hudson County Railway Company, of Hoboken, N. J., whose extensive railway system has been described in former issues of the Street Railway Journal, has recently adopted a system of electric signaling in connection with its patrol service, embodying many new and novel features. The system was designed by A. K. Bonta, electrical engineer of the company. By this apparatus it is possible to send signals from any point along the line to the patrol stations of the company, and to apprise the men in charge of the exact location and nature of the trouble.

Signal boxes, similar in appearance to those in use by the fire departments, are attached to the poles supporting the trolley and feed wires, and are located about a quarter of a mile apart along the entire line. The boxes are arranged to transmit six signals which are marked in plain letters on a circular brass disk as follows:

Signal No. 1. Car off the track.
" " 2. Broken axle.
" " 3. Trolley wire down.
" " 4. Telephone call.
" " 5. Rush call.
" " 6. Special call.

Each box is numbered, and its number and location are marked on a chart located near the alarm board in the patrol station.

The motormen are provided with keys to the signal boxes, and each key is numbered and charged to the man to whom it is given. After a signal box has been opened and the message sent, the key cannot be removed from the box without a special key which can only be obtained from the office. Owing to this arrangement motormen will not be apt to send false alarms.



FIG. 1.—PATROL HOUSE—NORTH HUDSON COUNTY RAILWAY, HOBOKEN.

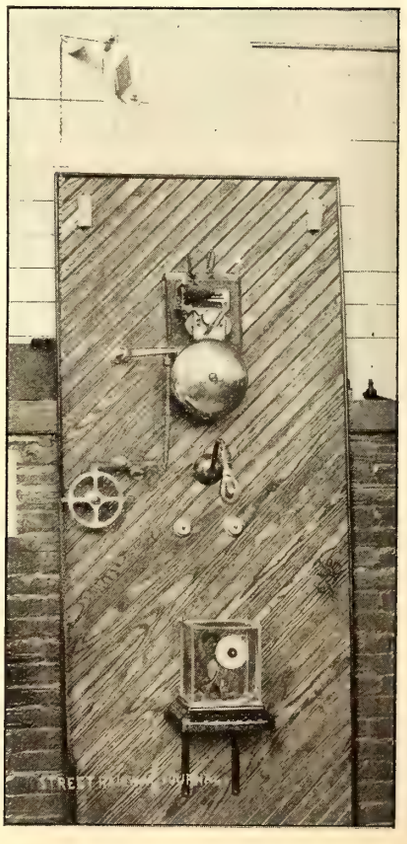


FIG. 2.—ALARM SIGNAL BOARD.

The operation of the signal boxes is extremely simple. In sending an alarm the motorman opens the box and pulls down the signal lever until the pointer on the lever is opposite the message he desires to send. He then lets the handle return automatically to the original position, when the message is transmitted to the patrol stations. Each signal consists of a certain number of strokes on a gong The number which is rung tells the location, and the number of times it is repeated indicates the nature of the trouble, according to the schedule already given. A recording instrument attached to the alarm board prints and records every signal. The dot and dash system is used, the dots representing units and the dashes tens. For example, a broken trolley wire near box No. 12 would be recorded as follows: —. . —. . —. .

An alarm sent from any signal box is recorded in every patrol station, and is answered by the station in whose district the box is located. When a patrol wagon returns, a signal is sent to the other stations, which notifies them of the return. It will be seen by this system that if a second alarm comes to a certain patrol station while the wagons of that station are out on duty from a previous call, the fact is known at the other stations, and the call is answered from the station nearest the district from which the signal is sent. There will be four patrol stations located at convenient points along the line. Two of these stations are now completed, and the others will be in operation in a short time.

The Palisade Avenue station, an exterior view of which is shown in Fig. 1, is located in the rear of the Palisade Avenue power station, at the corner of Racine and New York Avenues. The building is of wood, two stories in height, the ground plan measuring 30 × 50 ft. The interior arrangements of the station, as will be seen, are similar to the engine houses of the fire department. Each station has a patrol wagon and tower wagon, designed and built especially for the company, and provided with hydraulic jacks, blocks and tackle, and the necessary tools for any emergency. An interesting feature of the repair wagon equipment is a portable electric lighting outfit. This is supplied with current by a storage battery which is located under the seat, and is charged by the railway current while the wagon is in the station. In addition to side lights on the wagon, several extra lamps and about fifty feet of flexible lamp cord are provided. In case of an accident at night where a light underneath the car is desirable, the device is particularly valuable.



FIG. 3.—EMERGENCY WAGON—PATROL SYSTEM OF NORTH HUDSON COUNTY RAILWAY, HOBOKEN.



FIG 4.—TOWER WAGON—PATROL SYSTEM OF NORTH HUDSON COUNTY RAILWAY, HOBOKEN.

The stalls for the horses are located in the rear of and facing the patrol wagon, as shown in Fig. 3. The horses are thoroughly trained, and on the sounding of the alarm they are automatically released and immediately jump to their places. The harness is dropped by pressing a button, and by snapping the collars and reins they are ready to go. A well lighted and ventilated room on the second floor is provided for the men in charge of the station. It is eleven feet long and thirty-three feet wide, and is carpeted and comfortably furnished with beds, tables and chairs. The ground floor is reached by a wide stairway, and a brass sliding pole, similar to those used by the fire department, is used to expedite the movements of the men.

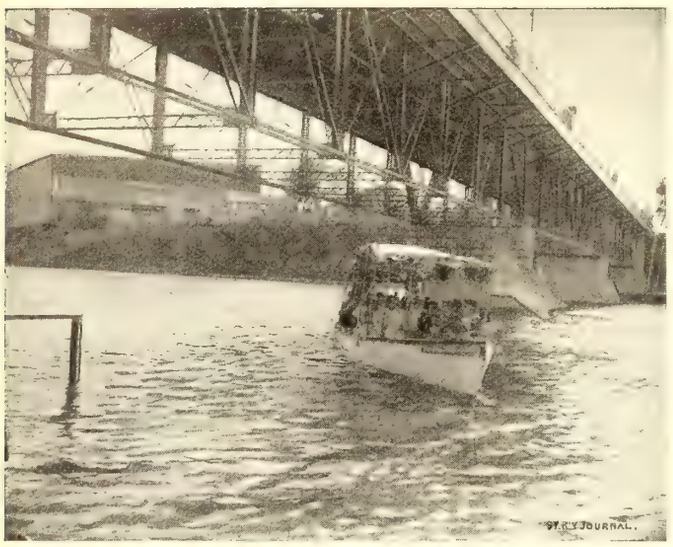
The operation of the system was witnessed recently by a representative of the STREET RAILWAY JOURNAL. An alarm was sent from a signal box four blocks distant from the patrol station, and the repair wagon was on the ground one minute and three seconds from the time of sending the alarm.

Meeting of the Maine Street Railway Association.

The midsummer meeting of the Maine Street Railroad Association was held at Rockland, Thursday, August 16. The meeting was called to order at 10 A. M. After the transaction of business, the delegates boarded the cars of the Rockland, Thomaston & Camden Street Railway Company, which took them to the Bay Point Hotel, where an elaborate repast was served and a most enjoyable time was had. By the courtesy of the Maine Central Railroad the use of a special car was tendered the Association, to transport delegates from Portland.

Electric Launches in Milwaukee.

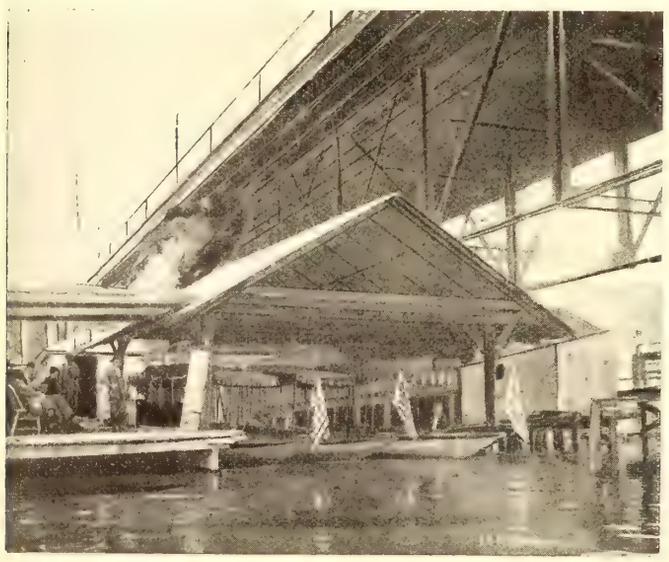
We have mentioned a number of instances in which electric launches operated by storage batteries have been used in connection with electric roads. It is the usual custom to store the batteries for these launches by the



ELECTRIC LAUNCH ON THE MILWAUKEE RIVER.

railway current, and to operate them on a lake or river at the terminus of some division of the railway as an attraction to pleasure seekers.

Three of the launches used at the World's Fair, Chicago, were purchased by the Milwaukee Electric Launch Company, and are now in use in that city at the end of the Cambridge Avenue line. The stockholders of the Electric Launch Company, include a number interested in the Milwaukee Street Railway, and the electrican of the road, O. M Rau, is manager of the Launch Company. A trip of four miles is made by the launches, and twenty-five cents is charged for the round trip. The managers state



STORING STATION FOR LAUNCHES—MILWAUKEE.

that this departure has proved very popular, and that it has added materially to the traffic on the electric division serving this point.

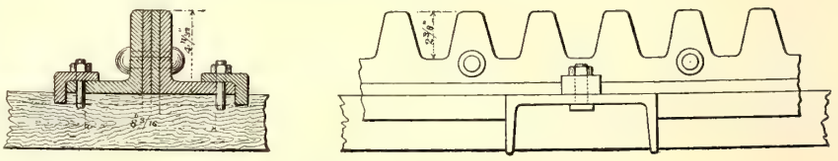
The Pottsville (Pa.) & Reading Railway Company, was organized August 23. C. H. Barritt, of Wayne, Pa., is president.

The S. Ellero-Saltino Rack Railway.

There are several mountain railways in Italy constructed on the principle of simple adhesion, with gradients as steep as 6 or 7 per cent., and there are many on the cable system combined with the rack rail. The S. Ellero-Saltino Railway is the first constructed there with the central rack only. On April 18, 1892, the Italian Government granted a concession, and the work, begun in the middle of May, was completed, and the line was open for traffic in four months after its commencement. Starting from S. Ellero, 366 ft. above sea level, on the Rome-Florence railway, about seventeen miles from Florence, the line which is intended almost solely for tourist traffic, ascends to Saltino, 3,131 ft. above sea level, a total of five miles, the steepest grade being 1 in 4.55. An interesting description of the railway was given in a paper read recently before the English Institution of Civil Engineers, by J. E. Caccia.

According to Mr. Caccia, the difference between this and other lines which have been constructed on this principle is the rack rail itself, the invention of Count Joseph Telfener. Rack rails have been made of cast iron (Blenkinsop system); wrought iron ladder arrangement (Riggenbach system); and steel (Abt system); or, as used on the Mount Pilatus railway, a double row of vertical cogs, milled out of solid steel bars. The Abt was, of course, a great improvement on the Riggenbach system, owing to the difficulty and cost of accurate construction of the ladder rack, although this system possesses greater lateral strength and stiffness. The Telfener rack rail (Figs. 1 and 2) is much like the Abt, but cheaper and simpler in construction, of Siemens-Martin steel. It consists of two L bars and intermediate steel bars.

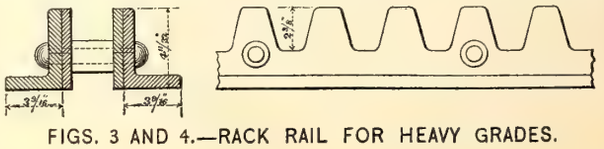
On lengths where the gradient does not exceed 12 in



FIGS. 1 AND 2.—TELFENER RACK RAIL.

100, the rack is formed of the two L bars riveted together, On lengths with grades over 12 in 100 and up to 22 in 100, the rack has the same L bars, but in addition two intermediate plates, the four thicknesses being riveted together (Fig. 1); so that, besides giving to the toothed line greater resistance in these lengths, it increases the width of the teeth, and by that means a greater gearing space is obtained, which is especially desirable on sharp curves. The dimensions of the rack are: Height of L bar, 4⅜ ins.; width at base, 7⅛ ins.; thickness of L bar, $\frac{11}{16}$ in. The dimensions of the plates between the L bars are: Height of plate, 4⅜ ins.; thickness of plate, $\frac{9}{16}$ in.

This rack rail may also be strengthened in the following ways: 1. By giving a greater height to the intermediate plates and grooving them into the longitudinal sleeper. 2. (Figs. 3 and 4) the L bar and plates, instead of being united, may be placed with a certain space between, as in the Abt system, using tubular distance pieces, and obtaining by that means a double or triple rack; this rack has the disadvantage that it cannot be placed in steps as in the Abt system, but the wheel is larger, and therefore able to grasp three teeth at a time. It was specified in the contract that the plates of the rack should have a resistance of 31 to 38 tons per square inch, and a shearing strain of 15 per cent. It was also required that each tooth



FIGS. 3 AND 4.—RACK RAIL FOR HEAVY GRADES.

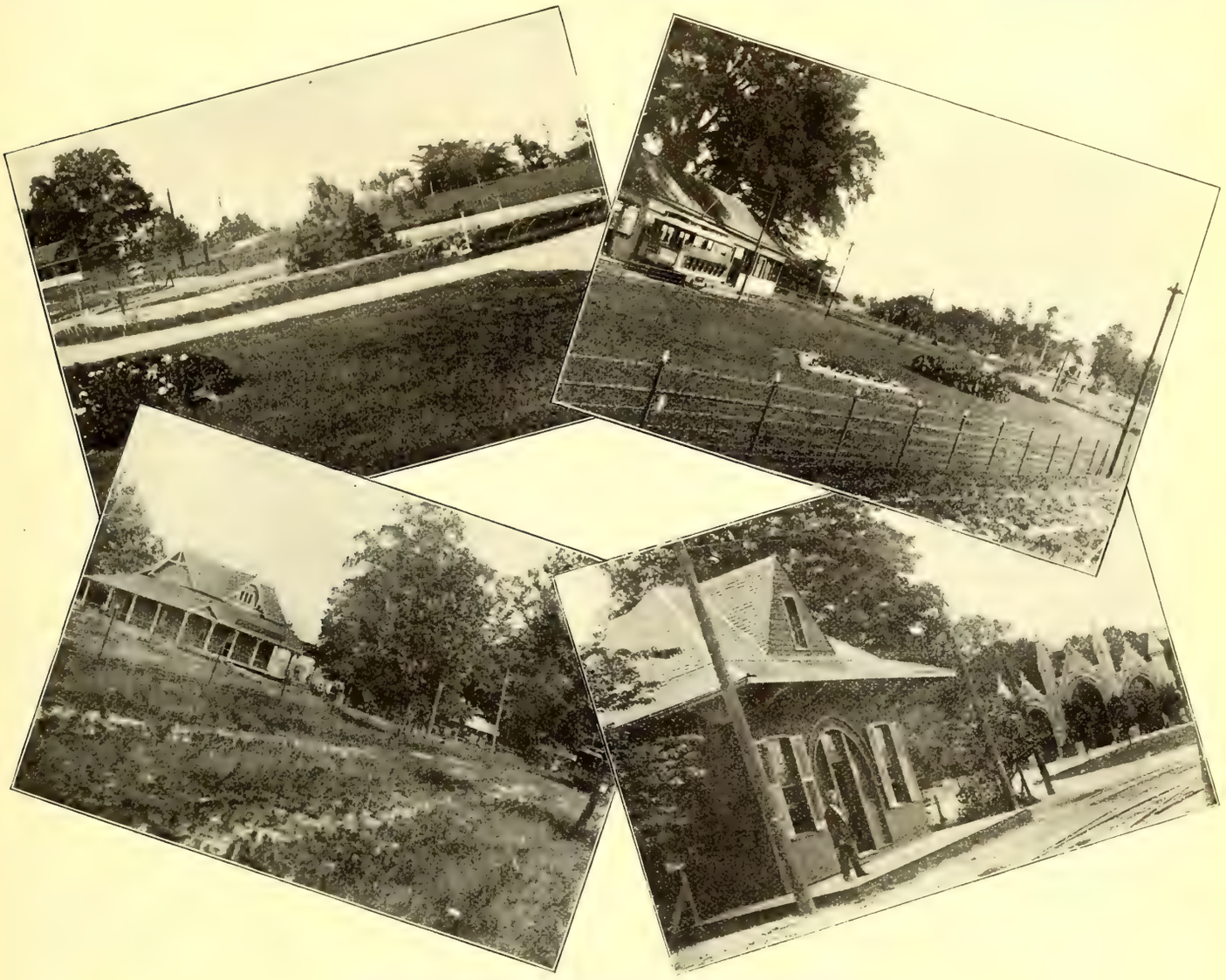
of the compound rack rail should support a weight of 78.73 tons on an incline of 22 per cent. The cost of the rack complete was approximately $3.25 per lineal yard,

which is considerably less than that of the Riggenbach or Abt rack.

The trains run at 5½ miles per hour on grades up to 15 per cent, and 4⅓ miles per hour on grades from 15 to 22 per cent.; so that the entire length of line, 4.97 miles, is traversed in fifty-seven minutes.

The Park of the Citizens' Street Railway Company, Indianapolis, Ind.

A description was given in our last issue of the plant of the Citizens' Street Railway Company of Indianapolis, and mention was made of the fine park which the company owns. It is located about five miles from the city, and is at the terminus of two or three of the company's lines.



PARK VIEWS—CITIZENS' STREET RAILWAY, INDIANAPOLIS.

We present in a group on this page three views taken in this park which is tastefully laid out and forms a very attractive outing spot. The fourth view, that in the lower left hand corner of the group, shows a station of the company and entrance to one of the cemeteries of the city.

These engravings, besides being interesting in themselves, show a growing tendency of street railway companies to establish parks or other pleasure resorts at the termini of their lines. The number of pleasure seekers which can be attracted to patronize the cars running to such resorts is often very large, and the added business created by the establishment of such pleasure resorts will often be found to pay a very large percentage on their cost of establishment.

The park of the Citizens' Street Railway Company at Indianapolis is ornamented with flower beds, tropical plants, and the turf and walks are carefully kept, making a most attractive resort. The usual attractions of a dancing pavilion, swings and merry-go-rounds are provided, and an excellent restaurant is located on the grounds. The company carries free a number of children for the Fresh Air Mission, of Indianapolis, to a building near the park devoted to this charity.

Progress in Europe of Gas Motors for Street Railways.

Some experiments covering a number of months have been made in Dresden, Germany, with the Lührig gas motor for street railway service. Although of somewhat complicated construction, this car worked successfully at a net cost of operation, it is claimed, far below that of electric or horse railways. Through the death of the inventor and other circumstances, the field of experiment has been transferred to England, where the Lührig patents have been acquired by a syndicate, and the car has undergone, during the past four or five months, material modifications.

According to a recent report submitted the State Department at Washington, by Frank H. Mason, United States Consul, at Frankfort, a car of this improved type is now worked regularly on the lines of a tramway company at Croydon, near London, and has attracted expert attention from all parts of Great Britain. But one gas engine is used, the two cylinders of which are set facing each other, and both working to the same crank. The engine is located under the seat on one side of the car; the other end of the driving shaft, which extends across beneath the floor of the vehicle, carrying a heavy flywheel, which steadies and regulates the motion of the en-

gine. By this improvement, the number of working parts, and, therefore, the weight, cost, and wear and tear of the motor have been greatly reduced.

The motor is designed to run at a constant speed and is arranged to be thrown in and out of connection with the car axle by means of friction clutches. A variation in speed is secured by the use of two sets of gearing, either of which can be used, one being arranged for a speed of four and the other for eight miles per hour. The gas engine, of course, is equipped with a governor.

Ordinary street gas is used, condensed to a pressure of ten atmospheres, and the reservoirs under the floor of the car, which can be filled through a flexible pipe within the time required to change horses, carry gas enough for a run of eight or ten miles. The consumption of gas by a loaded car is stated to be twenty-five cubic feet per mile, which costs two cents at Croydon, where the experiment is being tried.

All the machinery is enclosed, the motor lying under one seat and the wheels and clutches under the floor of the car. The latter carries twenty-eight passengers in all and makes a very fair speed. With the slow gear in action, it will readily mount an incline of 1 in 23, with a short piece of 1 in 16, and in coming down, it can be stopped by the brakes in its own length. It also goes round a curve of thirty-five feet radius on a 1 in 27 grade. Its weight, when filled with passengers, is five and a half tons.

Mr. Mason states that a special motor car of the type above described, combining all the improvements thus far made is now being constructed in England, to be carried to the United States for exhibition and trial in October.

The Steam Plant of the Fair Haven & Westville Street Railway Company.

The Fair Haven & Westville Railway Company, of New Haven, Conn., has practically completed all its track and overhead equipment, and upon completion of its power station operations will be commenced. The power house of the company is located on Grand Avenue, near Mill River. It is of brick with stone trimmings, and the roof will be supported on iron trusses. The station presented a very busy appearance during a recent visit of a representative of the Street Railway Journal with President Parmalee. The engine equipment will consist at present of three Reynolds-Corliss engines of the cross compound type, with cylinder dimensions 16 and 30 ins. × 36 in. stroke. They will be direct connected to Westinghouse multipolar generators. The steam generating plant will consist of Manning boilers, six being installed at present, and Allis condensers will be used. The stack will be 140 ft. in height.

The company is also erecting a new car house which will measure 90 × 225 ft., and will have a capacity of sixty-four cars. The first equipment of cars which will be put in operation will consist of twenty-four from the works of Jackson & Sharp. These will be mounted on Bemis trucks and equipped with Westinghouse motors. The plans of the power station were drawn up by Sheaff & Jaastad, of Boston. The railway company is doing its own construction.

Gardner, Mass., will soon have a model electric road connecting it with West Gardner. A 160 H. P. Mather multipolar generator will be employed in the power station, and Westinghouse motors will be used on the cars. The latter are from the works of Jackson & Sharp, Wilmington, Del., and are claimed to be as handsome as any in the state. The body is painted a dark red with lettering in gold leaf. The seats are of ash and reversible, and the top of the car is finished in maple. All the cars are equipped with roller curtains. The closed cars are painted yellow on the body, except on the center panel which is painted white, the lettering being in silver with a black border. Double doors meeting in the center are used. The interior of these cars is finished in cherry and antique oak with hand carving at either end.

The Manchester (England) Tramways.

Of all the horse street railways in operation in England, where the electric street railway has hardly yet been able to make much headway, that operated by the Manchester Carriage & Tramways Company is, perhaps, as perfect an example of a model city street railway system as could be found anywhere, not even excepting the very excellent one which caters to the traveling propensities of the Parisians.

Manchester, or Cottonopolis, as its nickname goes, is a city of over 700,000 inhabitants, standing upon the banks of the River Irwell, just above its confluence with the River Mersey. It is a city of tall factory chimneys, which from early morning until night breathe out the smoke and fumes from the soft coal burnt in the furnaces, and help to form a heavy smoky fog which rivals in intensity and unpleasantness that of London. It is a very thriving city of the pushing, go ahead type, and since the opening of the ship canal, which gives it an opening direct to the sea, he would be a bold man who would dare to stand in the open places of the town and publicly proclaim that it is not the second city of Great Britain and the metropolis of the North. The population is on the increase, the city is blessed with a good municipal government, and everything points to a rapid extension to meet the changed conditions which the opening of the canal has brought about.

The first omnibus which was run in Manchester, plied between Pendleton and the town, and the fare charged was sixpence or twelve cents. The success of the venture soon brought others into the field, and in a short time 'busses began to run from the town to Cheetham Hill, Rusholme, Fallowfield, Didsbury, Newton Heath and Harpurhey, all outlying suburbs at that time, but now part and parcel of the busy city which has absorbed them.

In 1852, a certain Robert McEwan started a new line, and as a new competitor in the field his omnibuses were much superior to anything that had gone before. They were larger, more commodious, had no doors, were each drawn by three horses, carried about fifty passengers, and the fare was fixed at twopence, or four cents.

In 1861, a tramway line was laid down in Salford, but the venture did not prove remunerative. In 1865, the largest 'bus owners, tired of an internecine warfare in which all were sufferers, pooled their interests and formed a company known as the City of Manchester Carriage Company; but not until 1877, twelve years afterwards, was the first genuine street car railway laid down. This ran from the Woolpack at Pendleton to the Grove Inn at Higher Broughton, and proved a marked success.

In 1880, the present Manchester Carriage & Tramways Company was organized out of the old Carriage Company, and the entire system for passenger traction began to assume an air of rapid development. It now covers a total length of over fifty miles spread over an area thirty miles in circumference.

The terminus of all the lines is in Piccadilly in front of the City Hall. To this point all the lines from the many different suburbs and quarters converge, and the constant movement presents a lively and ever changing scene.

The laying of the permanent way is undertaken by the municipality, the operating company paying a certain annual percentage or rental upon the outlay. The rails are of the channeled girder type, weighing about sixty-five pounds to the yard, and are laid upon ties set in concrete, the rails being bolted together at intervals. The roadway is formed of squared, grey granite blocks. This substantial method of construction has the advantage of lessening the cost of road maintenance, and is characteristic of all municipal work in England.

The cars are large and roomy four-wheeled vehicles, having seats for passengers both inside and out, a stairway leading from the platform to the roof, allowing of access to the latter. Some of these cars are double enders and are provided with two stairways, one from each platform. In addition to the tram cars there are a number of 'busses,

each drawn by a single horse, which are chiefly employed for the short distance services. The total number of cars and 'busses is 550, and, during the period of twelve months, carry a population equal in the aggregate to the entire population of the United Kingdom and the Channel Islands.

The largest cars weigh two and a half tons when empty, and nearly double that when loaded. The small, single horse vehicles weigh about one and a half tons. Each bears an initial letter to indicate the line upon which it is operated. In addition to the cars and 'busses, the company makes and uses a very large stock of carriages, cabs and other vehicles for private as well as public use. It provides complete turnouts for many of the wealthiest people in the city who find that for a sum about equal to what they would have to expend to keep up a stable of their own, they can get all that such an establishment could provide without the care and worry it would entail. Altogether the company owns 1,024 vehicles.

On account of the level condition of the Mancastrian roads, the majority of the cars are hauled by two horses, but for those running long distances three are found necessary. The number of horses in the company's stud at the time of the last inventory was 4,732. The principal stables are at Pendleton, where are also located the car shops. The stables are conveniently constructed, are well ventilated and under constant inspection, and kept scrupulously clean. The horses are kept in excellent condition, and those used in the carriages are, of course, of good breed, indistinguishable from those of the best private stables. The ordinary life of the car horse is five to six years, although some have been in the harness from ten to fourteen, and even more years. They are worked from twelve to fourteen miles a day, and receive as feed sixteen pounds of corn and the same weight of chopped hay mixed with beans, etc. For some time past the horses have been fed upon Canadian and American hay, and have thriven upon it in a remarkable manner. A first class veterinary hospital adjoins the stables. The stud is under the care of Mr. Guest, traffic manager of the company, who has been with the omnibus companies since 1848.

Opposite the stables is the car construction shop, where the cars are built and repairs effected. This shop is fitted up in elaborate style with all kinds of woodworking machines. The foundry is spacious and contains some eighteen or twenty forges as well as a large steam hammer and hydraulic presses. The erecting shop is also a spacious room in which the cars are assembled, the parts coming in at one end and the finished cars running out at the other.

The fares on the cars are collected by fare boxes each passenger depositing his own fare, the conductor having nothing whatsoever to do with it. The box is self registering, and although the price of the box is high—$15—it very speedily pays for itself.

The advertising on the outside of the cars, is not as prevalent in Manchester as in many other English towns, although indulged in to some extent. There appears to exist a sentiment against it similar to that which obtains here.



VIEW IN MANCHESTER, ENGLAND, SHOWING COMMON TERMINUS OF MOST OF THE STREET RAILWAY LINES.

The company has a capital of £500,000 or $2,500,000. Its last statement claims an increase in net revenue of £11,277 or $56,386 during the six months ending August 31, 1893, as compared with the preceding period. The company has been singularly free from actions for damages, only £800, or $4,000, having been paid during the half year just mentioned. The net profit for this period was £28,847 or $144,235, and this was divided into 5½ per cent. dividend for the half year, in addition to 2½ per cent. on the preferred stock, £5,000 being carried over to the reserve which now amounts to £25,000. The lands, buildings, cars and machinery owned by the company are valued at £275,026 or $1,375,130, and the rolling stock, horses, etc, £194,484 or $972,420. The amount of fares received was £214,573 or $1,072,865, and the hire of cabs and carriages reached a total of over $100,000. Only £36 or $180 was expended in legal fees.

The chairman of the board of directors is Alderman John King, J. P., and the secretary of the company is Mr. J. Collings. The central offices are located at 37 Piccadilly, Manchester.

The Hoosick Falls Railway.

By J. H. Vail.

In a town or city of moderate population the successful development and operation of an electric railway depends upon at least three important factors:

1. The selection of a locality having a class of people who will avail themselves of good rapid transit facilities.

2. The construction and equipment of a road and system on the basis of true economy, *i. e.*, substantial material and workmanship well adapted to the peculiarities of the local conditions, the capitalization and bonded indebtedness being within the limits of sound business investments.

3. Practical, intelligent and economical business management catering to the wants of the traveling public by offering good accommodations and rapid transit, polite employes and all the great and small features that place the public in complete sympathy and harmony with the railway company.

The Hoosick Railway Company, at Hoosick Falls, N. Y., thirty miles northeast of Troy, on the line of the Fitchburg Railroad, has been designed and equipped with a full appreciation of the foregoing rules. It is now operating over about five and a half miles of line, the initial regular passenger trips being made on July 13. Passing through the principal streets of Hoosick Falls, the line extends to North Hoosick and Walloomsac, the intervening territory being well built up with residences of a good class.

The track consists of forty eight pound T rail, with the usual form of four-bolt angle plate joint. The rails rest upon ties of standard dimensions, two feet between centers, and are bonded with No. 0000 copper wire. There are several grades worth mentioning; one is on the large radius curve approaching the North Hoosick Bridge, and is between 7 and 8 per cent.; another of 9 per cent. is encountered on Classic Street in Hoosick Falls.

The overhead construction consists of both span and bracket work, the former being employed within the city limits of Hoosick Falls. The No. 00 trolley wire is used throughout, paralleled by a main of like capacity. The No. 00 trolley wire is yet something of an innovation, but has proven itself to be a step forward, as the results obtained from its use are more than proportionately better than the service offered with the standard No. 0 wire. Tests of electrical pressure over the entire line give very satisfactory results, the electro-motive force ranging from 475 to 500 volts throughout the system, giving an average of about 487. Both track and overhead line were built by the Worcester Construction Company, of Worcester, Mass.



FIG. 2.—SWITCHBOARD—HOOSICK FALLS ELECTRIC RAILWAY.

A new iron bridge, built and erected by the Boston Bridge Company, spans the North Hoosick River at North Hoosick. This bridge is shown on the opposite page.

The rolling stock consists of three eighteen foot, closed motor cars, three ten bench, open motor cars, two open trail cars and one snow plow. The motor equipments consist of two twenty-five horse power motors per car, two series multiple controllers, a starting rheostat, a fuse block, a lightning arrester and a main cut-out switch. The controllers are of the latest design, embodying a number of novel features. They are giving excellent satisfaction, and are apparently an improvement on all past manufactures.

The motors are of the four pole, iron clad type, with a thoroughly water and dust tight casing to protect all vital parts. The armatures are of the toothed drum type, the coils being machine wound and interchangeable, as are also the coils of the fields. Mica is liberally used in the insulating of all the coils, and those of the fields have a protective winding to guard against mechanical injury. All insulation is tested with a 5,000 volt, alternating current. All parts are readily accessible for purposes of inspection and repairs. The loosening of two bolts allows the lower half of the field to be lowered. The bearings are of babbit metal, lubricated with grease.

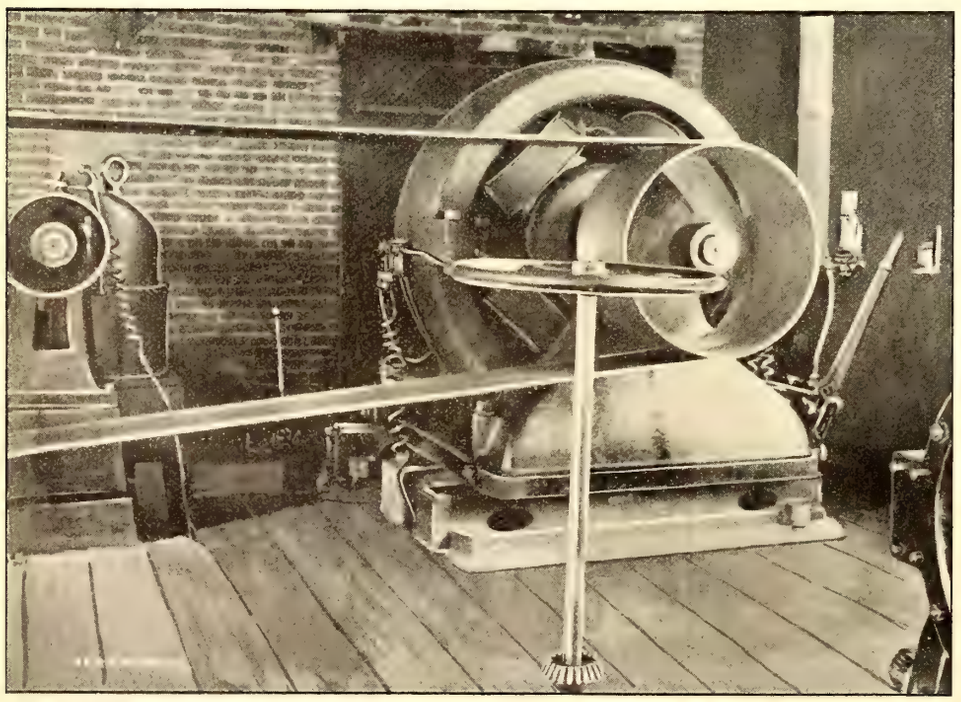


FIG. 1.—INTERIOR OF POWER STATION—HOOSICK FALLS ELECTRIC RAILWAY.

The gears are detachable and run in oil. The shaft is unusually heavy, with extra long journals, and is well protected with steel thrust collars.

The method of suspension is ingenious and entirely novel and fulfills perfectly the conditions necessary for eliminating the rapid deterioration of the rail joints, due to the usual heavy hammer blow. As the motor rides freely on springs adjusting themselves to varying conditions, no part of the machinery is subject to undue strain or shock of any description. The motor is of as light weight as is consistent with extremely strong mechanical construction and maximum efficiency. Apparently, every pound of material has been placed to the utmost advantage.

The motors have operated so perfectly ever since the road was started that there has been no necessity for removing any of the parts, a simple, daily cleaning being all that is required. These equipments are of the Walker Manufacturing Company's make, type No. 5. They are absolutely free from fault, either electrical or mechanical.



VIEWS ON THE LINE OF THE HOOSICK FALLS RAILWAY.

It is found that in operating the cars for high speed service, the motors are comparatively cool when returned to the car house after an eighteen hours' continuous run, the heating effect being far less pronounced than during the first week or two of service, when a slower schedule was in force.

The motive power is obtained from the station of the Hoosick Falls Electric Light Company, which is located one-half mile from the center of the railway system, the feeder wires being carried on a pole line to the main of the trolley line. The station is driven by water power, with an auxiliary steam plant to insure additional reliability in the event of low water or other accident to the water power. In the station is a 100 K W., multipolar generator built by the Walker Manufacturing Company. Its design is a model of beauty and strength. The field frame is cast in two pieces. The magnets are of the iron clad type, with pole pieces of soft laminated iron cast into the yoke.

The armature is of large diameter of very low resistance and ample radiating surface. It is of the iron clad, drum type, the core being built up of punched plates of the best quality of armature iron. These plates are insulated with enamel and compressed into a solid core. The insulation of the winding is most thorough, being composed of mica combined with fibrous material of great durability. Like that of the motors, this insulation is tested with a 5,000 volt alternating current. The machinery as a whole is highly efficient, and because of the rapid and perfect circulation of air, is unusually cool in operation. It easily stands a 50 per cent. overload without injury or sparking. The shaft is very heavy, with large bearings of the ball and socket, self-oiling type, lined with best quality babbit metal.

The car house is a frame building 36 × 100 ft., with two car pits and planked floor throughout. An extension is made on one side near the front end as a store room and office for the motormen and conductors. A handsome cupola, with flagstaff, surmounts the front end of the car house. The car house is sixteen feet in the clear under the trusses, thus permitting the trolley poles to assume a nearly vertical position when the cars are stored in the building. An interesting feature of the electrical station equipment is the Barber electric water wheel regulator, a brief description of which may prove interesting. It consists of two sets of solenoids and resistances, one set of which is almost continually in service to meet changes of load from one up to fifty amperes, while the second set is thrown in to compensate for changes between fifty and 200 amperes. These resistances are thrown into circuit automatically when the load is taken off the line, thus furnishing an artificial load, which steadies the water wheel and maintains the speed of the generator constant during all the sudden fluctuations of load peculiar to electric railway service.

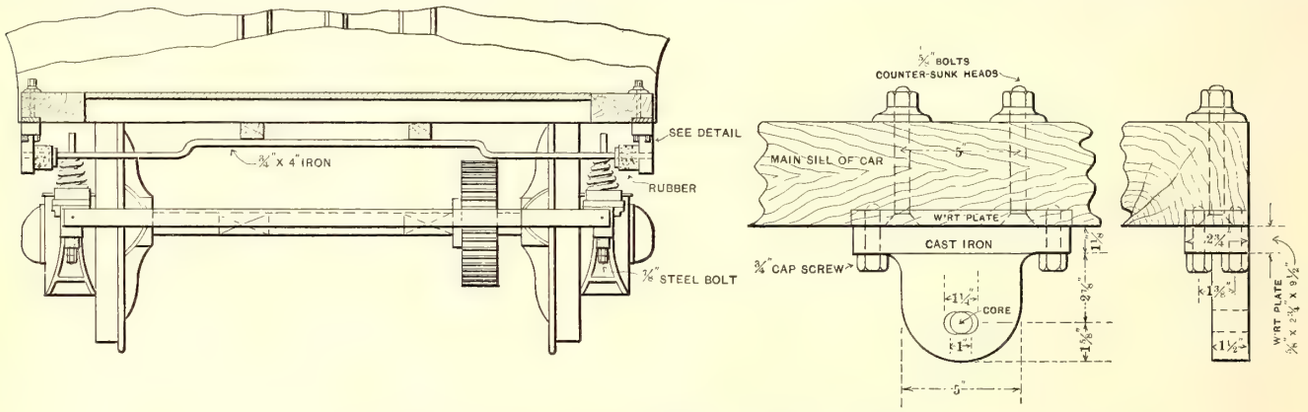
The entire equipment of the road, aside from the track and overhead system, was furnished and installed by the Electrical & Mechanical Engineering & Trading Company, of New York. This includes car barn, cars, trucks, motors, generator and switchboard.

The road has been most successful since the first day of starting, the first thirty days' business showing the patronage of 38,114 passengers. As a financial investment, there is every promise that the Hoosick Railway will be highly satisfactory. This comparatively small road, serving a population of between 9,000 and 10,000, is a most excellent illustration of the possibility of economically installing and operating an electric railway in such a way as to show handsome returns on the investment, even when the actual population of the locality is small.

It has frequently been stated that small roads will not pay, but there can be no question of this character if sound judgment and practical engineering experiences are applied, together with an appreciation of and a readiness to conform to the needs of the traveling public. During the early weeks of the operation of the road the round trip was made in forty minutes, schedule time; but, anticipating any requests on the part of the patrons for a quicker schedule, the management some days since reduced the round trip to thirty minutes. The sudden upward jump in the daily receipts of the road when the new schedule went into effect should prove a most impressive object lesson to managers of small roads everywhere.

Ingenious Device For Reducing Jolting.

An ingenious device for reducing the jolting of a car, caused when going around curves and when passing on and off switches, has recently been invented by S. Roy Wright, superintendent of the West End Street Railway, of Denver, Colo., and is illustrated by the engravings on this page. For winter service this company employs sixteen and eighteen foot cars, mounted on rigid trucks, but they have been found very unsatisfactory to the patrons, on account of jolting at the points mentioned. At one time it seemed as if it would be better to suspend the use of the cars and employ the thirty-six foot, double truck cars which were much easier at such points, but were longer than required.



NOVEL METHOD FOR REDUCING JOLTING OF CARS.

After careful study, the company concluded that it could overcome this objection by means of the device shown, and has done so beyond its expectations. As an eighteen foot car has two feet more swing than a sixteen foot car, the trial was made with an eighteen foot car first, and the results showed that the latter rounded curves and passed over switches with almost as little jolting and oscillation as the thirty-six foot, double truck cars.

As will be seen, the invention consists essentially of the interposition of a spring bar four inches wide and three-quarters of an inch thick between the truck springs and the sills of the car. The ends of this bar rest on a cast iron frame bolted to the main sills, a rubber buffer three-eighths of an inch in diameter being inserted next to the casting.

In the engraving a Bemis truck is used, but the device can be adapted to any make of truck, swivel or otherwise, and it is claimed will add materially to the life of car bodies. When it is necessary to take the truck from under the car for repairs, this can be done by simply disconnecting the motor and jacking up the car.

This car has been in daily service for a little over five months without requiring any repairs at all.

Cable Construction on the Columbia Railway, Washington.

The latest railway company to decide upon the equipment of its line with cable power is the Columbia Railway Company, of Washington, D. C. This company owns six miles of track which extends from the Treasury, 15th Street and New York Avenue, along New York Avenue, Massachusetts Avenue and H Street to the boundary N. E. The officers are: President, R. T. Baker; vice-president, E. G. Davis; secretary and treasurer, James B. Adams; superintendent, Wm. C. Bateler. The company decided in favor of the cable system in the early part of June of the present year, and on the 15th of the same month Wm. B. Upton was appointed engineer. The contract for street work was awarded to E. Saxton on July 20, and active work of construction will commence October 1. In the mean time the preliminary work of making the necessary changes in the gas and water pipes is in progress, as well as that of sewers, electric light and telephone conduits.

The roadbed construction will have tubes, 18 × 38 ins., built of Portland cement concrete. Eighty-six pound Johnson girder or grooved wheel rails, and Z type of slot will be used; ninety-two pound, new section Johnson curve rail will be employed on all curves. The yokes will be quite similar to those employed on the Washington & Georgetown Railway, and will be spaced five feet center to center, and weigh 350 lbs. each. Particular attention will be given to the rail joints, and these will be located on the rail seats and clamped down by means of four one inch hook bolts; they will also be spliced with heavy bars having six one inch bolts. The carrier pulleys will be fourteen inches in diameter with chilled face and will be spaced thirty feet between centers, running on babbit bearings attached to the yokes. All the traps and hatches, as well as the slot rails, will be level with the top of the wheel rails, and no projections will be allowed, so that fenders, which will be of a new form, can set close to the pavement. There are but very few curves and these are all easy, being not over twenty-four degrees deflection in any case, and the sharpest 150 ft. radius. The curve pulleys twenty-four inches diameter will be mounted on adjustable hangers.

There is very little special work outside of street railway and steam railroad crossings. The company will have one under cable crossing at 7th Street, that of the Washington & Georgetown Company. In all, the company will have two and three-quarters miles of cable construction, double track, and expects to have it completed before winter, with the exception of the buildings.

The plans of the power house and also that of the car house are nearing completion. These buildings will be on the east end of the line on property now owned by the company and at present used for stables. The power house is to be 80 ft. front by 200 ft. deep and one story in height. It will be built of brick and iron with tinned roofs. The latest and most improved machinery will be used, including rope drive, two simple engines of about 200 H. P. each, a battery of water tube boilers, mechanical stokers, coal handling machinery, electric light plant, improved tension regulating device, winding out reels, machine shop and everything necessary to make the same a complete and model plant. Only one cable is required and this will be one and a quarter inches in diameter, running nine miles per hour.

The car house will adjoin the power house, but there will be a twelve foot alley between. It will be built of brick and iron, covering a ground space of 128 × 200 ft. The front part will have all the company's offices, and will be two stories, the balance, or car shed proper, being but one story.

The company expects to make the contract for the power house September 1, and the car house October 1; all the contracts for machinery to be made in the meantime, the intention being to have the road ready for operations early the coming year.

The company has not yet decided the style of equipment to be employed, but it will be either the train system or the long, single car such as used on the Broadway line of New York. In either case both summer and winter cars of a first class make will be provided. It is calculated that the road will cost $450,000 when completed. Vitrified brick paving is being seriously considered in place of asphalt, as the latter has been found to be very troublesome in making repairs of track.

T Rail Construction in Paved Streets.

The T has always been a popular rail section with many managers, and it is interesting to note that there seems to be no difficulty in laying the rail in paved streets, and at the same time avoiding any obstruction to vehicular traffic. We have already illustrated in these columns sections of track in different cities showing method of paving to T rails. In our July issue the method of use in Memphis, Tenn., was shown, and in earlier issues that employed at Terre Haute, Ind.; Denver, Colo., and other cities. We publish below the results of a recent investigation made by the STREET RAILWAY JOURNAL upon the construction adopted at other points.

The Twin City Rapid Transit Company of Minneapolis and St. Paul, Minn., employs both the T and the ordinary girder rail. The height of the rail, in the T rail portion, is five and three-fourths inches, and most of the paving in the cities is of the same height, although in

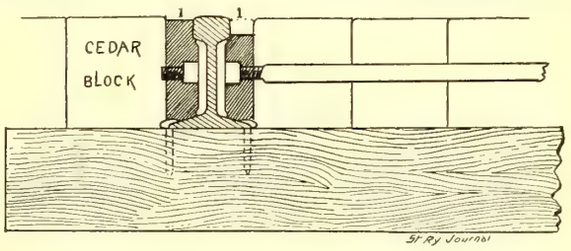


FIG. 1.—METHOD OF PAVING TO T RAIL IN MINNEAPOLIS.

some places a six inch block is used. A filling block of wood is used on each side of the rail, and this is sawed down to fit the side of the rail, leaving one inch to one and a half inches exposed on the top. This leaves a perfectly smooth line for the pavers to work against. The paving as put in is giving good satisfaction, both to the railroad company and the city.

In Des Moines, Ia., the Shanghai T rail is used, and the method of track construction differs from that adopted at St. Paul and Minneapolis, as will be seen in Fig. 2. Brick paving is used, and this is brought up flush to the head of the rail on the outside, and set just low enough on the inside to allow room for the rail flange.

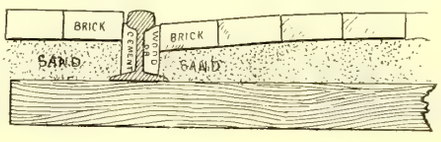


FIG. 2.—SECTION OF T RAIL CONSTRUCTION IN DES MOINES.

The space under the head of the rail is filled in with either wood or cement. The city authorities are so well pleased with the construction that they have insisted that the company shall use this rail hereafter on every new track laid in newly paved streets.

In Gloversville, N. Y., a six inch T rail is employed by the Cayadutta Electric Railroad Company in a street paved with cobble stones. A plank is laid edgewise on the inside of the rail. Mr. Frenyear, general manager of the company, tells us that he does not think the plank any advantage, provided the paving is properly done, but the company was compelled to use it by the terms of its franchise. The cobble paving to the outside of the rail makes a good joint. The T rail chairs are spiked directly to the ties.

In Covington, Ky., the only track construction with T rail on paved streets belonging to the South Covington & Cincinnati Street Railway Company is on the bridge

approaches, and was described in our June issue. The rail is four and a half inches in height, and the paving blocks are three and a half inches in thickness, leaving the rail one inch above the pavement. The superintendent of the company is of the opinion that a fifty-five or sixty pound T rail paved with properly constructed brick, makes the best kind of a roadway, both for the interests of the street railways and of the municipal authorities.

In Denver, on the line of the Denver Tramway Company, and in Salt Lake City, on the line of the Salt Lake City Railroad Company, two methods of construction are employed. One is to cut the paving block to fit the rail, and the other, which answers almost as well and is somewhat cheaper, is to run a strip of oak about two inches wide parallel to the rail on the gauge side and pave to this. The sections of rails used on these lines were illustrated in our September, 1893, issue. The T rail has a broad, flat head, so that little difficulty is experienced in turning out when a wagon or carriage wheel gets into the flangeway.

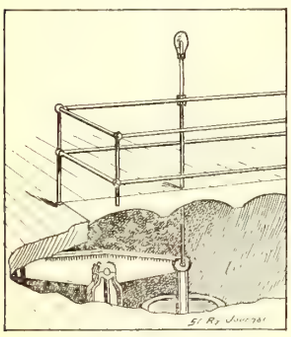
In Port Huron, Mich., all the tracks are laid with a forty-five pound T rail mounted on 5 × 5 in. pine stringers which are supported on ties. The space on the outside of the rail, between the rail head and flange, is filled with a 2 × 2 in. pine strip, the pavement laid against this, the top being made flush with the top of the rail. On the inner side of the rail the space is filled with a 2 × 2 in oak strip, laid about one inch below the top of the rail, and the pavement laid against it, and crowning to the center between rails to the top of the rails. The track gives good satisfaction when used in newly paved streets.

In Springfield, O., a fifty pound rail is used with brick pavements. The bricks are laid close to the head of the the rail, on the outside of the track, level with the top of the rail, and on the inside half an inch below the top.

Kinks in Station and Railway Practice.

AN INGENIOUS AIR PUMP INDICATOR.

A simple air pump indicator, designed by Mr. Goodwin, chief engineer of the power station of the Atlantic Avenue Railway, of Brooklyn, N. Y., is shown in the accompanying illustration.



AIR PUMP INDICATOR.

The condensing pumps, which are located in the basement, are of the single bucket type arranged on either end of a walking beam. The indicator consists of a piece of quarter inch pipe, about ten feet in length, attached to one end of the walking beam of the pump, and extends through the floor to the engine room above. An incandescent lamp is attached to the upper end of the rod. The lamp wires run through the rod, and are attached to a flexible lamp cord in the basement. A guide, through which the lamp rod moves, is secured to the railing surrounding the belt pit.

The lamp moves up and down with the motion of the air pump, and is readily seen from any part of the engine room.

A NEW TROLLEY SECTION INSULATOR.

A simple and effective trolley section insulator has been designed by A. K. Bonta, of the North Hudson Railway Company, of Hoboken, N. J.

The device consists of two 1½ × ½ ins. wrought iron bars, about ten inches in length, held together by bolts, on which are porcelain insulators, and a wooden insulator about twenty-four inches in length, of a slightly curved shape. This latter has on its upper side two projections by which it is attached to the wrought iron link by bolts.

A tongue is formed on the under side of the wooden insulator, which serves to guide the trolley wheel. The ends are protected by copper caps. The caps have lips which are clinched around the trolley wire, holding it firmly to the insulator.

The device is very simple and can be easily made by any good mechanic. These insulators have been in use



TROLLEY WIRE SECTION INSULATOR.

on various lines of the company for some time, and have given excellent satisfaction.

TIMELY SUGGESTIONS ON PRACTICAL SUBJECTS.

Noisy Cars—Some of the noises made by street cars are due not only to the rattling of the window sash, but the rattling of the glass in the sash. To stop this the window glass can be laid in putty when placed in the frames, as practiced by some manufacturers at present. To stop the rattling of the window sash, a spring can be placed between the sash and the post in such a manner as to stop all noise.

The placing of car bodies on rubber washers is an effective and most excellent remedy for noisy cars, and will be found an easy way of avoiding this trouble when other methods fail.

Poor Shop Work.—Many electric cars are entirely too light in construction. To make rapid speed, quick starts and stops, electric roads require a strongly built car, well braced with iron straps and rods, so that there will be no racking out of shape of the car body.

In many car bodies there is a lack of proper tying together of the floor frames, and sometimes even no tie straps are used from the side and corner posts to the floor sills. To have a strong car there should be at least six iron carlins used, tying together and bracing the upper deck as well as the lower deck of the car. The breaking of considerable window glass is often due, to a considerable extent, to the racking condition of the cars.

Lack of Standards.—Standardizing the parts of all car appliances should, of course, be the aim of every company, but it is not always advantageous, especially with the electrical appliances, to endeavor to keep too closely to any single set of such standards. Much, especially with the detail parts, is still in an experimental state, and to arbitrarily decide to use only certain fixtures in all work might prevent the use of economical and more efficient devices.

Dirty Rails.—While we do not know absolutely the amount of power (electrical) saved by having a clean rail, it will probably run above 18 or 20 per cent. Whether the saving secured by clean rails would justify the expense of using extra sweepers in muddy seasons is yet to be determined. The writer is of the impression that it will not pay from a power saving point, as it will take at least 10 or 12 per cent, or over half of the power saved, to use in cleaning the mud from the rails.

Snow Plows.—Electric railroad companies in cities where there is much of a snow fall in winter, should have at least one good electric snow plow for every fifteen miles of track, as plows will often nearly pay for themselves in a short time by keeping the other cars going. The plows should not be too light in weight and should have a power capacity considerably in excess of the maximum required at any time.

The half yearly report of the City & South London Electric Railway shows a gradual improvement, the dividend on the ordinary stock being 1 per cent. instead of ⅝ as in the past. The deep tunnel system will succeed if extensions can only be carried out. The total revenue amounts to £24,295, against £23,159 in the corresponding half of 1893, while the expenditure stands at £14,990 against £14,964. The train mileage has increased from 217,664 to 227,363.

A new street railway between Galt and Preston, Ontario, was put in operation last month.

The Insurance Problem.

By EDWARD E. HIGGINS.

Fire insurance rates have been generally raised within the past two years to a point where they have become—particularly to electric light and street railway companies—a serious charge upon earnings. The underwriters claim that they are doing business at a loss, and that increase of rates is unavoidable. The insured are indignant at what they believe to be the unreasonable demands of the underwriters and are trying in every possible way to excite competition, and to place their insurance at the old rates. A careful study of the situation is timely and important, if we are to determine how far the underwriters are justified in their increased demands, and what means can be taken to bring about a lower cost of insurance.

The National Board of Fire Underwriters of the United States, is an association of eighty-four leading American and English stock companies, and is the parent of the numerous local boards in various parts of the country. The Association is organized:

1st. To establish and maintain, as far as practical, a system of uniform rates of premium; to gather such information and statistics as may tend to that result, and and to promote harmony, correct practices and sound underwriting.

2d. To organize and sustain local boards of fire underwriters and to establish and maintain a uniform rate of compensation to agents and brokers.

3d. To repress incendiarism and arson by combining in suitable measures for the apprehension, conviction, and punishment of criminals guilty of that crime.

4th. To devise and give effect to measures for the protection of the common interests, and the promotion of such laws and regulations as will secure stability and solidity to capital enployed in the business of fire insurance, and protect it against oppressive, unjust, and discriminative legislation.

Whatever may be urged against similar associations or "Trusts," in commercial industries, it must be admitted that the enormous interests * dependent upon the prosecution of the insurance business on a sound and conservative basis justify an organization of underwriters. Such unrestrained competition as would affect the permanent solvency of insurance companies cannot be permitted. It is true that the great power of this combination might be abused, but any tendency in this direction is held in check by the publicity of the business, by outside competition, and by the very number of its independent, profit seeking members, who cannot be wholly restrained from rate cutting, secret rebates, etc.

In its report of May 10, 1894, the National Board of Underwriters furnishes the following general exhibit of the American business of 39 New York State insurance companies, 181 insurance companies of other States and 24 foreign companies. From this and other statistical matter contained in the report, it is found that for every $100 of premiums earned in 1893, these (stock) companies paid out for losses by fire $66.93—the largest percentage loss since 1871 and 1872, the years of the Chicago and Boston fires—and for commissions, salaries and other expenses, exclusive of dividends on stock, $34.84, a heavy expense percentage, but one somewhat less than the average of the last ten years. In other words, the sum of the fire losses and the expenses, actually exceeded the premium income by 1.77 per cent., so that in order to pay stock dividends (slightly less than usual, averaging for 220 American companies 9.58 per cent, as against average of 10.55 of last thirty-three years) the companies were obliged to use all their income from investments, and to encroach upon their surplus. *This disastrous result has been caused by a succession of steadily increasing fire loss ratios, dating from 1890.

What are the causes of this increasing fire loss? The companies themselves contend that electricity is their greatest enemy,† and it must be admitted, even by those of us who are most interested in proving to the contrary, that great care must be taken in the installation of electrical machinery and plants, if we are to prevent a decided increase in the real fire hazard, and that there has certainly been much careless and ignorant work done, especially in the early days of the industry. But there is another important influence at work in the insurance field, tending to reduce the profits of the stock companies—an influence which the latter are hardly disposed to recognize in public, but which is privately causing them much anxiety. The best, or "preferred" risks are being largely withdrawn from the rolls of the stock companies, and are being placed with the "factory mutual" companies, so called, whose methods, presently to be explained, are in many respects superior to those of the stock companies. By this process of separation the average quality of the risks remaining with the latter is probably deteriorate from year to year, and an increased percentage of fire loss is naturally to be expected.

Admitting that these losing conditions now prevail, it is evident that the underwriters—if they are to continue present dividends without encroaching upon surplus—must either take action to reduce the fire loss, or must decrease expenses, or must raise premiums. As a matter of fact, they are trying to adopt all three of these methods. Their rules governing the undertaking of risks and seeking to regulate the business of the insured are becoming more and more stringent, and have become in many cases, a positive annoyance, although these rules are even now seriously defective in that they do not go to the bottom of the matter and absolutely compel radical changes of building construction as a condition of assuming risks. The companies do not find it easy to cut down expenses, since a large part of these expenses are in liberal commissions to agents‡, paid generally under long time contracts, and by means of which the companies have been able to secure the best agency talent. The companies have, therefore, generally determined to raise the premiums, but it is a noteworthy fact, as pointed out in the underwriters' reports, that their best efforts in this direction have so far met with such stubborn resistance on the part of the insured, that the average rate of premium obtained by the 244 associated companies was but $.8671

TABLE SHOWING THE COMBINED EXPERIENCE OF AMERICAN AND FOREIGN FIRE INSURANCE COMPANIES DOING BUSINESS IN THE UNITED STATES—1860 TO 1893, INCLUSIVE.

Year.	Average No. of Cos. for each Period.	Rates of Losses to each $100 of Premiums.	Rates of Losses to each $100 of Risks Written.	Average Rate of Premium on each $100 of Risks.	Percentage Expenses to Premiums Received.
1860–'65.....	136	58.51	.4007	.6848	28.86
1866–'70.....	163	57.79	.5044	.8728	32.12
1871–'75.....	177	62.56	.5899	.9430	30.81
1876–'80.....	280	54.14	.4336	.8007	35.34
1881–'85.....	293	58.36	.4943	.8469	34.25
1886–'90.....	295	57.55	.5008	.8701	35.57
1891.....	258	61.23	.4956	.8094	36.60
1892.....	251	62.08	.5267	8485	35.93
1893.....	244	66.93	.5904	8671	34.84
Aggregate...	—	59.04	.5020	.8502	34.06

* The fire policies underwritten in the United States in 1893, by 244 companies aggregated $15,566,7 2,643.

*Figures compiled from last annual statements of 36 New York companies, 56 companies of other states and 19 foreign companies, show a reduction of over $8,000,000, in their aggregate net surplus, as compared with that of one year previous, and of nearly $14,000,000 as compared with January 1, 1891. (From President's address, N. B. F. U.)

†Concurrent action regarding our present greatest enemy—electricity—seems to be imperatively demanded. The companies as a unit should provide and enforce for the whole field more strenuous rules than any yet perfected for the installation of all plants, wiring, etc., for the use of electricity in all its forms. There has been plenty of evidence during the past ninety days that fires caused by electricity are growing alarmingly frequent, and inspections show that but few buildings in any community are safely wired, and that perfect insulation is rarely secured. I am convinced that the companies must for their salvation adopt at the earliest possible moment plans and methods that will compel the assured to substitute without delay the most modern wiring and safeguards, or be relieved of fire insurance protection. This great and increasing danger cannot be ignored. It threatens the very life of fire insurance companies. How can we meet it by joint and uniform action? (President's address, N. B. F. U.)

‡Averaging in 1893, 18.59 per cent. of the premiums received for 127 American and foreign companies.

per $100 in 1893, as against $.8485 in 1892, and $.8094 in 1891. (See table.)

"Factory mutual" insurance companies were originally organized in order to resist the attempts of the stock companies to charge excessive premiums upon factories which had been—for those days—most thoroughly and carefully protected against fire loss. These companies are primarily an association of mill owners, who agree to insure themselves. In doing this, it is evidently for the interest of each and all to adopt such methods of mill construction and such apparatus for the prompt extinguishment of fire as to reduce the hazard to a minimum, since losses by fire are a direct burden upon the mill owners themselves, not upon an outside, profit seeking corporation. Each "member" has a voice in the management of his company, and no new members are admitted whose mills do not come up to the high standards specified. The mill owners, through their agents, the company's officers, are constantly studying the causes of fire, discovering remedies and improvements in construction and in hundreds of ways reducing the real fire hazard. The expenses of the company are at a minimum, consisting almost entirely in officers' and inspectors' salaries, and in moderate office rentals, etc., as there are no commissions to be paid to agents for new business, and no expensive branch offices to be kept up.

The results of this wise and enlightened policy have been with the best "mutual" companies most remarkable. Note the following statements taken from a recent report of one of the oldest and most prominent factory mutual companies, which underwrites nearly one-fifth of the total insurance of this character:

Amount at risk, December 31, 1891, $93,528,991.
Premiums received during 1891, $766,361 = $.8194 per $100.
Losses incurred during 1891, $296,430 = 38.7% of premiums.
Premiums returned " " 482,025 = 62.9% " "
Average net cost of insurance written $.316 per $100.

Total number of fire claims 92, as follows:

51	of	less than		$100.
22	"	from	$100 to	500.
8	"	"	500 "	1,000.
2	"	"	1,000 "	2,500.
6	"	"	2,500 "	5,000.
1	"			8,564.
1	"			25,992.
1	"			225,000.

These are preferred risks indeed. We find an avererage *gross* premium rate slightly less than the average *net* rates obtained by the stock companies, 62.9 per cent. of these gross rates being returned, however, to the company's members in the form of rebates or dividends. The fire loss is but 38.7 per cent. of the gross premiums received, as against 66.9 per cent. in the experience of the stock companies. And, finally, the expenses of this particular mutual company are nearly or quite met by the interest on the premiums received and on the company's investments, and amount to hardly 5 per cent. of the gross premiums received, while, as has been seen, commissions and expenses eat up about 35 per cent. of the total premium income of the stock companies. In other words, the mutual companies are doing business on the theory of preventing fires, rather than insuring against them, and insuring it at cost, and they have certainly pointed out the ways and means of greatly reducing the country's immense and disastrous fire waste.

Now the improved methods of the factory mutual companies are entirely applicable to street railway insurable property, and will bring about a reduction of the fire hazard to nearly or quite as low a point as has been reached by the cotton factories, mills, etc., although there is an additional risk involved in the spark generating power of electrical plants, possibly somewhat greater than that caused by the necessary accumulation of inflammable material in cotton mills. The insurable property of a street railway is but a fraction of its gross "plant" and consists usually of one or more power stations with their boilers, engines and dynamos; one or more car houses with their contents, a large proportion of which are out on the road for about eighteen hours out of the twenty-four; and sundry miscellaneous buildings, repair shops, etc.

The street railway power stations are, with few exceptions, constructed of brick, and at an original expense which should have produced the very best results. Unfortunately, however, electric railroad architectural and engineering methods are young, and the best practice in the experience of kindred industries has been too often overlooked, so that grave mistakes of design and construction have frequently been made. The most usual error has been that of designing stations too small for what have turned out to be the requirements of service, and the result has been the overcrowding of machinery and other serious inconveniences. A great deal of inflammable material in the form of useless and expensive "gingerbread work" is often found, and must surely be removed if lower rates are expected. A street railway power station should be, wherever possible, a one story building constructed of brick. Ventilator shafts, flues, concealed air spaces in walls, floors or roofs, and wood sheathing of all kinds should be conspicuously absent. In this case, the highest art calls for a severely simple interior consisting of plain or painted brick walls, substantial wooden flooring with asbestos paper between the planks and the (matched) floorboards, iron roof structures, and with everything "meant for business," not planned to attract visitors. If a basement is necessary, its floor should be of concrete, and it should never be used for the storage of miscellaneous supplies. Where there is no basement, the floor planks should be laid directly on the ground if dry, or upon a flooring of ashes or sand topped with a coating of coal tar concrete, the engine and dynamo foundation being of course carried as low as may be found necessary. The boiler room should be separated from the engine and dynamo room by a brick wall, all openings of which should be protected by heavy fire doors constucted of wood completely lined with tin. Where it is necessary to build power stations with two or more floors, all openings from room to room, or from floor to floor should be avoided or protected by fire doors, the idea being to localize fires at their origin and prevent them from spreading to other parts of the building. Chimney or smoke stacks should not, of course, touch wood at any point when passing through floors or roofs.

Nearly all the real danger of fire from electrical causes in railway power stations is found at the dynamo switchboard, and by far the greater part of this special danger may be avoided by placing the switches, meters, automatic cut-outs and all other appliances, except the feeder switches, in the ground circuit instead of—as is usually done— in the trolley circuit. By this arrangement trolley lines and feeders would pass to the positive pole of the dynamos through the feeder switches only, and if the latter are placed in a sufficiently isolated position, "grounds" can be made almost impossible. An incidental advantage of this arrangement is found in the reduced danger from "shocks" in handling the controlling apparatus, since all parts of the main switchboard apparatus are firmly grounded and at the "potential" of the station floors and the negative bus bar. The switchboard should be made of incombustible material, preferably, perhaps, of vertical and horizontal T or L iron beams, supporting slabs of slate or marble, on which the apparatus is mounted. This arrangement provides for air insulation and makes it possible to instantly detect any incipient fire in the rear of the switchboard.

The car houses should also be one story brick buildings of the simplest and plainest construction. Means should be provided for quickly emptying the car house in case of fire, and this feature if well carried out will effect a material reduction in rates. Where land can be obtained in the rear of the car house at a reasonable cost, it would perhaps be well to continue the car house tracks outside the building into such a lot, and to build the tracks at a slight grade, so that the car house can be more quickly emptied in case of fire than is possible with the complicated switching arrangement usually found in

front leading to the street. The extra tracks at the rear of the car house can be used, if desired, for some kinds of repair work or for other purposes not inconsistent with the object just stated. In considering the desirability of making such an additional investment for land in any particular case, the interest on the investment should, of course, be compared with the saving in insurance, and a decision made accordingly.

Repair shops from an insurance point of view should not be directly connected with either the power station or the car houses. This is not always possible or convenient, however, and a brick repair shop forming an L on the car house, and separated from the latter by fire doors will not ordinarily be seriously objected to by the underwriters.

A source of danger of some importance is found in the use of the electric lights and motors in railroad companies' buildings, the current from which is taken directly from the trolley wire and returned to the dynamos through the ground. During the operating hours, when there is usually a constant attendance in the buildings, the hazard is not serious. When the plant is shut down it becomes of course nil. The underwriters have little reason, therefore, to demand an increase of rates on this account, provided that their specifications for wiring are carefully followed.

The fire extinguishing apparatus should be of the most complete and practical character, and *must always be kept in readiness for use.* An immense number of small fires have been put out, and can be put out in their first stages by a bucketful of water rightly applied. The first necessity is then, plenty of buckets of water placed around the room and kept full. Several coils of hose connected to a water pipe system which is kept constantly under pressure, from the city water mains if possible, and if not, from duplicate steam pumps supplied by the main boilers is the next important feature of the "apparatus in chief." Automatic sprinklers are hardly of as general application in power stations and car houses as in cotton factories, principally because of the danger of leakage and of short circuiting the dynamos. Nevertheless, they can be applied in repair shops and the supply rooms to excellent advantage. Thermo-electric alarms are useful in places. There should be, of course, a regular watchman on duty whenever the plant is shut down, and the value of his services should be checked by a watchman's clock. With these, and other precautions specified in detail by the underwriters, it is probable that an electric railway plant can be profitably insured on "mutual" principles, at a net rate not exceeding $.50 per $100, and by a stock company at a rate not exceeding $1.25 per $100.

Those companies who have already built their plants and made their mistakes have it in their power to correct the latter to a very large extent, and at a price which need not be prohibitive. The "gingerbread work" must be removed and the floors thoroughly cleaned *and kept clean*; all oily waste and inflammable supplies of every kind removed to an outside or L building, and every similar precaution taken to honestly keep the fire hazard at a minimum. The cure for the present difficulties of the insurance situation is not found in bitter combat with the underwriters, nor in desperate efforts to obtain competitive rates lower than those fixed by the experience of the sounder companies. Low rates, when not justified by real absence of fire risk, may help into insolvency the companies which assume such risks, and not only may premiums have to be paid twice over, but an actual fire loss of large proportions may precipitate insurance failures and cause repudiation of matured claims. The real remedy is for the assured to join hands with the underwriters in the attempt to make each plant a "preferred risk." If the underwriters should unwisely (and very improbably) refuse to recognize the right of any electric railway plant to demand preferred rates, however excellent its construction or means of preventing fires, a remedy for this real injustice is self insurance through mutual companies organized to take only the best selected risks in the street railway field.

Notes From England.

(*From our London Correspondent.*)

Perhaps no announcement could fill the American street railway man or even the average American city dweller with more astonishment than this, that there exists in this metropolis a body called the West End Tramway Opposition Association. Probably some of your readers will have heard of it before and of its activity, too often successful, in opposing Parliamentary bills for the construction of tramways in the West End of London. Of late the association has been very wide awake in view of proposals to make the tramway system of London something more than a laughing stock to the rest of England. The association seems to be animated by purely aristocratic, selfish feelings, for because streets would be rendered a little less pleasant for the elegant vehicles of the wealthy classes the general public have to suffer. Any street railway man from the States coming here and making a tour of observation in the West End of London, would be amazed at the miles upon miles of magnificent, straight, busy thoroughfares where there are no tramways.

A committee of Leeds Town Council has recently visited Newcastle and Edinburgh, and as a result it appears to view with great favor the working of the cable tramways in the latter city and the proposals for adopting cab e traction in the former. It may be said that it is now practically settled that the cable system will be introduced at an early date in the hilly city of Newcastle. In Edinburgh also, though no definite date has been yet fixed for beginning the work, there seems every likelihood that the Town Council will not very much longer delay starting a cable installation on the lines it has leased to Messrs. Dick, Kerr & Company.

That gigantic experiment in municipal working, the Town Council of Glasgow operating the tramways themselves, has now been started, with what success time will show. The Council has to compete with omnibuses which the dispossessed tramway company has put on the streets.

We have at length and for the first time in this country, got accounts of the working of a line on the trolley wire system. This is the South Staffordshire electric tramway. It appears that during 1893 the running expenses and repairs amounted to only 8.12 cents per car mile, against 8.44 cents for the same items on the Birmingham cable line and from fifteen to seventeen cents on various steam lines. This is a very favorable result should it continue.

The work of construction on the Waterloo & City Railway has now commenced, and it is expected to occupy three years. This will be the second railway in London on the deep tunnel system. The work has been begun by sinking a shaft in the bed of the Thames. When the proper depth has been reached the tunnels will be driven in both directions, and all the excavated material will be brought up the shaft in the river and taken away on barges. There will be no street interference whatever.

The decision given in the end of July by the House of Lords in the appeals by the London and the Edinburgh Street Tramways Companies is exciting the greatest interest all over the country. Briefly put, the judgment affirms the view of the courts below, that when a local authority buys a tramway all that it has to pay under the provisions of the Tramways Act of 1870 is the sum for which the tramway could be constructed, less an allowance for depreciation, but plus an allowance for preliminary expenses, and for the fact that the tramway has been successfully constructed and is in working condition. Thus the contention of the companies that they were entitled to a capitalized rental value is wholly shut out. This will be very bad for the companies owning prosperous lines, but probably will be to the advantage of the owners of routes which are worked at a loss, for in the latter cases there could be no rental value. The fear, however, is that local authorities will only buy up the profitable lines and leave the others in the hands of the unfortunate companies.

Practical Notes on Rope Driving—Part IV.

By M. E.

Having in the previous issues briefly reviewed the primary considerations to which attention must be given in planning rope driving installations, we propose to devote the concluding article of the series to a cursory discussion of the causes of loss of efficiency in this system of power transmission, to a few remarks on the relative merits of the two systems of rope driving, and to some general concluding notes on the subject.

So far as dynamo driving is concerned, the following causes of loss of efficiency require to be considered: (1) Stiffness or resistance to bending of the ropes. (2) Loss of power incurred by the ropes entering and leaving the grooves. (3) Elastic "slip" or "creep." (4) Differential driving effect when a number of independent ropes are used. (5) Excessive initial tension causing an abnormal loss due to journal friction and also increasing (2).

(1) *Stiffness of Ropes.*—The resistance to bending of a rope will be greater than that of a belt of equal power; one reason for this being that the depth in the plane of bending is much greater in the former case than in the latter. The increase, however, does not by any means follow in a similar proportion, since in bending the rope accommodates itself to the radius of the curve, partially by pure bending, but also by the sliding of one strand upon another, and, to a smaller extent, by a similar action among the fibres of each strand. It is seen, therefore, that the degree to which the rope is twisted as well as the lubrication of the fibres, etc., will greatly influence the amount of this resistance, and incidentally the life of the rope, since the wear of the rope is principally that due to the internal chafing and bending of the fibres. The arc of contact, the angle of the groove and the tensions on the two sides of the rope all influence the resistance to bending; but the size of the rope and the pulley are by far the more important factors. Obviously the smaller the rope and the larger the pulley the less will be the loss due to stiffness. The amount of power lost, however, may vary considerably under different circumstances. Quite recently M. Fauquier experimentally investigated this point in connection with the driving of a 200 H. P. dynamo. He finds that in the particular case cited, the loss of power due to stiffness was 5.25 per cent. of the power transmitted. This result is, in the writer's opinion, somewhat above the average, for although various estimates place this loss between 2 and 12 per cent., he considers from 3 to 4 per cent. should not be exceeded with reasonable proportions of pulley and rope diameter.

(2) *Loss Due to Ropes Entering and Leaving the Grooves.*—The amount of power lost by the compressing of the rope as it enters the groove and by releasing the rope therefrom, is probably not so great as generally supposed. It will evidently be greater with acute angled grooves, but its amount will also greatly depend upon the degree of slack side tension allowed as well as on the smoothness of the pulley grooves and the lubrication of the rope. The speed has also an important influence, since the centrifugal action induced by the rope being deflected around the pulley prevents the rope sinking as far into the groove as it otherwise would, thereby lessening the loss referred to.

(3) *Elastic Slip.*—The loss of power in this case results from the loss of velocity due to the elasticity of the rope, and should rarely exceed 1 per cent. It may be regarded as the power continuously absorbed by stretching the rope on the driving side.

(4) *Differential Driving Effect.*—Advocates of the continuous system of rope driving regard this as the principal defect of the separate system. When a number of separate ropes are employed to transmit power from one grooved pulley to another, it is evident that unless each individual member of the set acts in unison with the others in every respect, loss of power will follow. Among the causes which tend to disturb the equality of driving are: (*a*) Differences in size of the ropes; (*b*) of the pulley grooves, and (*c*) differences in tension due to variation in the length of the ropes. All or any of these tend to cause variation in the driving efforts of the several ropes, and thus result in a loss of efficiency due to what the writer has termed the "differential driving effect."

The difference in size of the various ropes cause those which are larger to ride higher in the groove than the others, and if—as is usual in dynamo driving—the driving pulley is the larger, the larger ropes will tend to drive the dynamo at a lower rate than will the others. Thus, if the difference in diameter between two ropes is such that the contact lines or "pitch circles" of the ropes and pulley grooves differ by a quarter of an inch, and we take a driving pulley, D, of sixty inches and a driven pulley, *d*, of thirty inches, measured at the pitch lines of smaller ropes—the velocity ratio due to the latter will be $\frac{60}{30} = 2$. But for the larger rope, the velocity ratio will be $\frac{60.25}{30.25} = 1.991$. The difference is not great, but quite sufficient to disturb the equality of driving effect. The same remark applies to difference in the diameters of the pulley grooves. It is evident that to avoid this loss, only ropes of the same diameter and make should be used in a set. The independent or separate system has the advantage of providing against breakdown, but if one worn out rope is replaced by a new, and therefore a larger one, it may frequently occur that this advantage of the system will prove a somewhat costly one. As a rule, however, the failure of one rope of an original set may be taken as indicating the necessity for an entire renewal.

The effect of variation in length of the ropes, and therefore in the tensions in the sides of each, is probably overrated. It is, of course, advisable to have the ropes all of the same length and all uniformly spliced, but in practice it is impossible to avoid some little difference in this respect. The variation in length will affect the slack side tension to a much greater extent than it will that of the tight side; but as the latter is that mainly concerned in the power transmission, it follows that unless the difference is considerable, the loss cannot be very material. As the number of ropes used is greater, the loss due to differential driving effect will be greater, but under ordinary conditions it should certainly not exceed about 3 per cent.

(5) *Loss Due to Excessive Initial Tension.*—This last source of loss is frequently very much in evidence in vertical drives with independent ropes, but in many short, horizontal drives the ropes are also much too tightly stretched over the pulleys. This is doubly disadvantageous, since it not only leads to increased journal friction, but also increases the loss by wedging the rope into the grooves, previously referred to. With overloaded ropes and pulleys differing considerably in diameter, this ultra-tightness can scarcely be avoided, but the life of the ropes under these conditions is, needless to say, only a fraction of what it would be under reasonably favorable circumstances. With dynamos set in sliding beds, the position of the machine can be readily adjusted, so that little more tension is imposed on the ropes than is necessary to prevent slipping under the greatest fluctuation of load likely to occur.

Axial Rotation of Ropes.—It is a somewhat remarkable fact, that of a set of ropes—apparently of exactly similar make, length and general conditions—some will persist in revolving axially while working, while others will speedily conform to the V-shaped groove and assume a somewhat similar section. Various theories have been propounded to account for this action, but none supply a rational explanation. As to the influence of this action on the wear of the rope, there is some difference of opinion. It is certain that the rope turns partially while it is in contact with the pulley, so that it is clear power is lost in this way, and the wear of the outside of the rope must be greater to some extent. On the other hand, if the rope becomes permanently flattened at the sides, the external wear will be practically confined to these parts, but probably the internal wear will be less as the bending takes place constantly in the same plane. On the whole,

it would appear desirable to prevent axial rotation as far as possible.

Comparison of Rope Driving Systems.—Much of what has been said in the foregoing applies equally well to the continuous system of rope driving as to the separate rope arrangement. The disadvantages of the latter system have been alluded to, and it now remains to briefly discuss the relative advantages of the two methods of driving. Among the disadvantages of the continuous system must be reckoned the risk of breakdown which means, in this case, total stoppage until a new splice is made or a new rope installed. In the separate rope system, the failure of one rope throws only a slightly additional load on the other ropes for the time being. In the continuous system, the unroving of the splice may work havoc in all directions, but with a separate rope, it usually draws out, until the defective rope is so elongated as to become useless as a transmitter of power.

Theoretically the continuous system is by far the most perfect of the two, since the tension on the slack side of the rope can be readily adjusted by altering the weight of the tension carriage. The several wraps of rope are under uniform conditions, and there can be no possible loss by differential driving effect, provided the grooves in each pulley are similar in form and size.

The erroneous theory of coil friction is frequently propounded in connection with the continuous system of rope driving, it being claimed that the resistance to slipping is enormously increased by reason of the successive wrapping of the rope, the idea being that the pulleys are in much the same position as a windlass or capstan employed to haul heavy weights, with only a small tension on the discharging end of the rope. The cases are, however, by no means similar, for in the first the pulley having the least frictional grip will tend to slip, *as a whole*, under the several wraps of rope, while in the second, the whole load is applied at one point on one of the wraps. As a matter of fact, the driving effort of each wrap is similar to that of each rope in the separate system, but in the former the slack side tension can be more accurately regulated, and the tensions throughout more evenly maintained.

It is not readily apparent why the use of winder pulleys and other complicated expedients should enter as largely as they do into the various arrangements of rope driving employed in this country. If winder pulleys are really necessary to the success of the continuous system, the fact may be taken as evidence of the practical superiority of the separate rope system, for no difficulty arising from insufficient frictional grip is experienced with the latter arrangement. At best, winder pulleys are costly adjuncts, and their use should be avoided; if used they should not, of course, be smaller than the smallest of the transmission pulleys. The friction of this idler pulley must detract from the efficiency of the transmission, but a more serious objection is the greater loss of power due to the larger number of bendings, as well as that due to the rope entering and leaving the supplementary set of grooves. The arrangement calls for a proportionately greater length of rope, so that the wear per unit length is probably not much increased if the pulley is as large as desirable. A much wider and, therefore, a more expensive dynamo pulley is required, and a greater amount of space is occupied when a winder pulley is used—disadvantages of moment for the service now considered. It may be taken that when trouble is experienced owing to insufficient grip on the small pulley, the other expedients, mentioned in a previous article, for increasing the frictional grip, are preferable to the use of winder pulleys. If the former devices fail, the rope is overloaded, and more working wraps should be used if satisfactory working and durability are to obtained.

When the length of drive is small and the continuous system is adopted, the width, W, and pitch, P, of the pulley grooves, given in Article III, should be increased somewhat to prevent the rope chafing on entering and leaving the grooves. The form of tension device adopted should be one which does not entail any reverse bendings of the rope, and the tension pulley should be as large as conveniently possible. The amount of weight necessary for the tension device can be best ascertained by experience, as much will depend upon the speed of the rope and other circumstances which cannot be readily taken into account by any simple rule.

Finally, it may be said that for short drives, such as are frequently necessary in dynamo driving, the continuous system appears to possess some advantage over the separate rope system; but since immunity from breakdown is of such primary importance in this service, it is very questionable whether the slight gain in efficiency is not more than offset by the increased risk of failure.

Splicing Ropes.—Much of the success of rope driving gear depends upon the care bestowed upon the splicing of the ropes. The result of an attempt by the inexperienced to splice transmission rope is generally a thick place in the rope, which necessarily produces a jerky and uneven motion, while the rope is rapidly worn and frayed at this part. A good splice should be scarcely distinguishable from the other part of the rope after it has been working for a few days. It is difficult to explain the *modus operandi* of splicing a driving rope, and the aid of an experienced splicer should be brought into requisition whenever possible. For driving separate dynamos with independent ropes, and with the position of the machine adjustable, the ropes may frequently be ordered ready spliced from the makers, but in this case measurements must be very carefully given. Each rope is placed in the groove of the dynamo pulley and also securely lashed to the driving pulley, on to which it is carefully shipped. The length of splice in feet for from one inch to two inch ropes may be six times the diameter of the rope in inches. Thus for a one and a half inch rope the splice would be nine feet long. For the smaller sizes eight times the rope diameter in inches may be taken as representing the advisable length of the splice in feet.

Care of Ropes.—The life of the rope and the general success of the transmission depend in no small degree upon the care bestowed upon the ropes when first set to work, and their subsequent treatment. It is recommended that cotton rope when received from the makers should be uncoiled and stretched, if possible, for a few hours. If this is not convenient, they should be uncoiled and placed in a warm room for a day or so, especially if they are already spliced. Care should be taken that the ropes in running do not come in contact with any obstruction such as shafts, beams, walls or columns. Chafing of the exterior of the rope, caused in this way, often passes unnoticed until the damage done assumes serious proportions. Similarly, contact between different ropes of a set is to be avoided, while in the continuous system, care should be taken to see that the rope has ample clearance in passing through the tension carriage, and also that the tension wheel is set at the correct angle to receive and deliver the rope with the least risk of side chafing in the groove. Large installations of rope driving gear are generally fitted with a simple form of "detector" arrangement, which gives indication of any fraying of the strands. One device consists of a light pine rod held lightly by end contact and placed close to the face of the rope wheel. The striking of the rod by a frayed strand is sufficient to release it, and in falling it may be arranged to operate on the governor of the engine or to complete an electrical circuit and ring a bell, etc.

Lubrication.—Opinion cannot be said to be unanimous with regard to the amount of lubrication necessary for driving ropes. Some makers of ropes hold that the internal lubrication of plumbago and tallow supplied during the manufacture of the rope is sufficient, and that additional treatment is unnecessary. There is little doubt, however, that a moderate amount of external lubrication is beneficial in all cases, and if the ropes work near the ceiling of a hot room or if the atmosphere generally is hot and dry, more frequent applications of some rope composition will be found of advantage.

Life of Ropes.—The life of manilla and cotton ropes is of very variable amount, for, as will have been gathered from what has previously been said, almost everything depends upon the conditions under which the installation

is operated. Cases have been of only too frequent occurrence where, either from ignorance or wilful disregard of the rules dictated by good practice, the ropes have failed after running a few months. On the other hand, under the most favorable conditions, eight years may be taken as the life of a manilla rope. The life of cotton ropes is, on the best showing, greater than this, ten or twelve years being a usual estimate, although many cases have been known of ropes lasting for sixteen and eighteen years when large pulleys have been used, and the ropes only moderately loaded. These two factors, *i. e.*, the proportion of rope to pulley diameter, and the working stress, may be regarded as primarily determining the life of a rope, but as we have pointed out, many minor matters are not without influence.

Cost of Rope Driving Plant.—The initial cost of manilla driving rope may be taken at from 30 to 40 per cent. of the equivalent belting necessary to transmit the power. In first cost, cotton rope may be taken at double the cost of manilla, but as it is more durable, the difference is not ultimately very appreciable. There are other considerations to be taken into account, however, in comparing rope with belt driving. Assuming the life of the belts to be no greater than that of the rope, we have to take account of the greater cost of rope pulleys which, when containing a large number of grooves, will show a substantial increase. Labor will also cost more in the case of rope driving than with belting, for almost any unskilled hand can be entrusted to joint up a belt, while the services of an experienced splicer are required to splice a rope. Needless to say, the splicing of a set of ropes will occupy considerably more of the expensive man's time. Nevertheless, after making due allowance for these items, rope driving will be found to be the less costly system of power transmission, always providing that the conditions are reasonably favorable to its success, and that due attention is given to the several points which have been briefly touched upon in these notes.

In conclusion, we give in Table IX, a number of practical examples of rope transmissions, which are all giving good results. As will be seen, the power transmitted is in most instances somewhat less than that given by Table VI. The latter may, however, be taken as agreeing closely with the best *recent* practice in separate rope driving by cotton ropes.

TABLE IX. Practical Examples of Rope Driving.

(Separate Ropes of Cotton).

Amount of Power Transmitted. I.H.P.	Diameter of Rope.	Number of Ropes.	Speed of Rope in Feet per Minute.	Driving Force in lbs. = $\frac{\text{H.P.}}{\text{V}} \times 33{,}000$.
250	2 ins.	8	3,395	306
270	"	8	3,015	369
340	"	10	3,510	320
380	"	15	3,450	238
400	"	14	3,455	273
460	"	14	4,100	266
600	"	20	3,775	262
690	"	18	4,570	276
850	"	22	3,540	360
150	1¾ ins.	8	3,015	206
200	"	9	3,950	185
200	"	10	3,265	202
290	"	10	3,345	286
300	"	14	3,000	235
400	"	16	4,140	199
560	"	18	3,955	175
600	"	20	3,770	263
800	"	26	4,100	250
130	1⅝ ins.	3	5,654	252
250	"	9	3,770	245
340	"	12	4,000	234
395	"	15	4,095	255
600	"	20	3,960	250
650	"	17	4,705	266
750	"	24	4,200	245
100	1½ ins.	5	2,640	250
200	"	7	3,700	254
340	"	15	5,045	148
380	"	15	4,805	177
425	"	15	5,020	185
585	"	19	4,800	213
685	"	22	4,800	213
700	"	22	4,520	232
60	1¼ ins.	6	2,825	117
100	"	6	3,770	145
180	"	8	4,400	169
230	"	12	4,500	140
290	"	14	4,500	152
400	"	19	4,400	157

Ascertaining the Speed of Trolley Cars.

By James F. Hobart.

Since the introduction of street cars propelled by electricity, a good deal of time and thought has been expended in considering the speed of cars at any given time or place. In their efforts to provide rapid transit facilities for the public, friction occasionally occurs between the street railway company and the local authorities regarding the speed attained. It is very easy for a board of aldermen or selectmen to issue an edict that a certain speed per hour shall not be exceeded inside of certain limits, but it is quite another thing for the honorable boards mentioned to prove that a car ran faster than allowed, or for the street railway company to prove that the car was running within speed limits. Here occurs the friction referred to, especially in case of accident, when the matter has been carried into court.

There is a method whereby any car can have its exact speed readily determined, either by a passenger on the car, or by a person beside the tracks. Even at a distance of several feet and out of sight of the car, the determination can be made within a very few feet per minute. The method indicated, is by measuring the musical note, or "purr" emitted by the motor gearing. The noise made by an electric car, especially when starting up, or when climbing a grade, is well known, and has ceased to excite even notice from the passengers. But in this noise lies the possibility of accurate speed determination. The faster the car is moving, the higher the pitch of the tone, or musical note, produced by the motor gearing.

The manner in which the musical tone is produced is as follows: Whenever a number of vibrations of the atmosphere (or of metal or liquid as well) are made in regular and uniform order, such vibrations are received by the ear one after the other in succession as made, and if a sufficient interval intervenes between the waves of sound (which may be caused by blows of a hammer, puffs of steam, strokes of a bell or other means) each wave will be received by the ear as a separate and distinct sound. But if the sound waves come closer together, they are blended into a sustained musical note. A lantern whirled about the head of a trainman seems a circle of fire. The reason is that a certain characteristic of the eye, called "persistence of vision," causes the image of the lantern at each point in the circle to be retained by the eye about the one-sixtieth part of a second. Various optical devices have their foundation in this peculiarity of vision.

The same thing occurs with sound and the human ear. That organ cannot get rid of an impression caused by a sound wave under a certain length of time. The ear cannot drop instantly each sound wave received. It requires about one-thirtieth part of a second to get rid of one impression, and if another is received before that time has elapsed, the result will be a running together of the two sound waves (apparent, not real) and they seem to the listener to become a sustained musical (or otherwise) tone of even intensity as long as the sound impulses are continued regularly.

The lowest key on a seven octave piano is $\overline{\overline{\overline{C}}}$, and is formed by about thirty-three vibrations, on sound waves, being received by the ear per second. "Middle" C requires about 264 vibrations per second. Frequently a steam fire engine, when running very fast, is observed

to yield a very pronounced, though sonorous, musical tone. That is because the exhaust puffs come so fast that the ear cannot separate them. Assuming that thirty puffs per second is the limit of comprehension by the ear, the engine must be running at least $30 \times 60 \div 2 = 900$ revolutions per minute. (Divide by two, because there are two exhaust puffs per revolution.) If the engine is running faster, the pitch of the resulting note will be higher. A person with a good, quick ear and a musical education will have no difficulty in ascertaining the exact pitch of the tone formed by a fire engine's exhaust. If he determines said pitch to be $\overline{C}$ below the base cleff he knows that the engine is running at the rate of 1,980 revolutions per minute. He figures thus because he knows that $\overline{C}$ is formed by sixty-six vibrations per second, and $66 \times 60 \div 2 = 1{,}890$.

The tone produced by the street car motor is caused by the teeth of the gear striking those of the pinion, or *vice versa*. On the motor gear generally in use at the present time there are sixty-four teeth. It makes no difference how many teeth there are in the pinion. That gear may be large or small; no difference will be made in the speed calculations, because a cog of the pinion must meet with each and every cog in the gear, and after sixty-four cogs have struck sixty-four cogs in the gear the latter has made one revolution, no matter whether the pinion has revolved two, three or four times.

The problem now becomes more comprehensible. A street car motor is observed to be giving off a hum which the ear decides to be D, just above fundamental C (middle C on the piano). The ratio between the number of vibrations for an entire octave is represented by the following:

C,	D,	E,	F,	G,	A,	B,	C.
1,	$\frac{9}{8}$,	$\frac{5}{4}$,	$\frac{4}{3}$,	$\frac{3}{2}$,	$\frac{5}{3}$,	$\frac{15}{8}$,	2.

It has been stated that fundamental C required 264 vibrations, therefore D will have to have $\frac{9}{8} \times 264 = 297$ vibrations per second. The average motor car wheel is 30 ins. in diameter, therefore the car "running in D," will have a 30 in. wheel making $297 \div 64 \times 60 = 211.25$ revolutions per minute. This speed is equal to $211.25 \times 2.5 \times 3.14 \times 60 \div 5280 = 18.8$, nearly 19 miles per hour. "Thirty inch" car wheels vary in size from about 31 ins. when new to 29½ ins. when worn out. The maximum variations on error in the above calculations, will be about 0.9 and 0.3. Thus a new wheel would run 19.7 miles per hour, and a worn out wheel down to the 29½ in. limit could go but 18.5 miles, slip on curves being neglected in all these examples. This gives a possible error of but about one-half mile per hour for wheel variation with motor gears "running in D." Were the car running twice as fast, the error could be twice as much, bringing the speed approximation within one mile per hour for cars running at 12 miles per hour, and, as the variation could not be both ways (above and below a 30 in. wheel) on the same car, it may be safely stated that only one-half the error could be made by wheel size in any single car, bringing the error within 0.5 mile at a 12 mile per hour speed, or within 4 per cent.

A set of "constants" may be easily calculated from the foregoing. A motor car giving "D," has been found to run 18.8 miles per hour. The table given above says $D = \frac{9}{8} C$. Then C must equal $\frac{8}{9} D$, and a motor car giving C will be running 16.6 miles per hour = a difference of 2.2 miles per letter. Using all the fractions given in the little table, eight constants can be obtained as follows:

When motor "purr" is	C	=	8.30	miles	per	hour.
" " " "	D	=	9.40	"	"	"
" " " "	E	=	9.82	"	"	"
" " " "	F	=	11.08	"	"	"
" " " "	G	=	12.46	"	"	"
" " " "	A	=	13.84	"	"	"
" " " "	B	=	15.57	"	"	"
" " " "	C	=	16.61	"	"	"
" " " "	D	=	18.80	"	"	"

For the octaves above and below, these speeds may be doubled and halved respectively, giving velocities from 4.15 to 37.6 miles per hour.

In ascertaining the pitch of the motor note, the observer must not make the mistake of listening to the commutator sound. That is separate and distinct from the motor gear note, and may be readily distinguished therefrom after a very little study of the two sounds. The speed may be calculated from the sound of the brushes upon the commutator, but it must be remembered that there are ninety-five segments in some commutators, while the gear has only sixty-four teeth, therefore different calculations will be necessary. The brushes would have to be given too great a pressure to make their sound readily distinguishable, and the number of teeth in the pinion would also enter into the calculations when the speed is estimated by the commutator "purr."

The sound made by the motor gearing can be distinguished whenever the car passes over a high place in the track; then the gears have more work to do than usual, and emit a loud note, similar to that given out when the car is getting up to speed or is climbing a grade. But very little practice is necessary to enable a man, with an ordinarily "good ear," to catch the sound of the gears. To determine the pitch of that sound is a matter that requires a better ear for music than is possessed by more than one man out of 1,000, but a little device can be purchased at any music store which will enable any man who can whistle a tune to do the "sound speed act" to perfection.

The little instrument referred to is known as an "adjustable pitch pipe." It consists of an ordinary organ reed upon which a pair of bearings, directly opposite each other, are made to slide by moving a gradient on an index plate, upon which the letters of the scale are stamped. The letters F to F are usually found there, and by adjusting the gradient so that the pitch pipe tone is in unison with the gear sound, its pitch may be taken directly from the reading on the gradient. A little calculation will enable a gradient to be made which is graduated to miles per hour, instead of letters, thus giving the speed direct.

A Well Drawn Insurance "Rider."

The following form of street railway insurance "rider" has been adapted by the Binghamton Railroad Company, of Binghamton, N. Y., from an earlier and somewhat similar form drawn up by the Buffalo Railway Company, and represents an excellent method of arranging for specific insurance. This rider has proved entirely satisfactory to some of the best insurance companies in the business.

BINGHAMTON RAILROAD COMPANY.

OF BINGHAMTON, N. Y.

This company covers such a proportion of each of the items named below as the amount hereby insured by this policy bears to the total sum of all the items.

On the following described property situate in the City of Binghamton, N. Y.

ITEM ONE—$..... On buildings—the term "buildings" to include all additions, permanent attachments and extensions thereto, and iron stack and transfer pits, and on platforms and car tracks, whether constructed in whole or in part of brick, stone, wood or iron, but is not to include stone or brick foundations underground.

ITEM TWO—$..... On engines and boilers, condensers, pumps, machinery, excepting dynamos, tools, implements, traveling crane and connections thereto, machines, shafting, belting, hangers, gearing, pulleys, heating apparatus, piping and electric apparatus and switchboard and connections, and blacksmiths' and machinists' stock, tools, materials and supplies, plumbing, and on timber, wire, lumber, oils, fuel, hose and reels, glass, stock and materials of every kind and description, and on office furniture and fixtures, patterns, designs and drawings (not more than 10 per cent. of this item to apply in any one location on patterns), printed books and models, iron safes, and on books of record and account, not exceeding their value blank, and on all other articles and supplies not otherwise insured pertaining to the business of operating street cars with electricity and horses.

ITEM THREE—$..... On dynamos and their connections, in event of loss, no one to be valued at to exceed $.....

ITEM FOUR—$..... On cars, sweepers, snow plows, sleds, sand cars, levelers, carts, sleighs, wagons, motor cars, transfer tables, motors and vehicles of every description, including all duplicate parts, attachments and appurtenances, and all other horse, car, motor and vehicle equipments and furnishings, and on horses. And on scales, hay cutters, tools, poles, harness, and parts of same, blankets, implements, apparatus, utensils, hay, grain, meal, feed, straw, bedding, sand and salt, including bags and packages, including also conductors' punches, fare

registers and cash boxes, and other fare recording apparatus, and stock and materials, and supplies of every kind and description, their own or held by them belonging to others. It is understood that this item covers property described while undergoing repairs on premises of assured.

Loss, if any, on cars not to exceed $..... for any one box horse car, $..... for any one open car, $..... for any electric street car, $.... for any one horse, $..... for any one electric snow plow.

Permission is hereby given to introduce and use trolley wires, electric light plant and electric light in the described premises.

It is understood that in event of loss, this policy shall not be liable for an amount to exceed its proportion based on the following schedule which is made a part of this policy.

Location.	Description of Property.	Item 1.	Item 2.	Item 3.	Item 4.	Total.
State Street, North West Side.	Car House, (frame).....	$...	....	$...	$...	$...
State Street, West Side.....	Power House, (brick).....	$...	$...	$...	....	$...
Robinson Street, North Side..	Storage Car House, (frame).	$...	....	....	$...	$...
Broad Avenue, West Side.....	Car and Horse Barn and Shed, (frame).....	$...	....	....	$ ..	$...
Glenwood Avenue, East Side..	Horse and Car Barn, (frame)	$...	....	....	....	$...
Cemetery Street, North Side..	Horse and Car Barn, (frame)	$...	....	....	....	$...
Conklin Avenue, South Side...	Dwelling, (frame).....	$...	....	....	....	$...
Cove Alley, North West Side..	Horse Barn, (frame).....	$...	....	....	$...	$...
		$...	$...	$...	$...	$...

New York Standard, Percentage Co-Insurance Clause. (For Application to Specific Items of Policy.)

If at the time of fire the whole amount of insurance on the property covered by each of the several items of this policy shall be less than 80 per cent. of the actual cash value thereof, this company shall in case of loss or damage be liable for only such portion of such loss or damage as the amount insured under each of said items shall bear to the said 80 per cent. of the actual cash value of the property covered by each of said items.

This insurance excludes all loss or damage to electrical appliances on motor cars, dynamos, exciters, lamps, switches and motors, that may be caused by electrical currents, artifical or natural, and will be liable for only such loss or damage to them as may occur in consequence of fire originating outside of the electrical appliances themselves.

New York Standard, Lightning Clause.

This policy shall cover any direct loss or damage caused by lightning (meaning thereby the commonly accepted use of the term lightning, and in no case to include loss or damage by a cyclone, tornado, wind storm, or to electrical appliances on motor cars and other property as stated above), not exceeding the sum insured, nor the interest of the insured in the property, and subject in all other respects to the terms and conditions of this policy. *Provided*, however, if there shall be any other insurance on said property this company shall be liable only pro rata with such other insurance for any direct loss by lightning, whether such other insurance be against direct loss by lightning or not.

Permission is granted for the use of the above described premises for any purposes incidental to the business of the assured; to let portions of them for purposes not more hazardous; for any building to be vacant or unoccupied; to keep and use such articles, materials and apparatus as may be deemed necessary, or may be incidental to their business or that of their tenants; to work at any and all hours; to repair buildings or personal property, and it is understood and agreed that in case additions or extensions are made to any of the buildings herein described, the respective items of this policy shall also attach and cover on and in any such additions or extensions as may be made, and on materials and supplies therefor. It is understood that the items on contents cover also in each case the insured property adjacent to the buildings described while in yards and on streets. Other insurance permitted without notice until required.

The validity of this policy shall not be questioned, because of any mortgage that may now be in force, or that shall hereafter be effected, upon property above described, that is not endorsed hereon.

It is understood that no oil except for illuminating purposes will be stored in car houses, and that metal cans for oily waste shall be provided, same to be emptied outside of the premises.

Errors or omissions in the description of the property shall not prejudice this policy.

Loss, if any, payable to the ..... Trust Company, of New York, trustees for the mortgage bondholders as their interest may appear.

It is understood and agreed that the title to property located on ..... is vested in ..... as owner, and that the insurance on said building is to protect and cover his interest, loss, if any, payable as interests may appear.

This policy covers to the extent of $....., being ..... part of each and every item specified above.

Attached to and forming part of policy No. ....., of the ..... Insurance Company of .....

.....*Agents.*

The Chicago & Suburban Electric Elevated Railroad Company, the incorporators of which are J. M. Hannahs, Albert Wahl, Fred W. Wolf, Canute R. Matson, Benezette Williams and Michael J. Ryan, will ask the City Council for the right to construct a downtown loop to connect the elevated railroad.

The Corrosion of Iron Pipes by the Action of Electric Railway Currents.

An interesting paper bearing the above title was read recently by Prof. D. C. Jackson before the Western Society of Engineers. The foundation of the paper was an investigation carried out under his direction by Paul Biefield and Fred. D. Silber at the University of Wisconsin. After mentioning some of the troubles caused by electrolysis in different cities, Professor Jackson continued as follows:

When electric railways were first constructed the rails in connection with the surrounding earth were relied upon to carry all the current back to the generator. It was soon discovered that the current would not confine itself to this path and that the resistance of the earth was far from being as low as was originally supposed. Bonding the rails, cross bonding, supplementary wires and ground plates were then tried. The last were found to be of little avail, while the copper bonds and supplementary wires were often themselves electrolyzed, and bond wires up to the present time have frequently been far too small in cross section for the large current to be carried. The tendency which now obtains is to make the return circuit of fully as great conductivity as that of the overhead supply circuit, without relying upon any conductivity from the ground. This is being accomplished by effecting the rail bonds and running heavy track feeders, or electrically welding the rails. There is little doubt that with a perfect return system, which is properly connected to systems of underground pipes, electrolytic disturbances will practically disappear in nearly all cities.

Though the corrosive action of the return current has been so frequently noticed and commented upon, no one has really determined what actually occurs in the ground under the conditions brought about by the operation of electric railway systems. Two theories have been put forward relative to the corrosion: First, that it is simply due to chemical action caused by ammonia, saltpeter, leakage from gas mains, etc., found in the earth; second, that it is the result of electrolytic action. While simple chemical action undoubtedly has much to do with shortening the life of a pipe, it cannot on the face of it produce effects of the magnitude of these noted above. The ordinary life of water and gas pipes where chemical action alone is met is said to be about twenty years, while the corrosive action with which we are dealing has destroyed new pipes in intervals having from a few weeks' to half a dozen years' duration. In every case of the corrosion to which we refer, an electric current has passed along the pipe, and the corrosive action has taken place at the point where the current left the pipe. This is conclusive proof of electrolytic action. Secondary chemical reactions play an important part in the final decomposition of the pipe, and these are dependent upon the character of the salts in the soil, but the current sets the ball rolling. The electrolytic action of the current may occur by means of two processes—(1) direct electrolysis of iron and (2) electrolysis of chemical compounds which are held in the water of the soil, setting up secondary chemical reactions at the electrodes. In order to have electrolysis at all, it is necessary to have the equivalent of an electrolytic cell. In the case of a current leaving a pipe at any point, the pipe is the anode or positive plate of such a cell, the waste of the soil containing the chemical compounds in solution is the electrolyte, and the rail is the cathode or negative pole of the cell. All corroded iron pipes taken from the earth present practically the same appearance. They are generally "pitted" in many places, and although the pipe is covered with a layer of reddish oxide, the bulk of the corroded metal has generally been entirely carried away in some form or other, presumably by a secondary chemical change.

In order to have the first electrolytic action go on (that is, direct electrolysis of iron), a soluble iron salt must be present in the soil, reaching from anode to cathode. The analysis of street soils shows no such salts, and hence we are safe in concluding that this factor does not enter into the corrosion to any practical extent. The point has been made by several writers on the subject that the phenomenon may be due to the electrolysis of water, the nascent oxygen set free at the anode attacking the iron directly, and forming iron oxide. An examination of the facts of electrolytic action shows that this is not an effect of practical magnitude. This leaves us but one hypothesis to work upon—that is, the electrolysis of substances held in solution in the water of the soils, with a resulting secondary chemical action on the pipes.

In order to determine as exactly as possible what occurs in the soil due to the return current, a series of laboratory experiments were performed in which the practical conditions were reproduced as fully as possible.

Almost every chemical analysis of street soils shows the presence of some soluble salts of ammonia, potash, soda, and because of their common occurrence an experiment was performed to determine the effect of these salts on the electrolytic corrosion of iron plates per ampere hour. Six small electrolytic cells were run in series under an electric pressure of about 100 volts, with a current varying from .2 to .04 ampere. The cells contained clean glass sand moistened with water containing the salts.

Cell	1	contained	$NH\ NO_4\ NO_3$ (Nitrate of ammonia).
"	2	"	NH_4 CL (Chloride of ammonia).
"	3	"	KNO_3 (Nitrate of potash).
"	4	"	KCl (Chloride of potash).
"	5	"	$NaNO_3$ (Nitrate of soda).
"	6	"	NaCl (Chloride of soda).

After a run of fourteen and a quarter hours the number of ampere hours was .7465.

Loss of anode of NH_4NO_3 cell per amp. hr. was .921 gramme.
" " NH_4Cl " " " " " 1.314 grammes.
" " KNO_3 " " " " " 1.887 "
" " KCl " " " " " 1.346 "
" " $NaNO_3$ " " " " " .729 gramme.
" " NaCl " " " " " 1.299 grammes.

It had been shown by previous experiments upon cells containing these salts that iron was carried off from the positive plates, but was not deposited on the negative plates. The deposit of iron was made in the form of a layer of hydrate or hydroxide of iron near the middle of the cell. The same was true of experiments made with cells containing street soil where only a comparatively small percentage of carbonates was present. This explains the remark often made in reports of the corrosion of pipes that the products of the corrosion had disappeared. It was noticed during the experiments that all the cells containing a nitrate gave off a gas at the anode, and this, on being collected, was found to be oxygen. The same cells showed an acid reaction at the anode when tested with methylorange, and the reaction grew less in intensity as the current decreased. In cell No. 1 of the series already referred to, this acidity failed to show itself when the current fell to .6 ampere; in cell No. 3 at .045 ampere, and in cell No. 5 it was very faint at .04 ampere when the current was shut off. The acid reaction and the escape of oxygen in these cells seemed to be associated, and here it becomes necessary to refer to the losses of the anodes in the different cells. It will be seen that the chloride cells exhibit the greater losses, while the nitrate cells show the smaller. Moreover, the cell containing a nitrate in which the formation of acid and oxygen ceased first shows the greatest anode loss, and the one in which it continued to a slight degree to the end of the experiment shows the least. These facts point very strongly to the soundness of the theory of the corrosion which has been finally worked out; namely, in an electrolytic cell with iron electrodes and a soluble salt or salts of the metals of the alkalies or alkaline earths in solution in the electrolyte the salt is electrolyzed by the current, the acid radical attacks the anode, forming an iron salt, while the akaline metal forms with water a hydroxide at the cathode liberating hydrogen there. Finally, the meeting by diffusion of these two products precipitates ferrous hydroxide (FeOH). As the amount of electrolysis varies with the strength of the current, a comparatively high current will liberate the acid radical more rapidly than it can combine with the iron, the critical point depending upon the affinity of the acid for iron. When this excess is present, the radical forms an acid by combining with water and at the same time liberates oxygen. Neither the acid nor the oxygen can combine with the anode because that is already engaged in the formation of an iron salt with the acid radical, and hence the gas escapes into the air. If the acid is formed in sufficient quantity, it diffuses through the electrolyte, meets the alkaline hydroxide and forms the original salt and water. In the case of chlorides the nascent chlorine liberated at the anode, forms with it a chloride of iron, and if the current is strong enough to form an excess of chlorine it will be dissolved in the water and may, under the influence of light and heat, form an acid and liberate oxygen; or, if enough heat is generated, free chlorine will be given off, as is shown by experiment. All conditions of these laboratory experiments are practically parallel in the earth, and hence it is safe to say that similar chemical reactions must go on there. Although the composition of street soils is more complex than the electrolytes in these experiments, they contain the same soluble salts, and as these are diffused through the moist earth they must lend themselves to exactly similar electrolytic influences and chemical changes. In fact where street soils were used in the experiments as the electrolytes of cells which were placed in series with cells containing known quantities of simple and mixed soluble salts, the losses of the anodes were entirely comparable. It is consequently seen that only such measures as will stop the electrolytic action on salts in solution in the soil can be relied upon to stop the corrosion of iron pipes.

The soil frequently contains carbonate of calcium and magnesium, which are dissolved by virtue of the carbonic acid in the water. When carbonates are present in the water to a considerable degree a reddish layer of iron carbonate is found on the pipe. This is generally mistaken by observers for oxide of iron, but we have never found the latter present as a result of electrolytic corrosion. To find the effects of carbonates upon the corrosive powers of soils we ran four electric cells in series. The first two had for electrolytes glass sand moistened with ⅓ per cent. solution of chloride of soda in distilled water, and the other two had the same electrolyte with the addition of a solution of carbonate of magnesia and carbonate of lime of uncertain strength. The latter solution was obtained by passing carbonic acid for one and a half hours through water containing equal parts of these carbonates in suspension. The test current was kept at .09 ampere for seven hours, making .65 ampere hours.

The average loss of the anodes of the cells containing chloride of soda alone was .6565 gramme, while that of the carbonate cells was .601 gramme. This makes it evident that the presence of the carbonates does not aid in the corrosion of the anode, and even the slight cathode loss, due probably to ordinary oxidation, is less in these cells than in those containing the chloride only. The difference in the losses of the anode is easily explained. In some previous experiments the loss of anode caused by the electrolysis of nitrate, a chloride, and a mixture of the two was compared. The chloride caused the greatest loss of anode, the nitrate the least, and the mixture caused a loss between the two. In the same way in the case of the carbonate and the chloride, the chloride caused a certain loss of anode, and when mixed with carbonate the loss is somewhat less than when the electrolyte is a chloride alone. The fundamental effect of the carbonates is shown by a further description of the experiment. Soon after the current was turned on the chloride cells began to show the formation of the ferrous hydroxide layer between the electrodes which has been previously spoken of, while the other two cells showed a reddish layer formed at the anode, spreading toward the cathode as the action progressed. The reddish layer consisted of carbonate of iron, which was formed by the action of the carbonates upon the products of the electrolysis.

The results of many experiments and the condition of corroded water pipes as observed leads to the conclusion that under the conditions existing in street soils the corrosion will primarily go on by virtue of the acid radicals of the hydrochloric, nitric, sulphuric and other acids, the carbonates held in solution by virtue of the carbonic acid acting merely to change the ferrous salts to the normal iron carbonates and the ferric salts to the ferric hydroxide. Should the carbonates in solution be electrolyzed in addition to the salts of the alkaline metals, the carbonic acid radical would not attack the iron, as the corrosive power of the other acids is so much greater, but would again form with the ferrous salts and iron carbonates.

Owing to the doubt which exists as to what minimum voltage is required to induce electrolysis of water pipes by the railway current, a series of determinations was made by means of the electrolytic cells. The iron electrodes were inserted in clean glass sand 1.5 centimeters apart, and had about 20 square centimeters exposed area. In the first cell a 1 per cent. solution of nitrate of soda was used with a voltage of .2. As before, the hydroxide layer was formed. The electrolytic action was plain without any other tests. In the following cells the existence of action was shown by chemical tests for the iron salt and the alkaline hydroxide. In the second experiment, a ⅓ per cent. solution of nitrate of soda was used with 5 volts; the action was at once apparent.

Cell 3.	Pressure .25 volt.		Action in 3 min.
" 4.	" .125 "		" " 5 "
" 5.	" .125 "	1-6 per ct. sol.	" " 5 "
" 6.	" .05 "	" " " "	" " 40 "
" 7.	" .013 "	" " " "	" " 50 "
" 8.	" .005 "	" " " "	" " 1 hour.

In cell 8 the hydroxide layer began to be apparent after one hour.
Cell 9. Pressure .001 volt 1-6 per ct. sol. Action in 1 hour.
" 10. " .01 " Action in 4 hrs. 45 min.
Cell 10: The electrodes were 20 mm. apart and were 40 mm. by 68 mm. in exposed surface. The electrolyte was street soil.

A surprisingly low voltage produced an appreciable electrolysis in the sand cells. The pressure on cell No. 10 might undoubtedly have been reduced to a millivolt without stopping the corrosion, but the resistance of the soil was so high and the percentage of soluble salts so low that the time necessary to produce action would have been considerable. A milliammeter showed a barely perceptible reading in the case of the experiments in which very low pressure was used. The observations plainly show that a mere directive force is necessary to produce electrolysis, and the corrosion is simply a question of current.

It is impossible to give in a reasonable space even a summary of the great number of experiments which were made, but the following conclusions are directly drawn from them:

1. In no case is the action due to the electrolysis of water; where oxygen is liberated at the anode it does not attack the iron.

2. Only a mere directive force in the nature of a pressure will cause electrolysis.

3. The actual corrosion is therefore only dependent upon the actual current which flows, and is as much dependent upon the resistance of the soil as upon the pressure tending to cause the current.

4. Only a minute quantity of soluble salt is sufficient to start the action, and it will then continue as long as a current flows.

5. The gravity of a corrosion of a pipe depends on the amount of current flowing from a given area and the nature of the salts present in the soil the order of the activity of the salts being (1) chlorides, (2) nitrates, (3) sulphates.

The following table gives the average loss of iron from the anode per ampere hour, due to different salts and mixtures of salts. It must be remembered that the cathode or negative pole in no case showed a gain, but generally showed a slight effect due to simple oxidation.

Electrolyte.	Loss per ampere hour.
Street soil from a certain place	.8 gramme.
" " " Madison Electric Railway route	1.16 "
" " " " " " (clay).	1.14 "
" " " in front of Madison power station	.91 "

	1	gramme
Sand with Na_2SO_4	.66	"
" " KNO_3, ½ per cent. solution	1.03	"
" " NH_4Cl " " "	1.38	"
" " KNO_3 " " " mixed	1.084	"
" " KH_4Cl " " " mixed	1.084	"
" " NH_4NO_3	.921	"
" " NH_4Cl	1.314	"
" " KNO_3	.887	"
Sand with KCl	1.346	"
" " $NaNO_3$	.729	"
" " NaCl	1.299	"
Average loss of chloride cells	1.335	"
" " " nitrate cells	.892	"
" " " sulphate cells	.600	"

One ounce is equal to about 28⅓ grammes.

The averages emphasize the fact that the chlorides produce the greatest losses of metal, nitrates coming next, the sulphates last, the mixtures in an intermediate place. This seems to show that the power of the acid radical to corrode varies in general as the activity of the corresponding acids.

In I. H. Farnham's paper on "The Destructive Effects of Electrical Currents on Subterranean Metal Pipes," which appeared in the "Transactions of the American Institute of Electrical Engineers" in April, 1894, the statement was made that when the current was reversed every minute extending over a period of ten days, no material change took place in either during that time. Our experiments have shown that only the positive plate or anode is affected by the electrolytic action which occurs under practical conditions, and hence we should expect that when the current is frequently reversed both plates will be corroded, since they are alternately positive, unless the frequency of reversal is too rapid for chemical action to occur at all. In order to ascertain the effect of such reversals the following experiments were performed: An electrolytic cell was run containing a weak solution of nitrate of soda. The period of reversals ranged from fifteen seconds to five minutes, the current flowing being .04 ampere under a pressure of three volts. After a few of the quarter minute reversals, the presence of the iron salt was detected at both plates of potassium ferrocyanide tests. On prolonging the periods the iron reaction diminished at one plate and increased at the other during the same period, and *vice versa* in the following period. When the period of reversal reached two and a half minutes the electrolytic effect was very evident; the iron salt disappeared at one of the plates with each reversal, giving way to alkalinity. The experiments showed that the minimum period of reversal during which corrosion goes on must lie below fifteen seconds, which makes the prevention of corrosion by reversals entirely impracticable from this cause alone.

The problem of preventing the destructive electrolytic effects upon iron pipes of the railway return current is shown to consist simply of the prevention of electrolysis of the salts in the soil when the products of electrolysis are of such a nature as to attack iron. It is a problem that requires a careful study of the local conditions in each case before it can be satisfactorily solved. I am quite confident, however, after carefully studying many cases of corrosion and applying the conclusions of these experiments, that there are very few places where the difficulty cannot be avoided by proper construction and arrangement of return circuits. This can be ordinarily done at a comparatively small expense, and with a resulting advantage to the operation of the railway. Some of the conditions that exert the most marked influence upon the corrosion are the nature and amount of the soluble salts in the earth, the resistance of the earth itself in the locality, and the electrical pressure between rails and pipes. High pressure differences do not necessarily imply a high degree of action, as it is shown by the condition of the Madison water pipes. Here as much as seven volts is found between the rails and the pipes in front of the power station, and yet only a very small amount of corrosion is shown after one and a half years' time. Evidently the resistance of the path here must be very high or the quantity of soluble nitrates, chlorides or sulphates is extremely small. The fact that a special and ingenious instrument made to measure the amount of current showed but .0003 ampere flowing leads to the former conclusion. On the other hand, with the favorable conditions of a low resistance path between the pipes and rails, and a relatively large amount of soluble salts in the earth, there is no doubt that serious electrolytic effects may be produced where quite a small difference in pressure exists between the pipe and rails. The extent of the railway system does not always offer a guide to the destructive influences of the return current. Mr. Farnham, in his paper previously referred to, mentions a small road in Rockland, Me., where much damage was done to pipes in five months, while the system in Madison, which is probably fully as extended, shows up to date (a period of nearly two years) a barely appreciable action.

The use of alternating currents, which produce no appreciable electrolysis, would avoid all difficulty, but their use for driving street railway motors is not, up to the present time, an assured success.

The use of a double trolley system of conductors would also avoid the major portion of the difficulty, but I believe it can be equally well avoided by proper construction where the usual single trolley systems are used. This is not a question which has a real bearing upon the discussion of single *vs.* double trolley systems. If single trolley systems were really well built, less talk of double trolley systems would be heard. One great advantage of double trolley construction lies in the absolute certainty of its failure if the insulation of the lines is not excellent. Connecting the pipes and rails with heavy cables at points where the former are positive to the latter proves the most complete method of prevention. The conductivity of the track circuit must be properly reinforced by feeders so that an undue drop is not experienced in the return conductors. These track feeders should always be insulated and put on the lines exactly as are overhead feeders, in order to save them from corrosion. The connection of pipes and rails has been practically carried out in Milwaukee, Wis., at a cost of about $8,000, and has apparently done away with the trouble, and has at the same time decreased the resistance of the return circuit. In the Milwaukee system there is about 125 miles of track and over 200 cars in daily operation. The track circuit was originally put down in excellent shape. In the Madison system present indications show that one connection between rails and pipe systems opposite the power house, costing all told about $15, would prevent any serious action. Investigations have shown that when the negative pole of the generator is connected with the trolley, the pipes are positive to the rails over an extended outlying district, and corrosion goes on over a large area, while with the reversed arrangement the dangerous area is concentrated about the power station. The latter method of connection allows the difficulty to be most easily handled, and after the district within which the pipes are positive to the rails has been accurately determined by proper voltmeter tests, frequent connections of pipes and rails should be made within its limits. This can usually be done at a comparatively small cost, the interest on which may be annually saved by the decrease of lost power, if the connections are properly placed. The boundaries of this district should be rechecked from time to time, and the corresponding changes in connections should be made, if the tests show that they are necessary. The outlines of the "danger district" are likely to vary with the growth of the system, and even change slightly with the seasons, and the connecting wires may be eaten away; so that vigilance is here as everywhere the price of safety, but safety may be absolutely secured in most cases.

Proper tests with a satisfactoriiy arranged voltmeter, such as was used in testing the Madison road, seem to give sufficient indications of the density of the current which is leaving the pipes at any exposed point. Such tests, when reinforced by chemical examination of the soil, probably may be used with advantage in determining the extent of the corrosive action which is occurring at any point.

I have not touched upon any argument in regard to the really serious corrosion which has sometimes occurred from other causes than electric railway return circuits. This is a matter which is now generally understood, but is of less magnitude in most cases than the electric corrosion. The owners of pipes are often at fault from the fact that they have filled the soil with electrolyzable salts, but even in that case they may generally avoid danger by proper co-operation with the railway companies.

Location of Overhead Equipments, and Rights at Crossings.

By R. D. Fisher.

The new and various uses of electric wires have led to controversies concerning the rights of location of overhead equipments. The first to obtain possession of streets naturally resented the intrusion of newcomers, and for good reasons, because it has been proven that the more powerful currents used in electric railway service causes serious disturbances with the telephone currents. The highest authority at our command holds that the primary purpose of a street is for public travel; that all franchises to use the streets for any purpose are subject to the rights of the public to use the streets for the purpose of travel; and, in doing so it follows that they have the right to avail themselves of the newest and most improved modes of transportation, and if the operation of a street railway by electricity disturbs the workings of other plants, the latter are required to so readjust their methods to meet the new conditions and afford self protection. See, *Cincinnati Inclined Ry. Co.* v. *Telephone Co.*, Reported in 26 Weekly Bull. 8; 44 Alb. L. J. 86; Ry. Corp. Law Journal 82 and 27 N. E. Rep. 890.

On the theory that every company using electricity in and above the public streets must exercise inventive ingenuity to protect itself from the effects of the use of the same force by reason of close contact or crossing of the wires, no one company or mode of public service having a monopoly of the earth or the air in the streets, it can only be insisted that each use the best appliances practically available to avoid injury to each other or to the traveling public.

In the matter of adjustment of wires to fit the new order of things, we have been enabled to find only implied authority. A grant to set up poles and wires in a street is generally made expressly subject to the condition that they shall be so located as not to interfere with local travel, and shall not be dangerous by reason of sagging wires, or unguarded currents of electricity. *Hudson Telephone Co.* v. *Jersey City*, 49 N. J. L. J. 303. Hence, it would appear that if traveling by means of an electric system is a general and ordinary mode of travel or use of the streets, any interference with it by reason of improperly constructed telephone or other wires would be regarded as an unauthorized obstruction and treated as a nuisance, unless such construction and location have been specifically authorized; and in such case general authority to construct telephone or other lines, is not sufficient to legalize such construction or location, if proven to be dangerous and to interfere with the new and common mode of travel. (See Keasby on Electricity, Chap. 5.)

The permission to set up telegraph and electric light wires is generally made expressly subject to the condition that they shall not interfere with the free use of the highway for public transportation, and even without express words such a condition would be implied, as it is always understood that statutory powers of this kind are subject to the condition that they shall be adjusted to the requirements of the times. This requirement carries with it the expense of such readjustment. (See Mersey Docks Trustees v. Gibbs, L. R., 1 H. L. 93; Gaslight, etc. Co. v. Vestry, etc. 15 Q. B. D. 1 (1884) Biscoe v. Great Eastern Ry. Co. L. R., 16 Eq. 636 and Lawrence v. Ry. Co., 16 Q. B. 643.)

There is a long line of decisions holding that wires must be suspended sufficiently high to avoid interference with ordinary transportation. The rule, however, will not apply to a load thirty or forty feet high, neither would it require wires to be strung so high as not to interfere with house moving. *Penna. Tel. Co* v. *Varnan*, 15 Alt. Rep. 624; *Tel. Co.* v. *Wilt*, 11 Am. L. J. 374 and *Scott* v. *Jarnagan* on Tel. See 53 and Note.

Many states have statutes declaring that the use of public streets in cities and towns shall be subject to such regulations and restrictions as may be imposed by the corporate authorities of said municipalities. In such cases it is reasonable to suppose that electric companies are required to elevate their wires so as not to interfere with the construction or maintenance of a system of transportation operated by the trolley which has been chartered by such corporate authority.

Applying the general rule of law concerning railway crossings to that of electric railways, it would appear that the cost of construction and insulation and the maintenance thereof would fall equally upon the companies. The right to cross and maintain a crossing is undoubted, but no contest, as yet, to our knowledge, has been made to determine the relative cost in providing such preventive appliances as are necessary to avoid current interferences and the safe and speedy operation of the trolley at such crossings.

The Question of Fire Insurance Rates.

The New York *Journal of Commerce* recently published an article on the subject of insurance rates and automatic sprinklers, which, while not referring directly to electric railway and lighting stations, is so pertinent to the general subject of electric railway insurance, that we publish it entire.

"It is becoming more and more apparent that the stock fire insurance companies of the United States must greatly improve their method of fixing rates upon risks which are thoroughly equipped with approved systems of automatic sprinklers. While they are better able to decide as to the merits of a sprinkler equipment than are the majority of the mutual companies and Lloyds, it takes them so long to settle the rate question that their knowledge is of little value.

"There are dozens of insurance concerns, independent of any rate combinations or tariff associations, which are eager and even anxious to make great reductions in rates when risks are equipped with automatic sprinklers, and, furthermore, they are always on the alert to solicit the patronage of property owners as soon as a sprinkler contract is given out. Their rates are quickly named and are low, and while many of the cut-rate institutions are weak and unreliable, enough good loss-paying concerns of this kind may be found to cover any establishment of moderate size.

"While the regular stock companies make reductions for the sprinklers, they are frequently only about half as liberal as those obtainable in the open market, and it is often the case that the non-tariff policies have been bought and paid for weeks before the tariff organization's red tape routine has been completed. Undoubtedly many of the non-boarders are making unprofitably low rates on sprinkled hazards, but nevertheless, few underwriters will urge that the present tariff allowances for equipments are liberal enough. They are being made more liberal each year, but are always behind the market. This means that eventually about all of the sprinkler risks will be in the hands of the non-boarders, and it is likely that two-thirds of the sprinkled risks of the United States are already there.

"Possibly it will mean a repetition of the experience with the New England mills, which, through the short sighted policy of stock underwriters, were permitted to go to the mutuals, and in fact were practically driven to do so. The stock companies are now making an expensive effort to regain these New England hazards at about half the rates which would have retained them. In insurance as well as in many other lines of business it is easier to retain than to regain. Perhaps some force is affecting fire insurance akin to the law of gravitation. The present conditions must seem very absurd to large insurers with well equipped hazards, and it may safely be predicted that sooner or later the stock underwriters will awake to the necessity of a more business-like handling of the sprinkled risk problem."

A very good description of the workings of the system of mutual insurance, referred to above, was given in an address on the subject by Edward Atkinson, president of the Boston Manufacturers, Mutual Fire Insurance Company, delivered in Minneapolis several years ago. In this address Mr. Atkinson said:

"Applying the law of chances to our factory combination, we find that after establishing all the safeguards which can be reasonably adopted with a due regard to true economy in construction and use, the average chance of damage to each risk of 25 per cent. is once in about 100 to 125 years, or annually in one out of 100 or 125 factories. The average chance of a total loss once in about 400 to 500 years on one factory, or one in a year out of 400 to 500. This is the maximum chance, and since these figures were compiled we have greatly reduced the chances. These figures cover our whole experience from the beginning. Our conclusion is that when a sufficient number of risks are combined to make the sum of the premiums of one year equal to one maximum risk taken, it is safe to begin business; but most of us have an annual income equal to two or three maximum risks. It is possible to have two maximum losses, or several lesser but important losses in the same year, but they very seldom happen in this order.

"If you contribute your present high rates of premium, you would be very safe to begin in the same way, because twenty members at 5 per cent. or twenty five at 4 per cent. on even risks would suffice. I should, however, advise a greater number.

"If I am correct in my judgment that a flour mill can be made as safe as a cotton mill, then see where you are. We should not hesitate to begin on:

40	mills	$30,000	each	$1,200,000	1 per cent.	$12,000
40	"	40,000	"	1,600,000	1 "	16,000
60	"	60,000	"	3,600,000	1 "	36,000
40	"	80,000	"	3,200,000	1 "	32,000
20	"	100,000	"	2,000,000	1 "	20,000
200				$11,600,000		$116,000

"Here would be 200 chances of loss on a premium equal to one maximum risk, plus taxes, expenses and a margin over, while the average chance of a total loss is only one in four to five hundred at the maximum.

"Now suppose you put in

5	flour mills	$250,000	each	$1,250,000	at 5 per cent.	$62,500
20	"	100,000	"	2,000,000	5 "	100,000
30	"	50,000	"	1,500,000	5 "	75,000
100	"	10,000	"	1,000,000	5 "	100,000
45	elevators	20,000	"	900,000	2½ "	22,500
200				$6,650,000		$360,000

"If 5 per cent. is too much, lower to 4 per cent. and increase the number. But bear in mind the rate charged should be high to give the stability of a cash fund. It is the dividend or return of unconsumed premium which is the matter of greatest import. Don't haggle about rates in a mutual company provided they are equitably adjusted. Here you have also 200 chances of fire on $360,000 deposit, and only five maximums of $250,000 each. If I am correct in my judgment of the risks, *after* the construction is made good, *after* the pumps and pipes established, and *after* the automatics are everywhere, you would not average a loss and expense account exceeding $60,000 a year, and you would then save $300,000. On $6,650,000 insured on cotton and woolen mills our average chance of loss would be less than $20,000 a year. So much for the general principles and methods. You should have excellent and skillful officers who are familiar with the quality of your risks and the standing of your members. The latter is essential to success. The whole system depends upon mutual good faith and confidence in each other. The integrity of the member is as essential an element as the quality of the risk. We have had, in our company, but a single suspicion of a fire being set by the owner, and after ten years that suspicion was removed by the confession of the real incendiary."

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

ST. JOSEPH, MICH., AUGUST 15, 1894.

EDITORS STREET RAILWAY JOURNAL:

Sunday, August 12, the Associated Press sent out a lot of dispatches in regard to a riot caused by an attempt to tear up the street railway tracks Sunday morning at about four o'clock, in Benton Harbor, Mich., and stated that I had shot an alderman while in discharge of his duty. The facts of the case are these:

The Street Railway Company constructed in November, 1892, two squares of tracks on Main and Sixth Streets running to Territorial Street, under the terms and provisions of an ordinance passed, accepted and approved August 17, 1892, the same continuing on Territorial Street and other streets to the east city limits. On June 7, 1893, the City Council agreed with the Railway Company to repeal that portion of the ordinance on Territorial Street, and change the same to Main Street, with the understanding that the property owners were to pay the railway company $1 per foot to develop their property on Main Street. Last June the financial depression caused them trouble and they could not raise the money. In May, 1894, the ordinance expired by limitation, this company claiming no further rights under it. On August 6, 1894, the property owners and this company came to an agreement. That night the Council passed a resolution repealing the ordinance of June 7, and requesting the company to remove the tracks at once.

I met the Council Committee on Thursday, August 9, and agreed to change the grade of 2,000 ft. of track, move all poles to the curb line, free of expense to the city. I also agreed to see that my track was planked with good three inch plank. The original grade was established by the city engineer, and tracks were laid according to his stakes. The two farmers on the committee said I should pave with cedar blocks. I declined to do it, as the planking was considerably better than the cedar blocks with sap, being the kind they are using for paving. Without authority of law or even a resolution from the City Council, two aldermen of the State Committee, with one of the paving contractors, three policemen, four wagons and a gang of thirty laborers, at the unseasonable hour of four o'clock, and on Sunday morning, proceeded to destroy my company's tracks. I appealed to the deputy sheriff after twelve o'clock Saturday night, and at his request and knowledge furnished him a posse of five men and myself, four guns. I ran a car to the scene of action and the rioters and track destroyers upon its approach began to throw blocks and planks on the track and proceed with picks to dig up the track. During the riotous proceedings and while the sheriff was trying to make them desist, my gun was accidentally discharged from the front platform of the car, the contents striking the gate of the car and going into the ground, with the exception of two No. 2 shot striking one of the aldermen, who was some distance away. One shot lodged in the thumb, just under the skin, and the other one lodged in the front part of the leg just above the knee. I assured them at the time that it was an accidental discharge of the gun. Not until the accidental discharge of the gun was heard did the sheriff have possession of the field. They gave me no time to appeal to the courts for relief, and I knew nothing of it until late Saturday night.

At the time of the trouble and arrest I was in full possession of the property, and after giving bonds and turning the property over to the sheriff for protection, I returned to my office in St. Joseph. After all of us had left the property, and the sheriff had taken charge of it for protection, he allowed the riotous work to begin again, and they succeeded in destroying the track, to the utter disgust of a large number of taxpayers and citizens who so badly needed the road to Morton's Hill. A petition had been circulated among the property owners and citizens of the East Side, known as Morton's Hill, and subscriptions had been taken for the further extension of this track. I declined to give my version of the affair to the Associated Press, through the advice of the railway company's attorney. Doubtless this was a mistake, which time will prove, but with the Street Railway Press and people I desire to keep the good name I have had among them for the past twelve or fifteen years.

W. WORTH BEAN.

Established 1884.

THE STREET RAILWAY JOURNAL

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H. W. Pool, Advertising Department. H. W. Blake, Associate Editor.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to
Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

The New York State Street Railway Association, as announced elsewhere, will hold its twelfth annual meeting at Syracuse on the 18th of this month. The papers to be read are upon subjects very pertinent to the operation of street railway properties, and new methods having a practical bearing upon railway economy will undoubtedly be described. The New York State Association has had a most successful history, and has been of great benefit to the industry in this state. According to the present indications there will be a very large number of attendants at Syracuse, and a pleasant time may be expected by all.

Three Other State Associations, those of Ohio, Pennsylvania and Michigan, hold their annual conventions during September, and a number of similar meetings have been held in other states during the past summer. The number of state associations is constantly on the increase, and as the advantages secured by them become better appreciated, we believe that similar bodies will be organized in other states. The regular meetings are looked forward to with pleasure by the delegates and others who attend, as presenting opportunities for improvement as well as social enjoyment. In no better way can managers in different cities become acquainted with each other and compare details of practice as at these times. Even from a pecuniary standpoint, the information gained upon economic devices and practice at conventions will usually more than repay many times over the time and expense of attending. No one in any extensive business is so well posted in all its details, as to be unable to learn some points of others, and this is particularly so in a new industry like that of operating street railways. But state associations have other functions than those of a purely instructive or social nature. They can help to unite the street railway owners of a state against vicious legislative oppression or other blackmailing, can provide a body through which concerted action can be taken to procure cheaper insurance, more liberal treatment from municipal authorities, or in a thousand other ways be of benefit to its members. For these reasons a more general membership of street railway companies in their state associations is desirable. For these reasons, too, an effort should be made by each member company to be represented, because while all these results are not accomplished at any one meeting, the advice and suggestions of all are invited; besides, a member who misses any number of meetings of a body of this kind is apt to lose interest in its aims and results—something which would not occur were he to keep acquainted and in touch with the body by regular attendance.

The Use of Accumulators, in direct current incandescent lighting stations to average the load on the generators and engines, is quite common in Europe, and is growing in favor in this country. Under certain conditions, *i. e.*, where the maximun load is required for only a few hours out of the twenty-four and the average output is considerably below the capacity of the plant, the addition of batteries has been found economical, both from an operating standpoint and as a method of increasing the station's capacity. The subject of the use of storage batteries in stations was ably discussed at the Milwaukee Convention in its application to railway needs, but the system has not been put into practice in this country, nor had it been applied to electric railway service abroad, so far as we know, until its adoption recently by the Zurich electric railway. A description of this road, which is published on another page, gives full particulars of the details of arrangement. The accumulator system is especially desirable for small roads on account of the violent variations of current, and as the Zurich railway operates an average of only nine cars, the value of the system for a road of this size will be thoroughly tested, The method of regulation adopted, however, that of switching cells in and out, is not as simple as that involving the use of a "booster," in the manner explained by Mr. C. O. Mailloux at the last Convention. Not only is there less complicaton in the booster regulation, but the number of battery cells required is smaller and they are always charged and discharged equally—an important point.

The Destruction of Water Pipes by the return circuit through electrolytic action, is now, perhaps, the chief argument made against the introduction of electric railways in cities where trolley lines have not yet been admitted. General knowledge of the existence of this popularly supposed universal accompaniment of electric railway service is of comparatively recent date, and the average opponent of electric railways is not fully posted in regard to its exact methods of destruction or the causes for its existence. It is enough for him, however, that it is an ever present foe whose deleterious action is hidden from view, and hence of any imaginable magnitude. Electrolysis has, therefore, assumed in these later times the place formerly occupied in the minds of trolley road obstructionists by telephone interference, and the danger of the 500 volt circuit to habitants of the street. Unfortunately, this fear has been greatly strengthened in the minds of many citizens through exaggerated reports of city engineers on troubles experienced with the water pipe

systems in some places, and has finally grown into conviction, by undoubted evidences of corrosion in cities using old fashioned and badly constructed railway systems. But as the early faults of electric roads have been corrected, or so far minimized as to present no practical disadvantages, so it is certain that the danger of electrolysis can be entirely eliminated by the adoption of scientific precautions and care in the construction of the return circuit. According to the well known law of electric currents, electricity will flow between two points of different potential by as many paths as may be presented, the amount of current in each depending upon the conductivity of the circuit. The first and most important rule, therefore, for preventing any electricity returning by the water pipe system of a city, is to make the rail return of as good conductivity as possible. This can be done by bonding the rails so that the resistance at the joints shall be no greater than at any other points of the line. It is well, too, to waterproof all places where there is a contact between copper and iron to prevent local action, and to provide alternate paths by cross bonding with, perhaps, supplementaries in case there should be a breakage in the bonds at any joint. Overhead return feeders to supplement the rail return should also be used from points having a considerably higher potential than the bus bar at the station, as indicated by the voltmeter. It is, of course, not enough that the return circuit should have as high a conductivity as the outgoing circuit, as any action on the water pipes depends entirely upon the difference of potential between points of the return circuit. All pipes in the neighborhood of the station, which show a positive potential as compared with the generator ground plate, should also be electrically connected with it. To assist in making potential measurements between the track or pipes at any points on the system and the bus bar at the station to which all such measurements should be referred, we believe it would prove very convenient to run a system of small copper or galvanized iron testing wires reaching to every part of the line. They could be carried on the feeder poles, and should be provided at frequent intervals with junction boxes at which connections could be made. The cost of such an overhead system would be slight, and the wires could, if deemed desirable, be used also for a telephone dispatching service or emergency patrol system in connection with the operation of the road. Prof. Jackson points out in a paper printed in another column that danger can be avoided by the construction of a good ground return. And as the slight additional cost of a good return over a poor return circuit would undoubtedly be made up to the railway company many times over during a few years of operation, through the saving of power alone, independent of other considerations, the most evident economic rules would dictate such construction

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Do You Know that the Thirteenth Annual Convention of the Street Railway Association is to be held in Atlanta, Ga., on October 17, 18 and 19 proximo?

Do you know that your presence will add to the success of the Convention; that there is an enthusiasm born of numbers that can be created in no other way?

Do you know that you will be greatly benefited from participating in the proceedings, and from the opportunity that you will have to confer personally with others engaged in the same occupation as yourself?

Do you know that a little vacation will do you good, and that you will return to your duties better equipped mentally and physically for your work?

Do you know, if you are a Northern man, that you owe it to yourself to pay a visit to the South in order to correct your preconceived notions of the character of its people, its climate, and its natural resources?

Do you know, if you are a Southern man, that a duty devolves upon you to meet and welcome your Northern visitors and assist them in studying the resources and natural advantages of the South, and informing them of the grand possibilities that await investment in Southern enterprises; and do you know that you can learn from them many things that will help you to more successfully manage your street railway properties?

Do you know, if your home is on the Pacific Coast, that it is time you became identified with the affairs of the American Street Railway Association, and through it to let the fraternity know of the splendid service which is maintained in some of your cities, and what discoveries you have made in the way of improved appliances and methods of operation?

Do you know, if you are a manufacturer of street railway supplies, that the South is entering upon a period of the broadest and most rapid development of any in its history, with improved credit, and that its cities, especially the coast cities, are bound to grow, with a corresponding increase of street railway mileage, so that at present, here is the most promising field for street railway development in the near future of any section of the country, and that now is the time for you to bid for this anticipated trade?

Do you know that a trip through the South during the month of October will be a most delightful one, as the climate at this season of the year is superb? You will see the cotton pickers at work, and in the rice and sugar regions the process of harvesting these crops, and be interested in the great stretches of yellow pine forests, and in studying the turpentine industry, together with "the grasshopper and sweet potato vine." You will be surprised at the numerous lumber mills along the railway lines, the little hamlets with their weather beaten homes and the numerous negro cabins, and interspersed everywhere between the fertile regions, the characteristic red and crumbling banks of the ridges and gullies, the result of the heavy rainfali to which most of the Southern region is subject.

Do you know that your reception and entertainment will be more cordial and on a grander scale than at any previous meeting of the Association? You will have a chance to test the proverbial hospitality of the cheery Southern people and listen to the eloquence of their famous orators.

Do you know that this trip will afford a rare opportunity for the men who fought on either side during the the late unpleasantness to visit old battlefields and historical points which are more numerous in the vicinity of Atlanta, and more easily reached than those of almost any other section of the country?

Do you know that a special train will be run from New York and probably from other central cities to Atlanta, which will give an opportunity for friends to make the trip together, and an opportunity to make acquaintance that will add greatly to the pleasure of the trip?

A Street Railway Mutual Insurance Company—would such an organization be possible, profitable and a permanent benefit to the industry? Sixty years ago Zachariah Allen filled his cotton mill with the best fire extinguishing apparatus then known, and asked an abatement of the insurance rates charged. "No," was the reply, "a cotton mill is a cotton mill; the rate is 2½ per cent." "Then," said Mr. Allen, "cotton and woollen mills will insure themselves." He at once organized the Manufacturers' Mutual Fire Insurance Company, of Providence, on which nearly all the present "factory mutuals" are modeled. The rates of premium on the Allendale mills are to-day less than $0.40 per $100 *net*, and the stock insurance companies are doing their utmost by extreme concessions in rates to win back the enormous and highly "preferred" business which has been lost to them by the enlightened competition of these "mutual" companies.

* * * * *

The street railway managers of to-day are in a position to sympathize with the cotton mill owners of 1835. The stock insurance companies, frightened at the increasing number of destructive fires, attributed, though often quite unreasonably, to electricity, are refusing to sufficiently discriminate between the best and most highly protected street railway risks and the poorer ones, and many companies are, indeed, disposed to withdraw wholly or in part from this field. Now it is emphatically wrong to say in effect that "a street railway risk is a street railway risk." As Mr. Higgins has pointed out elsewhere in this issue, there have been grave engineering mistakes made in the highly stimulated street railway construction of the past few years, and these mistakes have not only cost money, but have unreasonably prejudiced the whole industry in the minds of the underwriters. We firmly maintain that most existing power station and car house risks may easily be placed in the "preferred" class by the adoption of methods and apparatus for the extinguishment of fires which have proven so successful in other industries. Street railway companies, in their own interest—since the destruction of a power station or an equipment of cars means a far greater loss of income and profits than can be measured by the insurance settlement—should be the first to seek the ways and means of reducing the real fire hazard to a minimum.

* * * * *

But suppose the stock insurance companies refuse to recognize the possibility of sufficiently protecting power stations and car houses, and insist upon high rates, merely because "electricity is dangerous" or "there have been *x* street railway fires during the past year?" Would it then be wise for the street railway companies which have thoroughly protected their plants, to organize themselves into a mutual company for self insurance? Five years ago, the answer would have been a negative. The investigations of Messrs. Wyman and Woodworth, in behalf of the American Street Railway Association, disclosed a decided indifference upon the subject among street railway managers. It was felt that the real danger of fire among the horse barns and car houses of that period was sufficient to justify the insurance rates then charged, and that there was doubt as to the ability of the industry to support a mutual company. The situation has changed, however, since that time. The general condition of our street railway plants has greatly improved with, and in spite of, the introduction of electricity, and gross insurable values have enormously increased; while both the actual and the proportionate cost of insurance has become so great as to call for serious discussion of remedies. It seems probable that the field is now sufficiently large to support a conservatively managed mutual company, underwriting only such selected risks as can be brought up at once to a high standard of excellence in the matter of fire protection. Such a company, with a substantial guarantee fund and with rigid rules governing the admission of new members, would inspire confidence and would rapidly gain ground. It would probably largely reduce the present average cost of insurance in competition with the stock companies, burdened as they are with heavy expenses, the amount of the reduction depending, of course, on the volume of business to be secured. The fear of assessments urged against mutual companies has little force. The gross rates charged ought to be high enough to mark the practical limit of responsibility assumed by each member—the dividends returned being greater or less according to losses and to business management. The liability to assessment, therefore, would become in effect a dead letter, although it should always, of course, be an integral part of such an insurance organization, because of its moral effect in giving stability to the company's promises. On this matter of assessments, Edward Atkinson says of his own company, "One or two assessments were made in the early history of the business over forty years ago—none since. We have twice returned the whole premium; the interest and profits on a change of investments in certain years covering small losses and all expenses."

* * * * *

Finally, the whole problem—if it is found on further examination that the field is now sufficiently large to support a mutual company—is one of management. Commencing with the association for self insurance of a few strong and well protected companies who would select officers widely and favorably known in the street railway and insurance field, we believe that other companies would cheerfully adopt such apparatus and comply with such regulations as would make them "preferred risks," and would seek admission as members. It is true that there are unsuccessful and discredited mutual companies in the field. In most cases, however, it is found that in the necessity which is upon them of meeting expenses and losses within too narrow a field they have invaded other industries and have accepted poor risks—some even which may have previously been utterly rejected by the stock companies at any rates. The whole question of meeting this insurance problem in the best possible manner should be freely discussed at Atlanta, both in convention and in those exceedingly valuable and private "experience meetings" which form so important a feature of our annual gatherings.

The Terre Haute Street Railway Company netted large receipts during the great harness race meeting held in that city last month. A total of $91,000 was offered by the Terre Haute Fair Association for a single week of trotting and pacing, and as the weather was excellent the electric railway company was largely benefited by the meeting. Each evening when the races were finished both President Harrison and Superintendent Burke were at the entrance gate to facilitate matters, and notwithstanding the large number of cars put on the race track line, the same schedule was maintained on all branches. One night one car on this line drew five trailers all of which were loaded, the estimated number on the train being 700.

The Street Railway System of Montreal, Can.

Montreal, the largest city of our extensive Northern neighbor, Canada, is an ideal city from a street railway standpoint. It is at the head of navigation on the St. Lawrence River, and with its substantial stone quays and warehouses extends along the river front for six or seven miles. A mile and a half from the river rises Mount Royal which has been transformed by the inhabitants of the city into a magnificent park. This acclivity helps to confine the business and manufacturing districts of the city to the side of the river, making the local transportation system an important factor in the city's activity.

The Montreal Street Railway Company, which operates all of the lines of the city, with the exception of a short eight mile line belonging to the Montreal Park & Island Railroad Company, was chartered in 1861, and up to a recent date operated all of its cars by horse power. The road has now, however, an excellently well arranged electric system, and the cars are carrying large numbers of passengers.

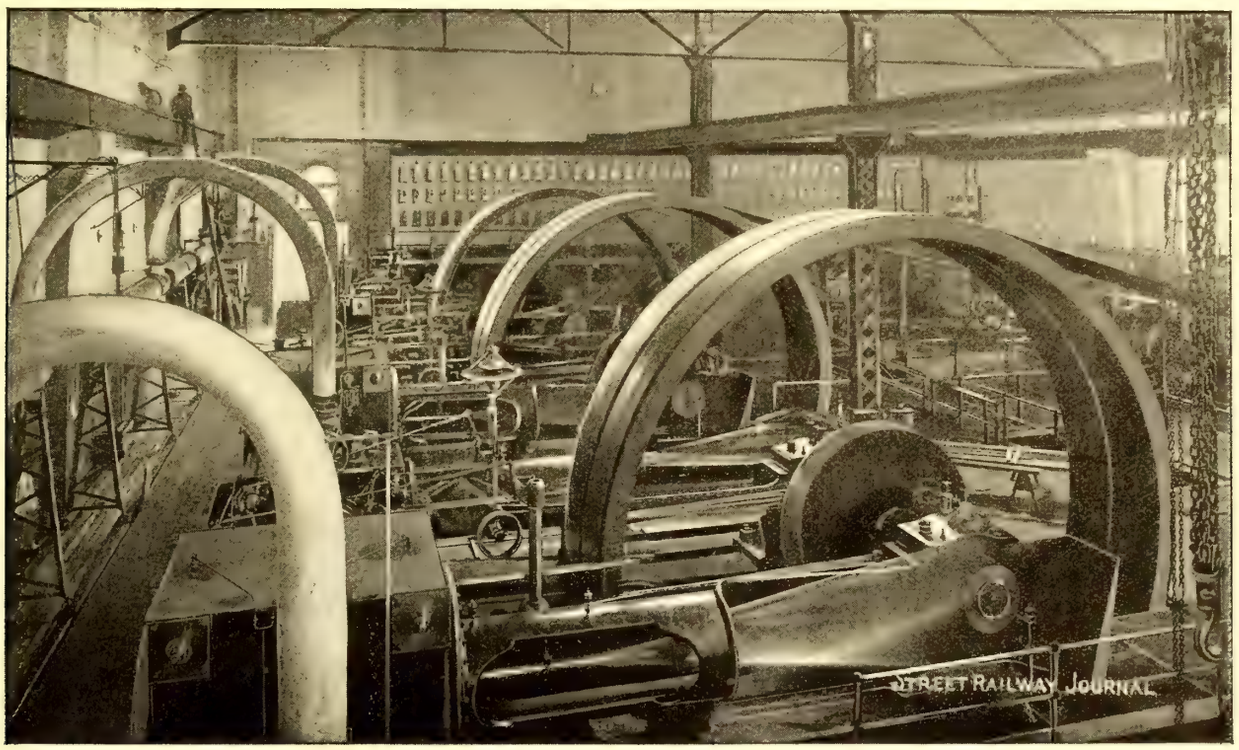


FIG. 1.—INTERIOR OF WILLIAM STREET POWER STATION—MONTREAL STREET RAILWAY CO.

The power station of the company is shown in Fig. 2. It is of brick and Montreal bluestone, and is located at the corner of McCord and William Streets, with a frontage on William Street of about 350 ft. The engine room, which is 200 × 80 ft., contains cross compound Corliss engines of 600 rated H. P. each, built by John Laurie & Brother, engineers, of Montreal. The cylinders are twenty-four and forty-eight inches in diameter and four feet stroke, and the rated speed about sixty-eight revolutions per minute, which gives a periphery speed on the twenty-two foot flywheel of nearly 5,000 ft. per minute To each of the first three engines are attached four General Electric 200 K. W., bipolar generators, built at the Canadian works of that company at Peterborough. Each of the remaining three engines will drive two General Electric multipolar generators of 300 K. W. each, by one pulley and friction clutches. The belts used are three ply, twelve being twenty-four inches wide and three fifty-four inches wide. Two cranes of ten tons capacity each operate in the engine room. Peerless engine oil, manufactured by Samuel Roger & Company, is used for lubrication.

The switchboard extends entirely across one end of the room, as shown in Fig. 1. It is built of hollow bricks made of terra cotta lumber and cemented over with adamantine plaster, which insures thorough insulation. The switchboard appliances are of the Westinghouse type.

The exhaust steam from each engine is taken care of by an independent condenser of the Worthington type, 12 ins. and 15 ins. × 10 ins. The circulating water is taken from the canal through a main twenty inches in diameter, running through the boiler and engine room, having connection for each pump. The hot water is returned to the outgoing main and from there to the canal; part of this water is taken off for boiler feed.

The boiler room, which is 100 × 125 ft., contains twelve boilers of the double flued Lancashire type, built by Daniel Adamson, of Manchester, England. The flues are solid welded and jointed together with Adamson's patent flanged joint. The boilers are rated at 250 H. P. each, on the thirty pounds of water per hour basis. They are fitted with a dead load safety valve, which is the one nearest the front. Then comes the steam nozzle, which is six inches diameter. Next in turn is the low water and safety valve combined, and then the manhole with the government pop valve on the cover. The boilers are built of nine sixteenths inch steel plate, with eleven sixteenths end plates, double riveted on the transverse seams and butt joints and straps, and quadruple riveted on the longitudinal seams, and capable of carrying a working pressure of 125 lbs. per square inch.

The gases from the furnaces pass along the flues and return under the boilers and go back by the sides into the main flue at the back. The temperature of the gases leaving the boilers is 450 degs. From there they pass into a fuel economizer of the Green type, made by the Fuel Economizer Company, of Matteawan, N. Y., and also of Wakefield, England, which reduces it considerably, at the same time raising the temperature of the feedwater from 80 degs. to 260 degs. A by pass is arranged for passing the gases direct to the chimney, to allow of inspection and repairs to the economizer. Stratton separators, Chapman valves and Schaffer & Budenberg gauges are used. Water is fed to the boilers by four Northey pumps, manufactured by the Northey Manufacturing Company, of Toronto.

The chimney, the highest in the city, is 190 ft. above the fire grate and gives a draft equivalent to a column of water of one and one-eighth inches. The core of the chimney is circular in section, and nine feet inside diam-

eter, built with an air space all the way up; the external wall is eighteen feet on a side at the bottom.

The steam piping is made of solid welded tube covered with Asbestos block covering. The main header where it enters the engine room is eighteen inches diameter, diminishing as it extends on either side. The flanges are made from three-quarters of an inch steel plate and pressed from the solid plate. The pipes are made doubly secure by means of wrought iron bands being shrunk on the body of the pipe. The hoop pipes from the header to the engine are seven inches diameter, and bent by John McDougall, engineer, of Montreal, as were also the six inch pipes connecting from the boilers.

Coal to the boiler is brought in on a side tipping carriage which holds 1,400 lbs. and runs on a specially prepared track from the coal yard. The yard when fitted up will be capable of storing 2,000 tons of coal. The ashes are got rid of in a very simple and efficient manner by means of doors in front of the boiler, through which they are passed into the ash pit below.

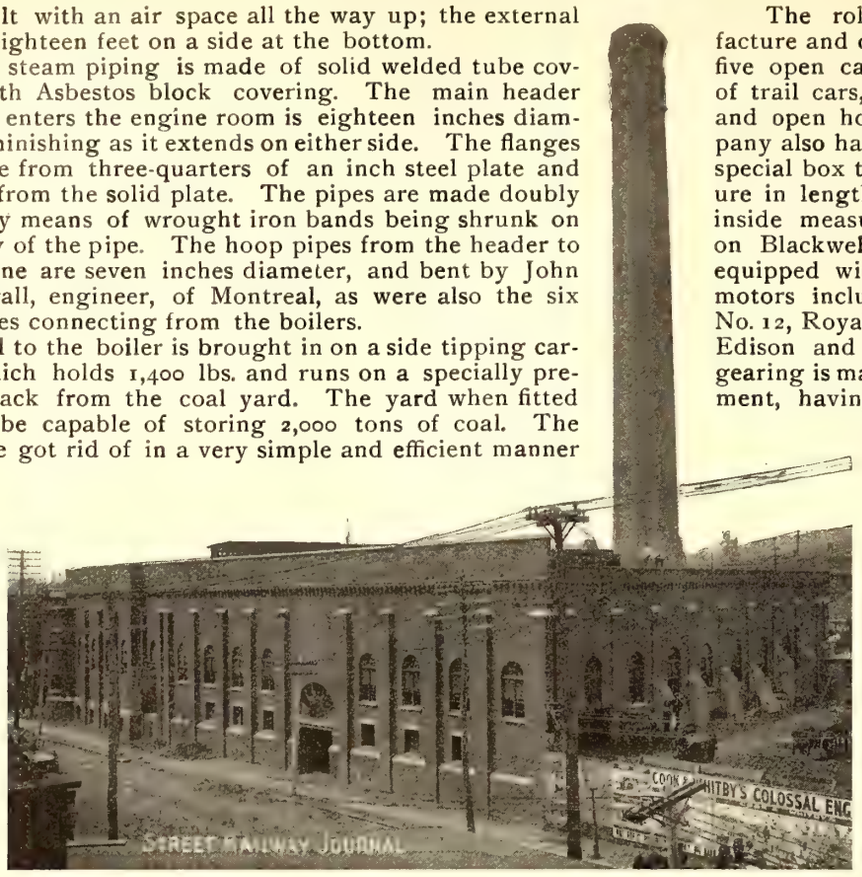


FIG. 2.—EXTERIOR WILLIAM STREET POWER STATION—MONTREAL STREET RAILWAY CO.

The line of the company has a length of sixty-four miles with a maximum grade of 10 per cent. for a distance of 200 ft. The sharpest curves are of forty-five and fifty feet radius. Both wood and iron poles are used. The trolley wire is of No. 00 hard drawn copper and the feed wire of No. 0000 with solid weatherproof covering. The return circuit employs sixteen No. 0000 copper feeders. The rails are bonded with No. 4 wire which is soldered into rivets driven in the rail.

The rolling stock is of Canadian manufacture and consists of 150 box cars and twenty-five open cars, together with a large number of trail cars, consisting principally of the box and open horse cars formerly used. The company also has five special open trailers and ten special box trailers. The box car bodies measure in length from twenty-six to sixteen feet inside measurements. The cars are mounted on Blackwell, Brill and Bemis trucks, and are equipped with a number of different types of motors including the Westinghouse, No. 3 and No. 12, Royal and General Electric, of which the Edison and W. P. 50 types are used. Steel gearing is mainly employed for the motor equipment, having been found preferable to any other. The cars are equipped with foot gongs, sand boxes, Clendinning stoves, etc. New Haven registers are used on a number of the cars, but fare boxes carried by the conductor, and in which the passenger deposits his own fare, are also employed. St. Thomas wheels and wheels from the foundry of John McDougall are used. Some of the cars are equipped with the Ives fender manufactured in Montreal, and some have a special fender manufactured by the street railway company itself. The orlling stock of the company also includes four snow sweepers manufactured by Ahearn & Soper, one snow plow and two extension tower wagons. A number of other snow sweepers are under construction for the company.

The car house of the company is 250 × 103 ft., and contains nine tracks in groups of three, located eleven feet from center to center. It is a substantial building of brick and stone.

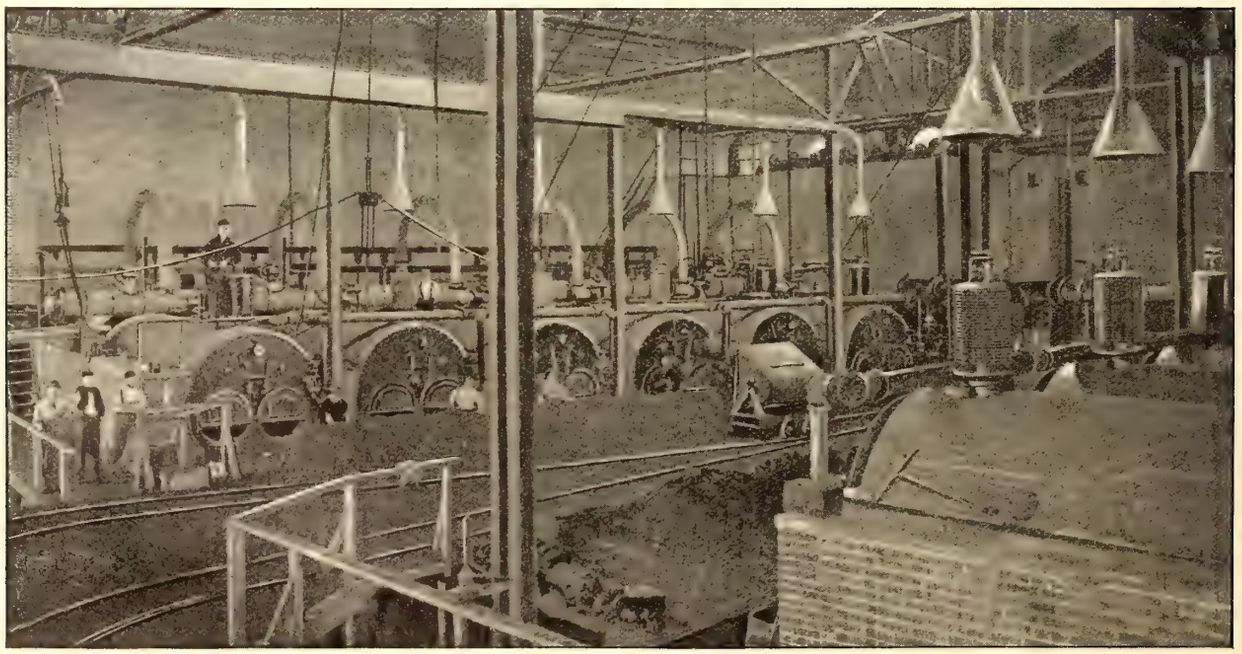


FIG. 3.—BOILER ROOM—MONTREAL STREET RAILWAY CO.

The company is also well equipped in the line of repair and machine shops, and does a considerable amount of its own machine work. An idea of the completeness of this portion of the company's equipment is shown by the fact that in the repair shops of the company are the following tools: One planer, two engine lathes, one speed

lathe, one three-spindle drill, one emery grinder, one grindstone made by Gardner & Son, of Montreal, one Brainard milling machine, one shaper, one drill made by A. R. Williams, of Montreal, one tool grinder made by Robert Mitchell, of Montreal, and one Prentice drill

The track construction is of a most interesting type, being the first trial in this country, so far as we are aware, of the English method of laying girder rails directly on concrete. The type of rail used is grooved girder weighing seventy-two pounds per yard, and supplied by Dick, Kerr & Company, of England. The joints are connected by six bolt fishplates.

Fig. 6 shows a section of the construction used. Wooden ties are not employed on streets where there is a concrete foundation under the pavement. Where the girder rail, which is six and a half inches deep, is laid on wood, paved or stone blocked streets upon concrete foundation, the concrete was cut to the width of the flange of the rail about an inch deep. The rails were then placed on oak shims in this excavation and flooded with a cement grout, consisting of one part of cement and one of sand, under the flange of the rail. The rails were tied together with iron rods, and each side of the web of the rail was filled with cement grout mortar of one to one to the width of the rail. The wood or stone blocks were then replaced, and all the intersections were filled up with cement grout of the proportions mentioned. The track has stood thoroughly well under the heavy traction, in spite of the fact that during the winter the temperature fell as low as 20 degs. below zero.

A considerable amount of interesting special work was also laid in the construction of the road. One of the most complicated pieces of special work is at the corner of St. Lawrence, Main and St. Catharine Streets, and was installed by the Canada Switch Manufacturing Company, of Montreal. It is at a point where two lines of double tracks cross each other with double track right angle curves, connecting each set of main tracks with the other.

The width of St. Catharine Street between curb lines is thirty-eight feet, and that of St. Lawrence forty-three feet, and the special work is built up of girder rails and connected with wrought iron fishplates. The joints were all accurately produced by machinery, and the tongues are made of hammered steel.

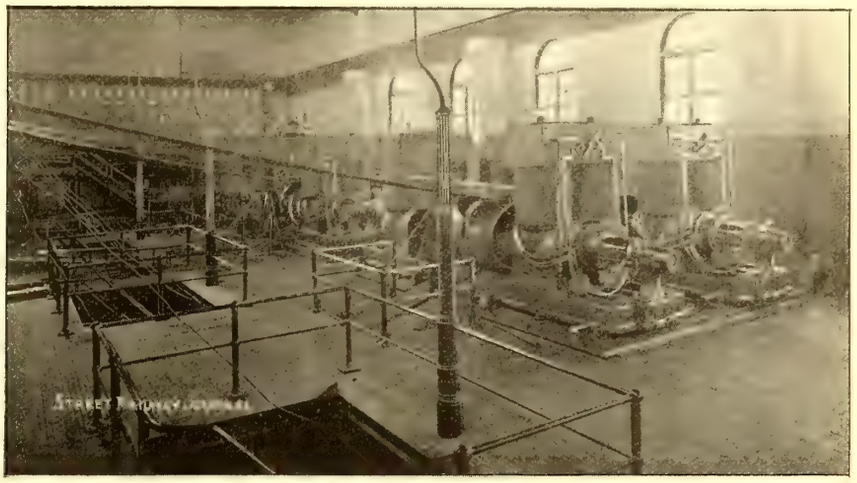


FIG. 4.—GENERATORS—MONTREAL STREET RAILWAY CO.

The number of feet of rail used is 2,148 ft.; total weight of iron in intersection, twenty-six tons; radius of curve

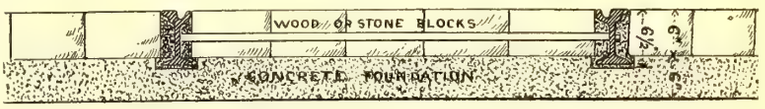


FIG. 6.—SECTION OF TRACK LAID ON CONCRETE—MONTREAL STREET RAILWAY CO.

corner, ten feet; weight of girder rail per yard, seventy-nine pounds; depth of rail used, six and a half inches; radius of curve of inside rail, forty-five feet; maximum width of devil strip, eight feet six inches; minimum width of devil strip, four feet; angle of intersection, 87 degs., 45 mins.

The rails of the crossing are spiked to cedar ties which are bedded in concrete.

The company carried last year 17,177,952 passengers, or an average of five per car mile run. The total operating expenses per car mile were 17.04 cents, and with the present equipment it is believed that this can be materially reduced during the next year. The average number of car miles run per car per day during the last fiscal year was eighty and a half. The officers of the company are: President, L. J. Forget; manager and chief engineer, Granville C. Cuningham; secretary and treasurer, Edward Lusher; comptroller, J. T. Hill; electrical engineer, Robert C. Brown; superintendent, Duncan McDonald; directors, the president and manager, with James Ross and K. W. Blackwell.



FIG. 5.—SWITCHBOARD—MONTREAL STREET RAILWAY CO.

A NEW branch of the Montreal Park & Island Railway was put in operation August 1. It extends from the Island of Montreal, giving direct communication with the city to the outlying districts of Outremont and other suburbs. A large number of prominent guests were present. This company is rapidly putting into operation new lines and extending its system.

An Elaborate Crossing.

The system of curves, switches and crossings illustrated on this page of the Journal, has just been completed by the Milwaukee Street Railway Company, and perhaps contains some features of interest to other companies. It is located at the intersection of Farwell, North and Murrays Avenue, and embraces the crossings and connecting curves of the lines on these streets, and the entrance curves to Farwell Avenue car house. The curves are so arranged that cars from any of these three streets can be switched to any other, or into the car house without delay or difficulty. These tracks are used by five lines, the Farwell Avenue, Lake Park, North Avenue, Forest Home and the Whitefish Bay steam dummy line. The cars from the first three lines are operated from the Farwell Avenue car house, which has a capacity of 125 cars.

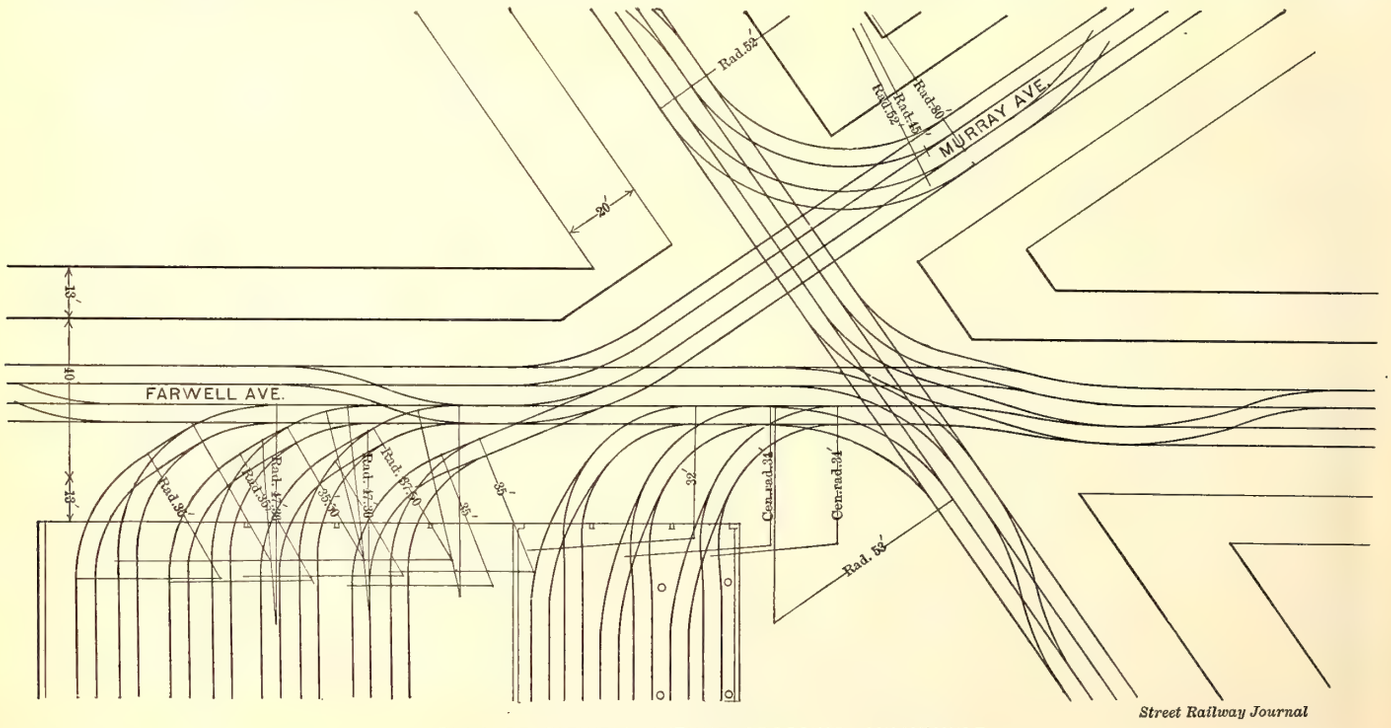
The present curve construction includes twenty-four distinct curves (fourteen of which are entrance curves to the car house), requiring thirty pairs of tongue switches and mates, with forty-nine frogs and two double track crossings, besides five crossover switches. The whole work is built of fifty-eight pound girder rail five inches high, with a base of four inches, which is the standard rail of the company.

In designing this work the first requirements were to obtain the best possible construction, to insure the smooth riding of the cars, and, subject to this to keep the expense as low as possible. The difficulties in the way were chiefly due to the narrowness of Farwell Avenue, the roadway of which is but thirty-eight feet, in width, the tracks being laid ten feet center to center. The distance to the front of the car house is but twenty-five feet from the gauge line of the inner track.

The car house was rebuilt from a horse car barn, and consequently the tracks and the posts are closer together than they would be for a new structure planned for electric cars. This made it a matter of some difficulty to get curves into the house that would permit the cars to enter without striking the posts. It was also necessary to keep the switch point of the first of these curves out of the crossing of Farwell and North Avenues, to avoid having the cars run over the tongues. This required a small reverse curve at the barn entrance, to get back on the track in the barn. The wide angle between Farwell and North Avenues threw the curves connecting these two lines into



VIEW DURING CONSTRUCTION OF FARWELL AVENUE CROSSING, MILWAUKEE.



PLAN OF FARWELL AVENUE CROSSING, MILWAUKEE.

the crossing, so that there are thirty-four frogs within a radius of twelve feet. None of these frogs are three-way, and none closer together than two feet, a result which was obtained by running a piece of straight track through the crossing, connecting the curves on the northwest corner.

Besides making a smoother construction, this also made a great saving in cost, and the frog will last longer, and be more easily repaired, than would be possible if any were three-way.

Owing to trouble with property owners, and legal proceedings in connection with earlier work, it was necessary to keep the curves as far as possible from the corners, this distance being fixed in one case by an order of the court.

All of these curves are guarded on the inner rail with a guard made by bolting an old tram rail five inches wide to the girder rail, using cast iron fillers. The switch-tongues are made of machine steel, first bent to the proper curve, and then planed straight on one side. The shortest radius used is thirty-two feet, which is for a curve entering the car house. The wheel base of the cars is six feet six inches, and not the least trouble is found in running over these short curves.

The first cars out of the barn were taken out before the curves were wired, and consequently had to leave the barn at a good speed, in order to reach the main track, which was easily done. The entire work was built in the shops of the company under the personal supervision of A. W. Lynn, superintendent of construction and repairs, and cannot be excelled by the best work of any of the regular switch and frog companies.

Mr. Lynn was formerly manager of the Old Cream City Railway, of which the Farwell Avenue line was a part, and at the beginning of electrical reconstruction by the consolidated companies he realized the value of a system of lines radiating from the intersection of Farwell and North Avenues, making the Farwell Avenue car house the distributing center for all of the East Side cars.

Owing to the large expense of changing from horse to electric power, Mr. Lynn was for several years unable to persuade the company to go to the additional expense necessary to carry out his plans embracing the extensions of the lines and the construction of the curves and crossings just described.

The first cars ran over the new work on August 5, opening a line to the beautiful Lake Shore Park and the rapidly growing residence region adjoining. This route became at once so popular, that two lines of cars are run over it, with the results of bringing the North Avenue line from the condition of being operated at a loss to that of the best paying line in the city, and materially increasing the business of the other intersecting lines. It now seems probable that this increased business will pay for the work the first year, thus fully demonstrating the value and accuracy of Superintendent Lynn's foresight.

All the plans and detail drawings for this crossing were drawn up by Clement C. Smith, at that time engineer of the Milwaukee Street Railway Company, and at present connected with the Chicago City Railway Company as engineer of track construction. Mr. Smith is a well known authority on track work, and has had long experience in this branch of street railway construction.

New Switching Facilities—Chicago City Railway Company.

The Chicago City Railway Company has just put into practice a new system of switching at the 63d Street terminus of its State Street line, which has points of interest, not only in itself, but as indicating the great change of sentiment from old ideas, and as marking the great contrast to the old ways, when tow horses were deemed an indespensable adjunct to cable roads on level streets—a characteristic quite pronounced in Chicago topography. It is not many years ago that horses towed trains from

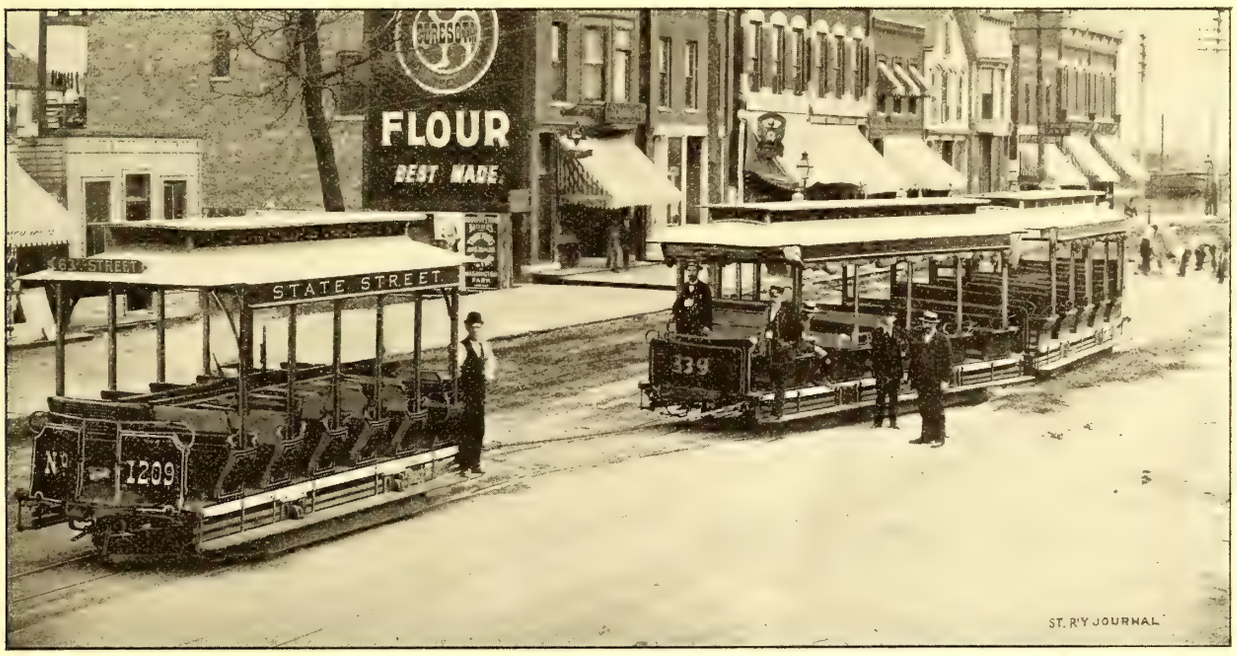


FIG. 1.—METHOD OF SWITCHING CABLE CARS AT 63D AND STATE STREETS—CHICAGO CITY RAILWAY..

the throw-off point of one cable to the pick-up point of another; whereas now, the unnecessary crook in the tracks at pick-up points having been abandoned, nine passengers in ten do not know when one cable is dropped and another taken.

Fig. 2 shows a plan view of the new switching arrangement, and the manner of operation is as follows: The train, which we will suppose comes along the lower track, passing from left to right, acquires a headway from the cable which is then thrown from the grip. The coaches are uncoupled from the grip car, while in motion, the grip car passes over on the grip crossover, which is the one farthest to the right in Fig. 2, and which is always open, to the return track. The coaches are stopped by the conductor, between the grip and coach switches. As the grip car passes on to the return track, the grip jaws are open and receive the cable which is elevated to meet the grip jaws by an elevating sheave.

Should too great a speed be attained and the car go beyond the pick-up, the cable is prevented from being thrown off the sheave by a guard which leads the grip around the sheave, guiding it away from the cable. The coaches are now pulled over to the return track by means of a rope manipulated by the conductor of the trail car, as shown in Fig. 2. The rope is of hemp, one and a

quarter inches in diameter and wrapped with wire to prolong its life. One of these ropes lasts about two weeks.

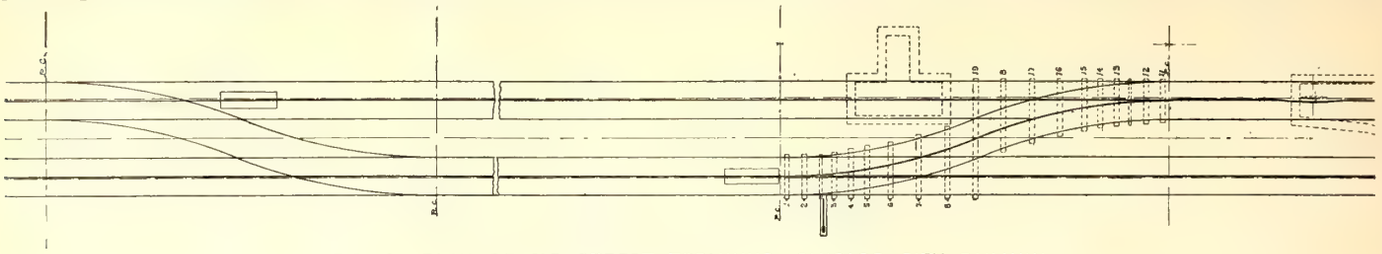


FIG. 2,—PLAN OF 63D STREET TERMINUS—CHICAGO CITY RAILWAY.

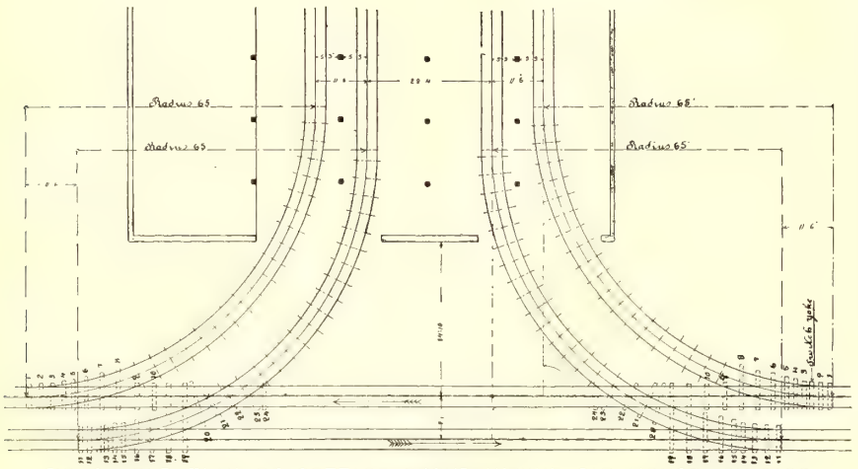


FIG. 3.—OLD PLAN OF COTTAGE GROVE AVENUE CAR HOUSE—CHICAGO CITY RAILWAY.

The very small speed required to carry the grip car from one track to the other is one of the striking features of the system, the car entering the switch at a speed not exceeding five or six miles per hour.

The grip switch is the standard in use by the Chicago City Railway, and was constructed by the Paige Iron Works, of Chicago.

The rapidity and ease with which trains are handled and switched back gives rise immediately to the query: "Why has not this system been adopted long ago?" This is especially so when the cost of the change and saving in operation are considered. Originally, or under the old way, there were required to do this switching two horses and two men with an extra horse and man during the rush hours, making in all shifts seven horses and five men. More recently, however, this had been cut down until one horse and two men did the work, making in all three horses and four men, there being three shifts for the horses and two for the men. Under the present system all of these are dispensed with. Allowing as the cost of keeping one horse fifty-five cents per day, and the wages of the men $1.50 per day, there will appear a saving of $230 per month or $2,760 per year, while the cost of the new switching arrangement has been less than $2,500. The saving compared to the time when seven horses and five men were required is annually $4,086. Practically the company has made an investment which nets it annually over 100 per cent. over the very best previous methods.

This is only one of the many improvements made in its switching facilities by the Chicago City Railway Company in the last three years. The principle of using the momentum derived from the cable to do the work formerly done by horses has been successfully applied at all the cable car houses with the result that labor of men and horses has been done away with by investments ridiculously low compared with the resultant saving.

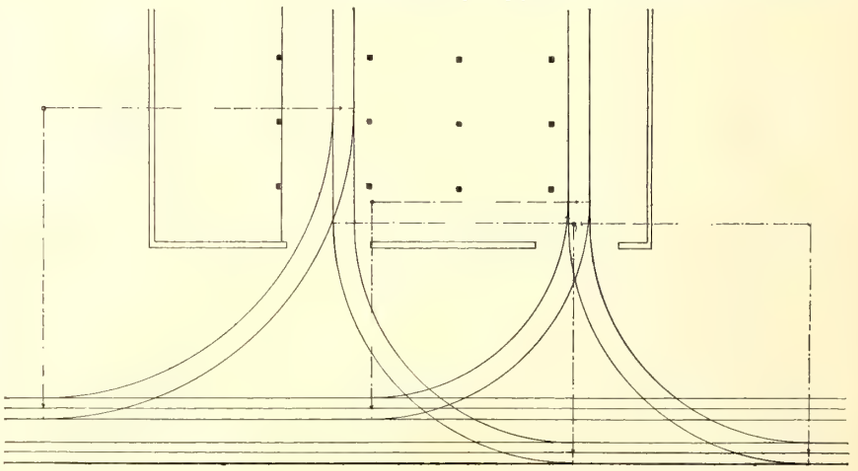


FIG. 4.—NEW PLAN OF COTTAGE GROVE AVENUE CAR HOUSE—CHICAGO CITY RAILWAY.

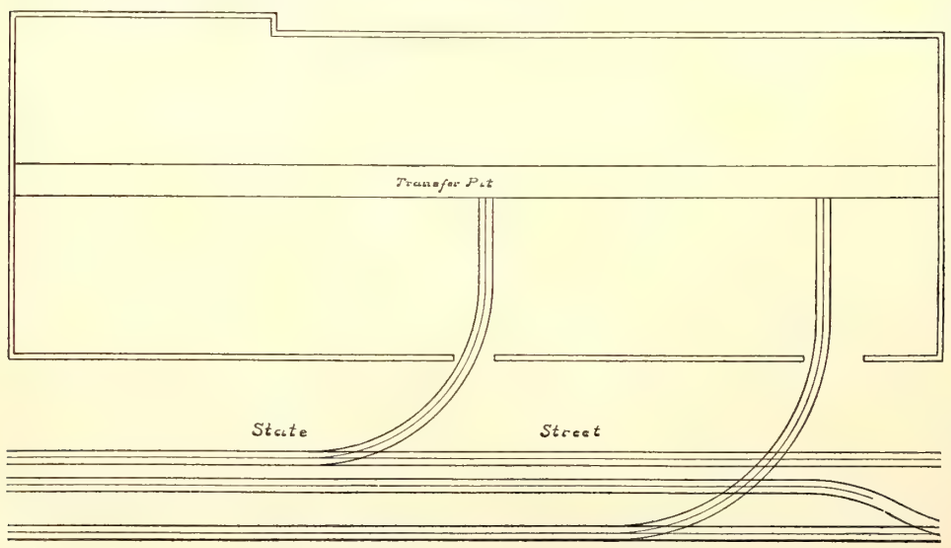


FIG. 5.—PLAN OF CAR HOUSE AND SWITCHES—39TH STREET CAR HOUSE—CHICAGO CITY RAILWAY.

Figs. 3 and 4 represent respectively the old and present arrangement of switches at the Cottage Grove Avenue car house. Under the old system nine horses and nine men were required, nearly all of these being dispensed with under the present system, resulting in an annual saving of $7,774.

Fig. 5 represents the arrangement of the switches at t he 39th Street car house of the State Street line. Here, as in the Cottage Grove Avenue car house, the trains run in by momentum and out by gravity. A saving in horses and men of $4,608 per year has been effected here.

Figs. 6 and 7 represent respect-

ively the old and new arrangement of the 61st Street car house of the State Street line, and in the new system here there is annually saved $3,474.

It is learned from the management that by studying out and by putting into practical operation labor saving devices, of which the foregoing are merely a few examples

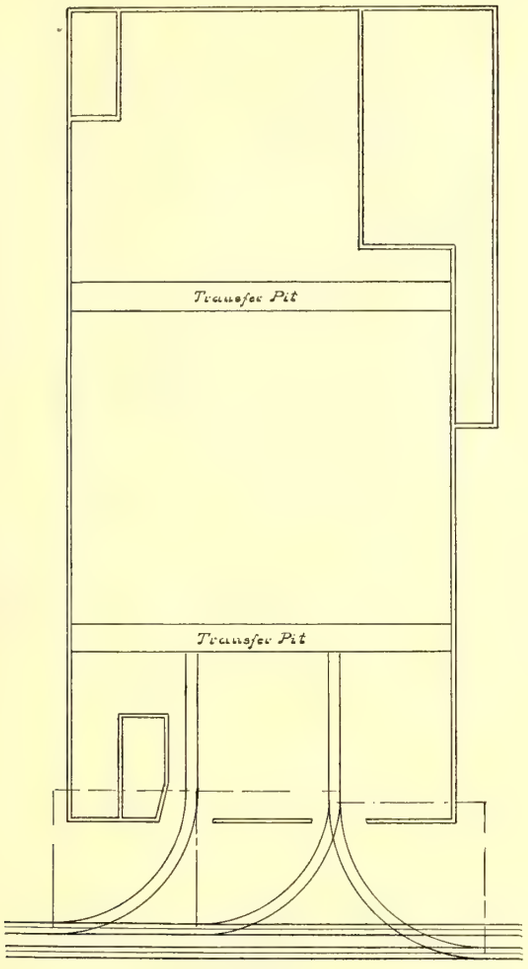


FIG. 6.—OLD PLAN OF 61ST STREET CAR HOUSE—CHICAGO CITY RAILWAY.

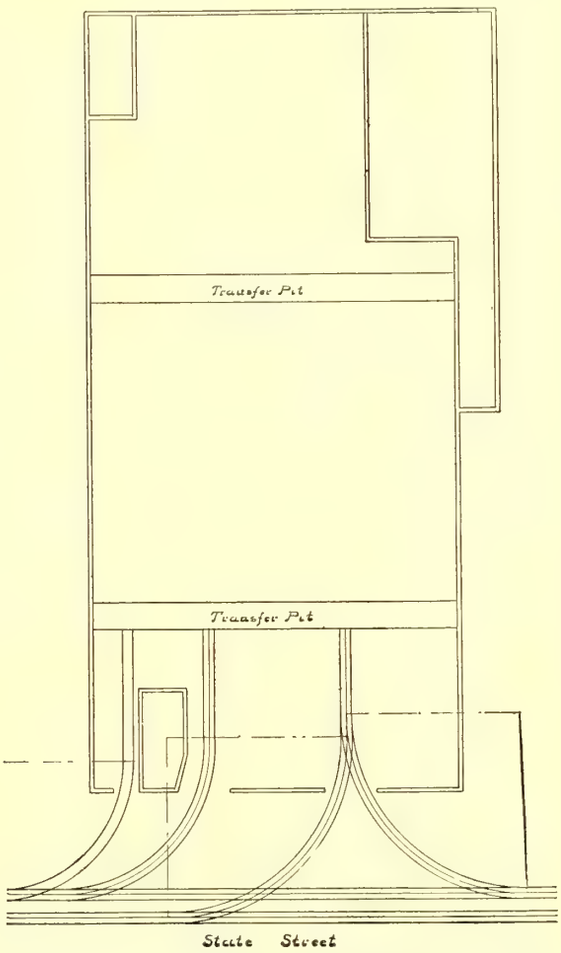


FIG. 7.—NEW PLAN OF 61ST STREET CAR HOUSE—CHICAGO CITY RAILWAY.

along one particular line, that $8,183 monthly is being saved in the labor of men and horses alone over the operation of 1891, equal to $98,196 annually.

The Clipping of Horses in Germany and Austria-Hungary.

The *Strassenbahn* has recently analyzed several works which treat of the clipping of horses in Germany and Austria-Hungary. The excellent work of the German major, Richard Schoenbeck, entitled "Guide pour les Officiers Montés de l'Infanterie," published by R. Bredow, Leipzig, gives the following information:

The clipping of horses has more defenders than opponents. Major Schoenbeck is of the opinion that for horses which have much work to do it is very desirable. With horses which are not clipped perspiration dries with difficulty; it remains in the hair and chills the skin. A clipped horse perspires less, and the perspiration dries more quickly. He commends also the regular clipping of horses which have to stand still very much of the time. The process of clipping is good for the skin, and exercises an influence on the appetite of such an animal, which makes up for the want of exercise. The clipping ought to be done during the months of October and November.

According to Mr. Eberhardt, author of the book entitled "Le Cheval et l'Art de Conduire," also published in Leipzig, the clipping of horses is also considered of value from a hygienic standpoint. This author recommends, however, the making of an exception of those horses which have long and difficult work to do in winter.

After being clipped, the horses ought to rest for at least three days without work, so that they may not catch cold. According to Mr. Eberhardt, the month of October is the best month for clipping. At this time the hair of the animal is not yet entirely grown, and crops out rapidly. By means of recent improvements the clipping of horses has become an easy matter. A good groom ought to clip a horse in from four to five hours. As a groom ought to take care at the minimum of eight horses, it is not possible for him to look after this number well if the hair is kept too long. No disease of the skin is caused by clipping.

At the stables of the tramway company of Lintz-Urfahr all the horses are clipped near the end of October or during the first part of November. The company employs a clipping machine.

THE New York, New Haven & Hartford Railroad Company has recently constructed a solid steel, four track swing bridge over the Bronx River at West Farms. The bridge is one of the first four track bridges of the kind to be constructed in the state. It will be operated by electricity which will be furnished from the power station of the Union Railway Company. It is said to be the largest bridge in the country to be moved by electric power. Its cost when completed will be $50,000.

THE Chestnut Hill & Spring House Passenger Railway Company, of Philadelphia, Pa., was incorporated August 18, with a capital of $48,000. Henry C. Moore, 624 North 22d Street, Philadelphia, is the president of the company, and other stockholders are Hyland C. Murphy, D. C. Golden and Thomas B. Foot, all of Philadelphia.

Intramural Motors in Brooklyn.

The Atlantic Avenue Railway Company, of Brooklyn, has recently added to its motor equipment three of the motor cars which were employed in the operation of the Intramural Railway at the World's Fair. These motors are in operation on the company's West End division, which extends from 39th Street Ferry to Coney Island. This line was formerly operated with steam locomotives, but is now entirely equipped with electric motors.

As already stated in these columns, the motor cars are equipped with four General Electric motors of the single reduction, four pole type, one on each axle. These are probably the most powerful railway motors ever constructed, being rated 150 H. P. each, and especially designed for heavy passenger traffic. They are geared for a speed of thirty-five miles per hour, and weigh, exclusive of the gear, only a little in excess of 3,000 lbs. The armature is of the slotted, iron clad type, the winding being embedded in the laminated iron body. The motor was illustrated in the June, 1893, issue of the Street Railway Journal.

The trucks were built by the Jackson & Sharp Company, of Wilmington, Del. The original car bodies have been removed and replaced by forty-five foot closed car bodies built by the Wason Manufacturing Company, of Brightwood, Mass. The cars are similar in appearance to those in use on the elevated railways, and have seating capacity of forty-five persons. The interior finish is rich and tasteful. The seats and backs are of rattan, and they are lighted by six oil lamps held in handsome brass chandeliers.

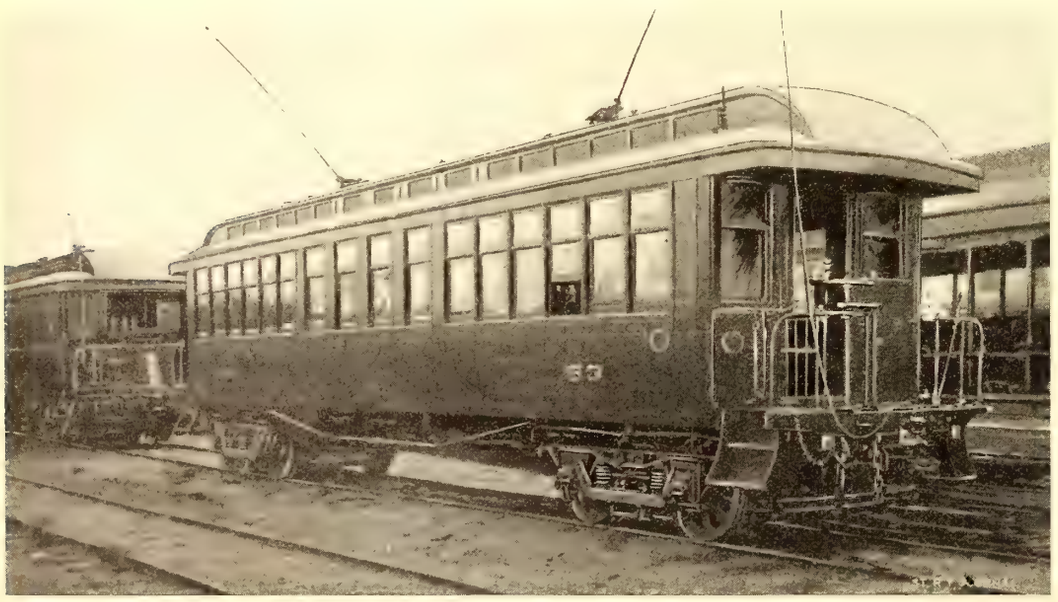
In the operation of the motors on the Intramural Railway current was taken from the conductor rails by means of a sliding contact shoe. These latter have been removed and the cars are now equipped with the ordinary overhead trolley.

When the change was made from the sliding contact shoe to the overhead trolley some trouble was experienced on account of the trolley coming off. The difficulty has been overcome by the use of a Carpenter enamel rheostat of special design. The rheostat works automatically, and protects the motor in case the circuit is broken by the trolley coming off and suddenly closed by replacing it. The cars are provided with two trolleys, one of which is used for the regular run and the other for switching purposes at the Brooklyn end of the line. Whistles operated by air from the brake reservoir are employed instead of gongs.



FIG. 2.—INTERIOR OF CAR ON BROOKLYN, BATH & WEST END RAILWAY.

Trains are operated, consisting of a motor car and three open trail cars. The trail cars were built by the Wason Manufacturing Company, of Brightwood, Mass. They are forty-five feet in length, and have a seating capacity of eighty passengers.



45 FT. CAR ON BROOKLYN, BATH & WEST END RAILWAY—BROOKLYN, N. Y.

The cars are provided with the New York air brake system, the air being stored in the reservoirs by means of an automatic air pump, with cylinder dimensions 5×9 ins., and operated by a stationary motor. The motor and air pump are controlled by a pneumatic rheostat, which automatically cuts out the motor when the air pressure reaches sixty pounds and starts the motor again, when the pressure falls below that point.

First Trip of Brooklyn's Postal Car.

The first trip of the electric postal car of the Atlantic Avenue Railway Company, described in our last issue, was made August 12. The car carried the postmaster of Brooklyn and other postal officials of that city, Superintendent Newkirk, Treasurer Frick and Engineer Silliman of the Atlantic Avenue Railway Company, and other invited guests. C. C. Overton, who was one of the party, on entering the car, mailed a letter to himself for Bath Beach. It was the first carried on the new line. A number of mail pouches were also taken aboard. The trip was then begun, and several mail bags were received and contents distributed along the route.

There will be three deliveries each day. The postal car will leave the Post Office at 6 A. M., 12 M., and 4.15 P. M., arriving at Coney Island, one hour and nine minutes after the start in each case.

Electric Brakes in Philadelphia.

Passengers on the People's Traction electric railway in Philadelphia for the past two or three weeks have been treated to quite an unusual and pleasing experience of riding on cars equipped with the electric brake. The action of the brake in stopping is described by a reporter in one of the dailies as "though the car were running into a feather tick or air cushion." Each car is equipped with one Sperry forty horse power motor, swung on springs between the two axles. The armature of the motor revolves at right angles with the direction in which the car moves and is connected with the two axles by flexible joints and bevel gears. The Sperry controller is operated by a lever moving crossways of the car, and the controller box is placed, as usual, close to the dasher, and occupies very little space. The current is thrown on and the car started by moving the lever to the left. There is an attachment for reversing the motor.

The electric brake is operated by the controller lever, and is entirely distinct from the hand brake, which need not be used except in emergencies. It consists essentially of a friction clutch composed of a disk carried on the wheel, against which a C-shaped magnet surrounding the axle is made to bear, as shown in Fig. 1. The coils are placed inside of this magnet, and it is held from revolving by being attached to the truck. The electric power to operate the brake is generated by the motor, which becomes a dynamo and produces a current from the power supplied by the momentum of the car.

In operating the brake the lever is thrown back sharply. This shuts off the trolley current from the motor and at the same time connects the motor, brake magnets and about eighteen ohms of resistance in series with each other. The motor immediately generates a current which actuates the brake. The amount of current and consequently the braking power varies with the amount of resistance in the circuit, so that this can be regulated by the controller handle. This enables the motorman to make the hardest application at high speed and have it automatically reduced as the speed falls off, the true principle of braking, as explained by Mr. Sperry at the Milwaukee convention.

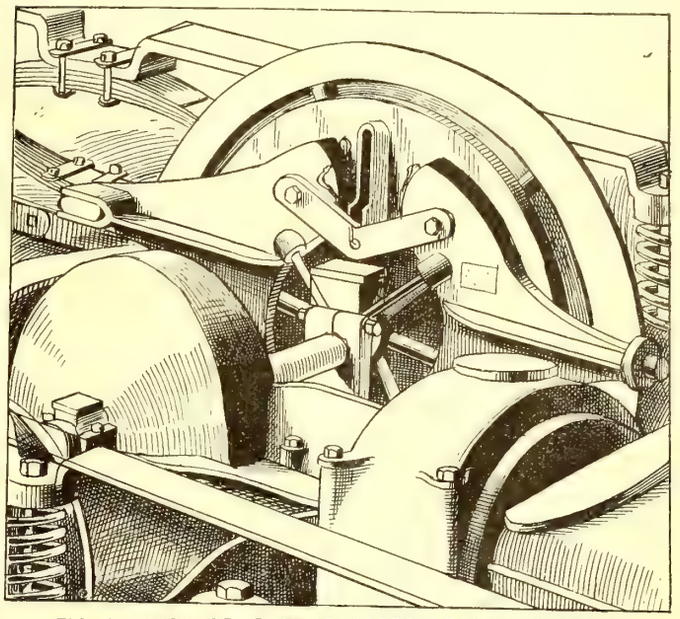


FIG. 1.—ARRANGEMENT OF SPERRY ELECTRIC BRAKE.

Trolley parties seem to be all the go in Philadelphia at the present time, as many as three or four each pleasant evening going over the line and enjoying the delightful air, the historical Germantown battlefield being the Mecca of most of the excursionists. The electric brake cars are universally preferred for these parties; the smoothness of the action and remarkable ease of operation and control on the part of the motorman on the heavy grades making them the favorite cars.

The new extension of the line from the old car stables on Dauphin Street to Germantown is not only over a road of considerable historic interest, but quite remarkable for its grades and curves. The rise is almost continuous to the end of the track in Germantown, the ascent being fully 200 ft. in the distance.

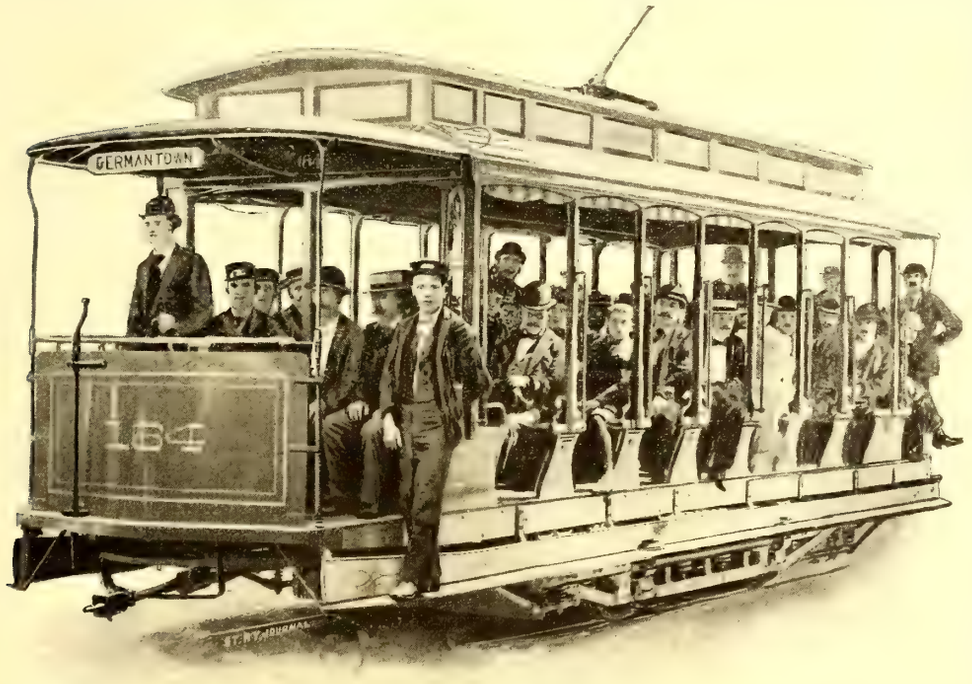


FIG. 2.—CAR—PEOPLE'S TRACTION CO., PHILADELPHIA.

The action of the brakes on these grades has been watched with much interest. The car seems to be under perfect control, and when the register shows eighty fares with people standing in the aisles, the brake stops the car very smoothly on the most abrupt descent. The fact that the company is daily adding to its equipment of the cars on this line seems to indicate that the brakes are successful in handling the cars upon these grades.

A more delightful ride could not be had than by taking one of the electric brake cars of the People's Traction line and riding to Germantown and return.

THE Delaware County & Philadelphia Railway Company of Philadelphia, Pa., recently purchased a 2,500 gal. tank sprinkling car of the Jackson & Sharp Company of Wilmington, Del. On account of the excellent satisfaction given by the sprinkling car, the company has recently placed an order for vestibule cars with the same manufacturers.

THE Willow Grove (Pa.) & Hathore Street Railway Company, was organized August 25, with a capital of $18,000. John H. Fow, of Philadelphia, is president. Others interested are A. D. Markley, S. J. Garner and J. F. Cottman, all of Jenkintown, Pa.

A NEW electric road will be built by the Braintree (Mass) & Weymouth Street Railway Company.

The Next Annual Meeting of the American Street Railway Association.

As the time approaches for the annual meeting of the American Street Railway Association, at Atlanta, indications point to the largest and most successful convention ever held by the Association. The selection of a Southern city for the meeting seems to have been a most popular choice. The Southern members of the Association will certainly be present in force, and those who live north of the Mason and Dixon line seem to be also preparing to attend in large numbers.

The number of those who will avail themselves of the special train to Atlanta, mentioned in our last issue, seems to be growing, and as the train will run via Chattanooga, delegates will have the opportunity of visiting Lookout Mountain at perhaps the most beautiful time of the year as regards scenery.

The local committee in Atlanta has been most assiduous in its labors for the proper entertainment of all, and those who attend may be sure of enjoying to its fullest extent the large hearted hospitality for which the Southerners are famous. The arrangements for the entertainment of attendants have been perfected, and a varied and attractive programme has been decided upon. Some of the special features are as follows:

On the evening of Wednesday, the first day of the convention, a reception will be extended, from 4 to 9 P. M., at the Capital City Club, of Atlanta, to which all attendants and visiting ladies will be invited, and at which a number of Atlanta ladies will receive. On Thursday afternoon carriages will be provided for all the ladies in attendance, and a drive will be taken to visit the most beautiful parts of the city. The annual banquet will be given Thursday night at 9 P. M.

On Friday the attendants will have an opportunity of enjoying a genuine, royal, big Georgia barbecue at Stone Mountain 20 miles east from the city.

A number of changes have been made in the local committees, of which Joel Hurt is general chairman, and these are now composed as follows:

Hotel.—Wm. W. Kingston, chairman, W. M. Kelley, S. W. Trawick, E. P. Thomas. Exhibits.—N. W. L. Brown, chairman, Dana Bullen, W. M. Kelley, Wm. W. Kingston. Transportation.—W. M. Kelley, chairman, J. H. Allen. Entertainments.—R. J. Lowry, chairman, J. C. Payne, J. W. English, Jr., Wm. W. Kingston, T. K. Glenn, Henry Inman, Livingston Mims. Banquet.—H. E. W. Palmer, chairman, J. C. Payne, R. J. Lowry, E. Woodruff, Henry Jackson, T. B. Felder, Jr. Excursion.—W. M. Kelley, chairman, E. Woodruff, H. N. Hurt. Finance.—E. Woodruff, chairman, R. J. Lowry, T. B. Felder, Jr., J. J. W. English, Jr. W. C. Sanders.

The Opening of the Bridgeport Traction Company's Electric Road.

On Friday, August 24, occurred the official opening of the new electric system of the Bridgeport Traction Company of Bridgeport, Conn. A large number of gentlemen interested in the company were present, including the president, Col. N. H. Heft; general manager, Andrew Radel; vice-president, Elias Ward; secretary, Gen. Thomas L. Watson; cashier, W. J. DeShays; electrician, Thomas Moncks; contractor, Thomas Murray, the contracting engineer, C. J. Field, as well as a number of invited guests, including a representative of the Street Railway Journal.

Special cars were provided to carry the party over the lines of the road to the power station. A sumptuous and hospitable repast was provided for the visitors, and altogether a most pleasant time was enjoyed by all.

The power station of the company contains one Providence-Greene tandem compound engine, 12 and 20 × 42 ins., and two Watts-Campbell Corliss engines are also being installed. The latter two engines will be run direct connected to two 300 K. W. General Electric generators, while the former now drives by belting one 200 K. W. General Electric generator. Return tubular boilers, manufactured by the Pacific Iron Works of Bridgeport, Conn., are used.

The rolling stock of the company consists of fifty handsome cars of the J. G. Brill type, mounted on Brill trucks and equipped with Lewis & Fowler registers.

The track is laid with nine inch and six inch T rail, and a remarkable record was made in its construction by Contractor Murray and his engineers, E. G. Wright and R. N. Billings, twenty-three miles of roadbed having been constructed in sixty-five days in order to meet the conditions of the franchise.

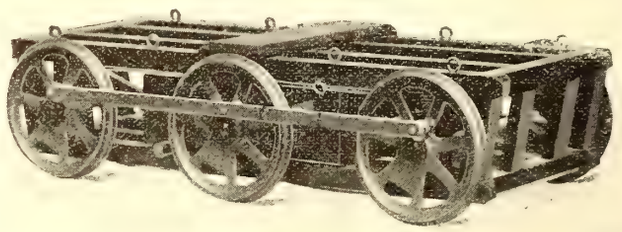
An Electrical Clambake.

The annual clambake tendered the electrical fraternity by the American Electrical Works of Providence, R. I., and which to this class of the community has come to be recognized as one of the most delightful events of the year, occurred on Saturday, August 25. The day was an ideal one, and there were a large number of guests to enjoy the hospitality of this well known company. All sections of the country were represented, and there were in all over two hundred guests who sat down to a most generous repast.

The event was held at the Union Club's country house, which was reached from Providence by electric cars chartered for the purpose. Upon their arrival the guests found a huge tent spread on the grassy lawn adjoining the club house. The usual baseball game, hammer throwing and other pastimes were indulged in to the accompaniment of an excellent band of music and before the discussion of the menu. President Eugene F. Philips, of the American Electrical Works, was an ideal host and extended a cordial welcome to all the attendants. The printed menus were artistic and a thorough good time was enjoyed by all.

A Reciprocating Electric Motor Truck.

Reciprocating electric motors have not up to this time been used extensively in street railway operation, but a truck employing them has been devised by J. T. Wilson, of Tyrone, Pa. Early forms of Mr. Wilson's truck have been illustrated in previous issues, and we present herewith an engraving of a model showing Mr. Wilson's latest improvement. The principle of the truck is as follows: The motors, of which there are four for each truck, are each mounted in a frame



A RECIPROCATING ELECTRIC MOTOR TRUCK.

adapted to slide longitudinally on balls running on girders supported from the end bars of the truck. A disk is carried on each armature shaft, and a point on its circumference is connected rigidly by a rod with the truck. Another rod connects the field magnet frame with an internal crank on the car axle. As will be seen, the effect of operating each of the motors is to give a reciprocating movement to the motor frame, which is communicated to the axle with which it is connected. The four motors are similarly connected, but are arranged to operate quarterly so that there will be no dead points.

No lurching effect is imparted to the motion of the truck, since half of the motor equipment is moving in one direction, while the other half is moving in the opposite direction, thus balancing each other. To the connecting rods of the truck are attached slotted blocks in which the disk pins of the armature move to insure proper action of each motor at points that otherwise at times might prove to be dead points.

The middle wheels of the six wheeled truck shown may be with or without flanges, and are mounted on spindles with ball bearings, as their use is to support the middle of the truck. These cars will start on and run up grade. They run smoothly and with but very little noise. When the electric current is cut off, the mechanical action reverses from axles to motors, making it an easy matter to start the car quickly.

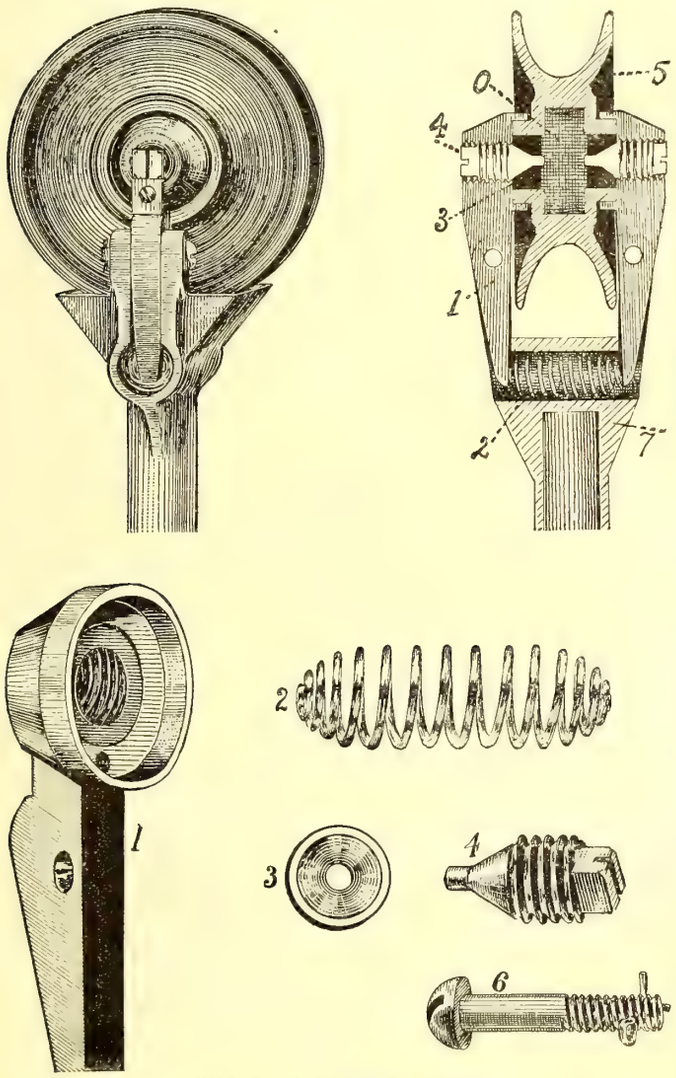
Application is to be made at the next General Assembly of Connecticut for leave to build an electric road between New Haven and Bridgeport, with connection at the West Shore terminus at Woodmont, the line continuing by Merwin's Point, through Milford, to Stratford and Bridgeport, and sending off spur tracks to various points in Milford.

A New Type of Trolley Head.

We illustrate herewith a trolley head manufactured by the Falk Manufacturing Company of Milwaukee, which has been adopted by the Milwaukee Street Railway Company for all of its cars, and which is giving excellent satisfaction. The conditions in Milwaukee include the use of center pole construction for a considerable portion of the equipment, and a working conductor of small diameter, conditions which are particularly arduous, and which consequently reflect greater credit for satisfactory operation by an appliance of this character.

The Falk trolley head avoids the use of graphite bushings or roller bearings, and employs instead cone bearings which automatically adjust themselves to compensate for any small wear. Every part of the trolley head is made of steel. If a railroad company insists upon the use of brass wheels they will be furnished by the Falk Manufacturing Company, but steel is recommended in every case. The cut, which presents a view of the trolley head in cross section, shows very clearly the arrangement of the cone bearings. As will be seen, they are kept tight automatically by the spiral spring, 2, which presses outwards on the arms which holds the cone points. Both cones and bushings against which they bear are of hardened steel.

When the wear becomes greater than can be cared for by the spring shown the cone points can be screwed in or out by a screw driver and adjusted by means of the split pin shown in the engraving. In case the cones break, the wheel will not fall out of the harp, as there is still a shoulder to act as a bearing until the trolley head can be conveniently fixed.



THE FALK TROLLEY HEAD.

A hollow space is left on the inside of the wheel for dope. This is applied every three or four days by removing one of the cones and inserting the nozzle of a specially constructed dope can which fits the hole in the bushing. When the cone is replaced the inspector, of course, adjusts the bearing so that the spring holds the cone at the proper tension. The wheel requires absolutely no other attention until worn out, and at Milwaukee one man will dope thirty cars in an hour and a half.

The bushings have been found to last about four months, which is an excellent record when the wear is as severe as in a case of this kind. The cost of maintenance is very low, and all rattle and play is avoided.

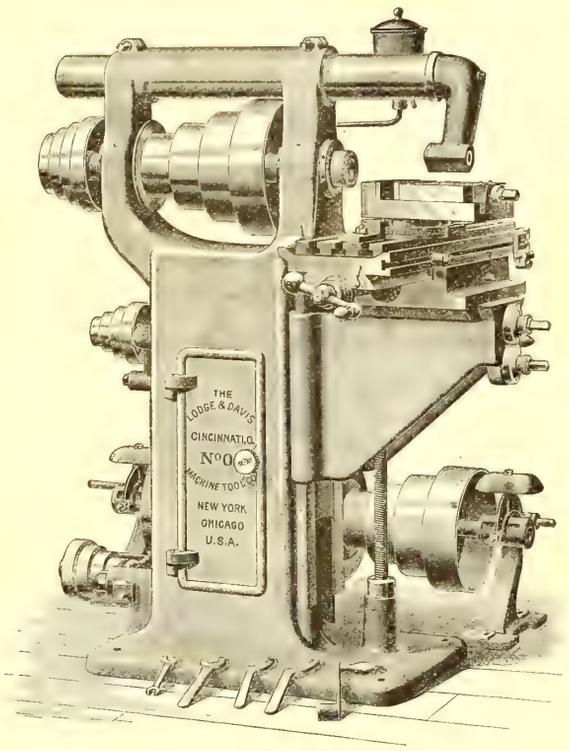
The harp is so shaped that it will not engage on the span wires.

Plain Milling Machine.

Milling machines form a necessary part of street railway repair shops, and a conveniently arranged machine of this character, made by the Lodge & Davis Machine Tool Company, of Cincinnati, O., is shown herewith. As will be seen, the machine conforms in its features to the standard knee form of machine, has its uprights tied together above the cone pulley, and has an overhanging arm for supporting the outer end of the mill arbor.

The table is provided with an oil channel running around it, and drainage tubes are provided at each end for running the oil into vessels which can be hung upon hooks provided for the purpose. All the traversing screws are provided with micrometer graduations, and the rings are secured in place by knurled nuts, so they are very readily adjusted without the use of tools. There is a quick return motion for the table, this being at the right of the machine, and operated by a crank. The automatic stop for the feed operates in either direction, and is placed on a T slot, which also receives the auxiliary dog for hand feeding. A new device is provided which is adjusted by a slotted screw, and takes up all lost motion in the traversing screws.

The feed is reversible by tumbler gearing, and has a range of .008 in. to .1 in. per revolution of spindle. The lower feed cone is mounted



PLAIN MILLING MACHINE.

upon a swiveling yoke by means of which it can be adjusted to keep both feed belts at proper tension. A double friction countershaft accompanies the machine. The feed of the table is twenty-four inches; movement of table in line with spindle, seven inches; vertical movement of knee, nineteen inches.

A New Storage Battery.

A new storage battery, for which excellent claims are made, has just been placed on the market by Haschke & Creelman, 18 to 30 West Randolph Street, Chicago. The battery is very light in weight, small in size, and capable of withstanding rough handling.



ACCUMULATOR CELL.

The elements in the 300 ampere-hour cell, especially constructed for street car propulsion, weigh only thirty-four pounds. It is five inches wide, seven inches long and ten inches high. One of the main features of the battery is the secret process of insulation used in separating the elements. This insulation is electrochemically treated, and when placed between the elements, causes them to solidify and withstand punctures or rough handling, and renders buckling impossible. The batteries have a very low internal resistance. The chemical action is very quickly revived after an excessive discharge, thereby maintaining a constant voltage.

Compressed Air for Car Cleaning.

Railroad car cleaning by compressed air is one of the latest developments of compressed air application, of which, in late years, there has been almost endless multiplication. Attention was drawn to it recently in a report of a committee of the Master Car Builders' Association detailing the growing use of compressed air in car shops and yards, and illustrating various forms of pneumatic hoists, pumps and other labor saving apparatus for railroad service. Not the least interesting among these were the dusting nozzles, which in three instances at least—on the West Shore, the Erie and the Chicago, Rock Island & Pacific lines— have been put to use with such good results that they would seem to promise the early relegation to the railroad curio scrap heap of the conventional rattan beater and brush. These compressed air dusters, as shown by tests made by the committee, effect a decided saving in time in cleaning car cushions, the average time consumed by two men, one operating one of the nozzles and the other handling the seats, in removing the dust from plush and springs of 200 seats, cleaning them perfectly, being from twenty-seven to thirty-three seconds for each seat. The air used in these tests was supplied from a reservoir at a pressure of from sixty to ninety pounds per square inch. Another test at cleaning by hand in the usual way, with beaters and brushes, showed the time necessary for each seat to vary from three to four minutes, the air dusters thus effecting a time saving of about 85 per cent.—*Cassier's Magazine.*

Handsome Cars for the Dartmouth & Westport Street Railway.

The Dartmouth & Westport Street Railway Company, of New Bedford, Mass., has recently put on its line some very handsome cars, which we illustrate on this page. The cars are from the works of the Jackson & Sharp Company, of Wilmington, Del., and have given such good satisfaction that orders for additional rolling stock of the same make and finish have been given.



FIG. 1.—COMBINATION BAGGAGE AND PASSENGER CAR—DARTMOUTH & WESTPORT STREET RAILWAY.

They are 22 ft. long inside and 30 ft. over vestibules; the width over panels is 6 ft. 6 ins., and the height of the car from the under side of the sill to top of trolley board is 9 ft. 1 in. The height from the top of track to the top of the trolley board is 11 ft. 7 ins. All the sills are of Georgia long leaf, yellow pine, and cross framing is of oak; the floor is also of yellow pine. Posts, top rails, ventilator rails and all material used in framing is of white ash.



FIG. 2.—CLOSED PASSENGER CAR—DARTMOUTH & WESTPORT STREET RAILWAY.

The roof is of the dome pattern, extending the whole length of the car and out over the platforms the same as steam cars with vestibuled platforms. The roof is covered with the best quality of duck. The ceiling is of three-ply veneer of birch, neatly and tastefully decorated with one large bronze candle and electric lamp in the center and two small lamps at each end with one light in each vestibule. The deck sash is of mahogany and glazed with Muranese glass, and is hung on ratchets with bronze deck sash openers to operate it. Two beveled mirrors are located in each end in neat mahogany frames. The hand

rails are of mahogany with bronze bratckets, and there are seven padded hand straps to each. There are seven windows on each side and two in each end, glazed with the best double thick glass, and imbedded in rubber on all edges.

The inside finish of the cars is of the best Mexican mahogany, handsomely figured. The curtains to each window are fitted with the McKay patent fixtures. The seats are reversible, with Hale & Kilburn



FIG. 3.—INTERIOR OF CAR—DARTMOUTH & WESTPORT RAILWAY

patent fixtures, and are upholstered in old gold plush. There are seven single seats on one side and seven double on the other with nickel plated arm rests. The aisle is covered with carpet, which gives the car the effect of a regular railway coach.

Large, roomy vestibules are provided with gates on each side. Bronze brake wheels and Stanwood steps are used, and all trimmings, both inside and out, are of bronze of the newest design.

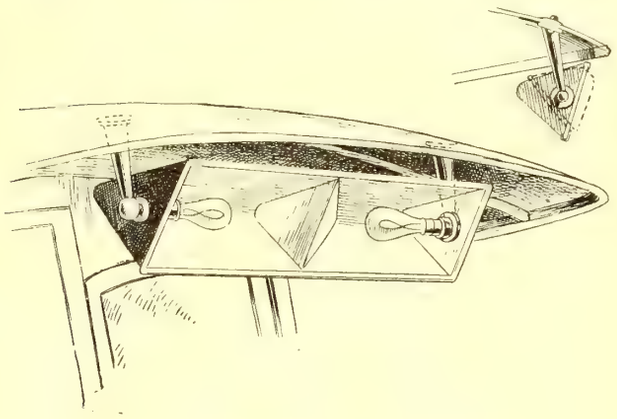
In regard to the outside finish, the cars are painted chrome yellow with white concave panels handsomely decorated with the name "Dartmouth & Westport Street Railway" in silver. On the outside of the vestibules the name "Fall River and New Bedford" is painted in large, gold letters. Each car is also provided with side signs. Fig. 3 gives an interior view of the car. The combination car (Fig. 1) is the same size as the passenger cars, except that it has a bulkhead dividing eight feet off for a baggage room. The baggage room is finished in ash, while the balance of the car is finished in quartered oak, with cross seats upholstered in leather. This car is to be used as a smoker. It is also provided with two card tables to be used by card players. The baggage room has two large doors, one on either side, the same as used in baggage cars on steam roads.

A New Electric Headlight.

The Lindell Railway Company, of St. Louis, has recently equipped its cars with an electric headlight of a new type, an illustration of which is presented herewith. It is the invention of George W. Baumhoff, superintendent of the company, and has given excellent satisfaction. It consists of a triangular shaped casing of metal about twenty-four inches in length and nine inches in width, with its inner surface lined with reflecting material. The casing is attached to the under side of the car bonnet by hollow tubular castings through which the wires connecting with the lamps are carried and arranged in such a manner as to protect them from the weather and prevent them coming in contact with passengers. Two lamps are provided, the sockets for which are attached to the horizontal parts of the supporting casting which also provides bearings on which the lamp casing turns.

The interior of the casing is divided by a V-shaped central partition forming a powerful reflector for each lamp.

The reflector is arranged to turn on its bearings, the front headlight being used to light the track in front which it does for a distance



A NEW ELECTRIC HEADLIGHT.

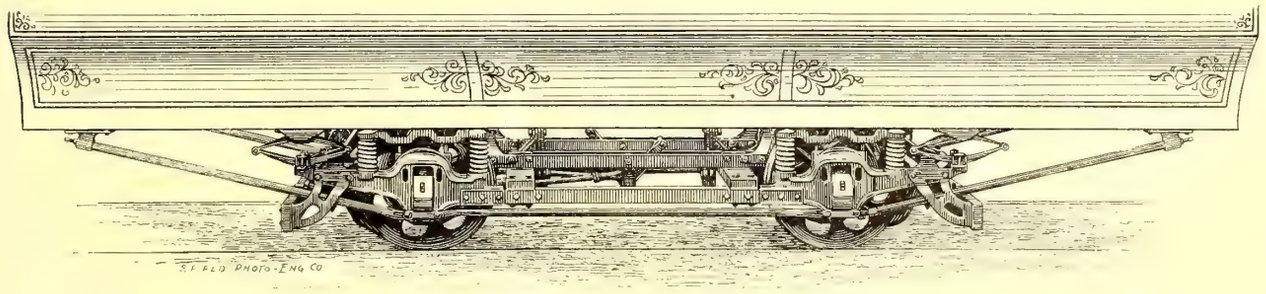
of about 150 ft., and the rear one for lighting the rear platform and the interior of the car.

Previous to the adoption of the electric headlights the cars were provided with oil headlights which required the services of two men to keep in order.

With the new headlight the company estimates a saving of the salary of two men, the cost of lamps and current required to operate the new system being equivalent to the cost of coal oil and the breakage of lamp chimneys and headlights.

Bemis Standard Cable Truck.

The engraving of the Bemis Car Box Company's truck, on this page, shows that company's standard motor truck, as adapted for cable



BEMIS TRUCK FOR CABLE CARS.

Recent Work of a Large Car Company.

The American Car Company, of St. Louis, Mo., as mentioned in our last issue, is receiving orders for a large number of cars in its own city, as well as elsewhere. The order from the Union Depot system covers thirty twenty-five foot closed cars, fitted with plush covered, cane, cross seats. The interior finish of these cars will be elegant and elaborate, and they will be mounted on Sutton's maximum traction, double motor trucks. Captain McCulloch, general manager of the Citizens' Street Railway Company, of St. Louis, has also placed a recent order with the American Car Company. This calls for sixty twenty-six foot closed cars, to be mounted on Sutton's maximum traction, double motor trucks. These cars are to be very handsome, both in design and finish. The attractive cars recently built by this company for the Missouri Railroad Company assisted very materially in deciding where the order should be placed.

THE Quincy & Boston (Mass.), Street Railway is to be extended from West Quincy to East Milton.

work. 180 of these trucks have been adopted by the Third Avenue Railroad Company, of New York, for use under its twenty-two foot box cars.

The truck is equipped with the Bemis cushioned wheel brake, and the drum brake as used by the Third Avenue Railroad Company. It carries the grip independent of the spring motion of the car, is easy riding, and in all respects a very satisfactory truck.

Recent orders for this truck, adapted for electric service, are from the Baltimore Traction Company, the Electric Traction Company, of Philadelphia; Hestonville, Mantua & Fairmount Passenger Railroad Company, of Philadelphia; Fair Haven & Westville Railroad Company; New Haven Street Railway Company; Norfolk Suburban Street Railway Company; Calais & St. Stevens Street Railway Company; Skowhegan & Norridgewock Street Railway Company; Marlboro Street Railway Company; Gardner Street Railway Company; Lowell & Suburban Street Railway Company; Union Street Railway Company, New Bedford, and at other points. The Bemis Company has also just completed an order for 450 for the Philadelphia Traction Company, and owing to other large orders has now about three months' work ahead.

Flexible Pole Brackets.

We illustrated in a recent issue the Creaghead single, flexible bracket for wooden poles. The results secured by this bracket in practice,

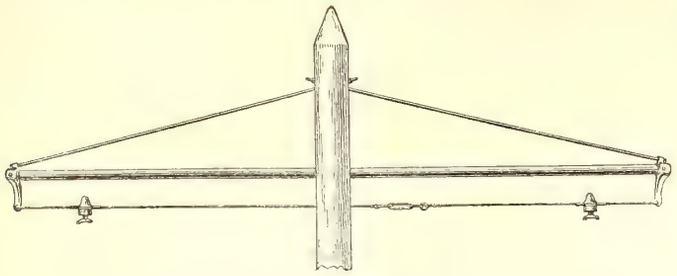


FIG. 1.—DOUBLE FLEXIBLE BRACKET FOR WOODEN POLES.

especially on high speed suburban and interurban lines, have been so satisfactory that we present views of other standard types brought out by this company. Fig. 1 illustrates the double bracket for wooden poles; Fig. 2 the single insulated, flexible bracket for iron poles, and Fig. 3 the double insulated, flexible bracket for iron poles.

The Creaghead Engineering Company has designed a number of special forms in which its patented flexible device is used, but the three forms herewith illustrated are designed for the standard single and double track work for use with wood or iron poles. The single and double flexible brackets for iron poles are insulated from the iron poles, thereby giving double insulation between trolley wire and pole. Figs. 2 and 3 show clearly the insulated turnbuckle in the top guy rod, the hard wood, corrugated plug in the horizontal arm and the insulated bushing in the

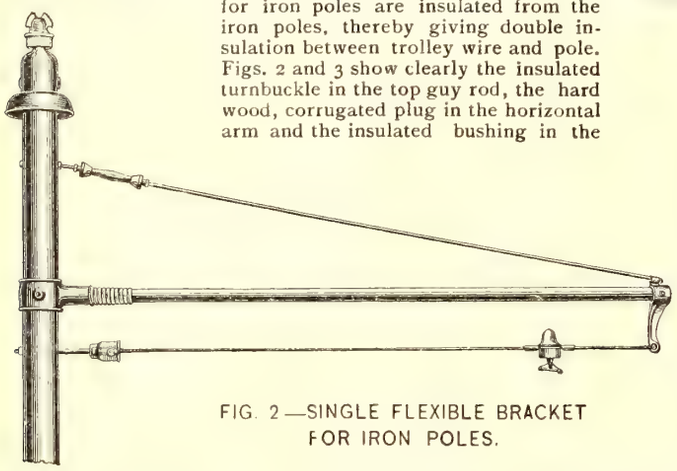


FIG. 2.—SINGLE FLEXIBLE BRACKET FOR IRON POLES.

pole through which the flexible span wire passes. The Creaghead Engineering Company has recently equipped throughout, the Cincinnati & South Covington Street Railway Company's Evergreen line, with a large number of double brackets for wood poles with special ornamental curve brace on each side of the pole under the arm. The Rutland Street Railway Company, of Rutland, Vt., has also recently placed an order for several hundred of Creaghead brackets for its new lines, and a large number of orders for standard brackets have been received and filled by the Creaghead Engineering Company, besides the above mentioned orders for special brackets.

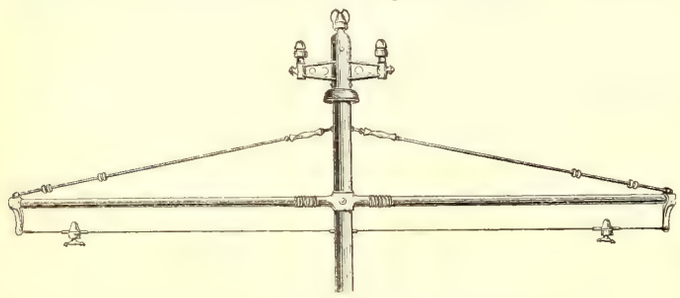


FIG. 3.—DOUBLE FLEXIBLE BRACKET FOR IRON POLES.

By use of this flexible bracket the "hammering" and sudden jars peculiar to stiff forms of brackets are avoided, the first cost of construction is greatly reduced and cost of maintenance brought down to correspond with ordinary span wire construction.

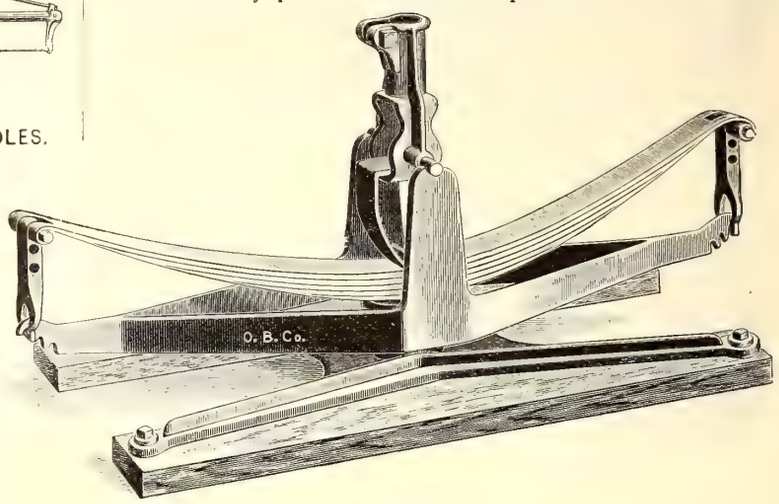
Handsome Vestibuled Cars.

An excellent opportunity is offered by one of our advertisers for a street railway company to secure a small equipment of substantially built and well finished cars. These cars were built by the J. W. Fowler Car Company, and owing to the financial embarrassment on the part of the road for which they were built, the cars were never delivered. They are described in detail elsewhere in our columns this month, together with an illustration of one of the four cars, all of which are handsomely finished and beautifully decorated.

The Ohio Trolley.

The Ohio trolley, manufactured by the Ohio Brass Company, of Mansfield, O., is shown herewith, and is claimed to be very simple and most effective. It is made up of less than a dozen pieces, any of which can be easily duplicated. The spring is the regular flat leaf style, such as any manufacturer of carriage springs keeps in stock. The working parts of the trolley are made of steel and malleable and wrought iron, and in consequence are not easily broken, and do not get out of repair.

The base and stand are three feet long and eight inches wide, and when the trolley pole is in a horizontal position but thirteen inches



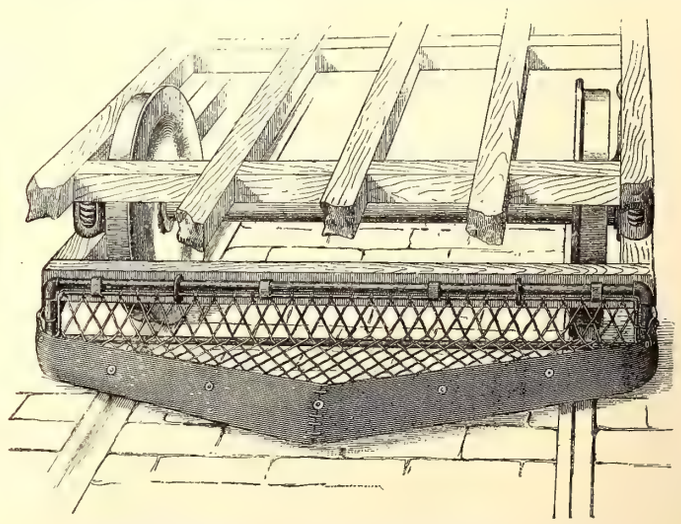
THE OHIO TROLLEY BASE.

high. The trolley pole can be swung either forward or backward or in a complete circle, and the pressure against the trolley diminishes as the pole assumes more nearly a horizontal position. The trolley can be assembled or dismantled in a few minutes' time, without the aid of tools. It is very easy and flexible in action, and will follow the variations of the trolley wire quickly and surely.

In fitting these trolleys out complete the Ohio Brass Company uses its special carbonized steel trolley pole. This pole is drawn cold through a die and is made of the best Norway iron. It is then carbonized to a proper degree to give it sufficient elasticity. It is seamless and endless, and formed to a perfect taper. The claim made on this pole is that it is lighter, more flexible and stronger than the regular style trolley pole. It will not break, and if bent out of shape can be straightened cold without injury. This pole is one of the specialties of the Ohio Brass Company.

Recent Orders of the Sterling Supply & Manufacturing Company.

The Sterling Supply & Manufacturing Company, of New York, reports an excellent business. During the first three weeks in August the company booked orders for several hundred registers. Among these



FENDER USED ON THE BROADWAY CABLE ROAD.

may be mentioned thirty registers for the Columbus Avenue division of the Broadway cable system, a large order from the New Orleans Traction Company, which will amount to about 150 machines; the Consolidated Traction Company, of New Jersey, 100 machines additional; the Yonkers Railroad Company equipment; the Lake Cities Railroad Company, of Michigan City, Ind.; the Geneva & Waterloo Railroad

Company, of Geneva, N. Y.; the Nassau Electric Railway Company, of Brooklyn, for its entire equipment; the Terre Haute Railway system and the Middletown-Goshen Railway Company.

This company has also just been awarded the contract for sixty sand box equipments by the Nassau Electric Railway Company of Brooklyn, and report a large business in this department.

The car fender of the company has been adopted by the Metropolitan Street Railway Company, of New York, and the Third Avenue Railway Company, of the same city, is also using the device. It is designed to be carried as close to the track as possible, and its shape is such as to practically preclude the possibility of any person getting under the wheels. It is made of wrought iron pipe, malleable iron fittings, woven wire and rubber belting. We present a view of the fender on page 586.

The managers of the company seem to find business in a very satisfactory condition, and believe that the best evidence of the merit of their goods is the additional orders which they are receiving for them.

Report of the North Metropolitan Tramways Company.

The annual report of the North Metropolitan Tramways Company of London, England, for the year ending June 30, 1894, was submitted to the stockholders at a meeting held August 10. It shows gross receipts of £227,709 12*s* 8*d*; expenditures, £182,166 5*s* 2*d*. A dividend of 8 per cent. was declared.

Owing to the leading position taken by the company among tramway companies in London some of the facts given in the report will be of especial interest to American readers as giving an idea of the average receipts: Average number of cars running, 324.88; mileage, 49; miles run, 4,177,696; passengers carried, 41,608,498; average receipts per passenger, 2.56 cents; average receipts per mile run, 25.42 cents; percentage of total working and general expenses as compared with total receipts, 79.90.

To better compare the cost of operation, we give below a statement of the provender required for the half year ending June 30, with the prices paid: Maize, 9,857¾ qrs. @ $4.57; oats, 7,296¾ qrs. @ $4.00; beans, 44¼ qrs. @ $8.16; bran, 1,492 cwts. @ $1.19; peas, 5,285 qrs. @ $6.17; barley, 6,580½ qrs. @ $3.24: hay, 2,988½ loads @ $24.54; straw, 1,134 loads @ $12.32.

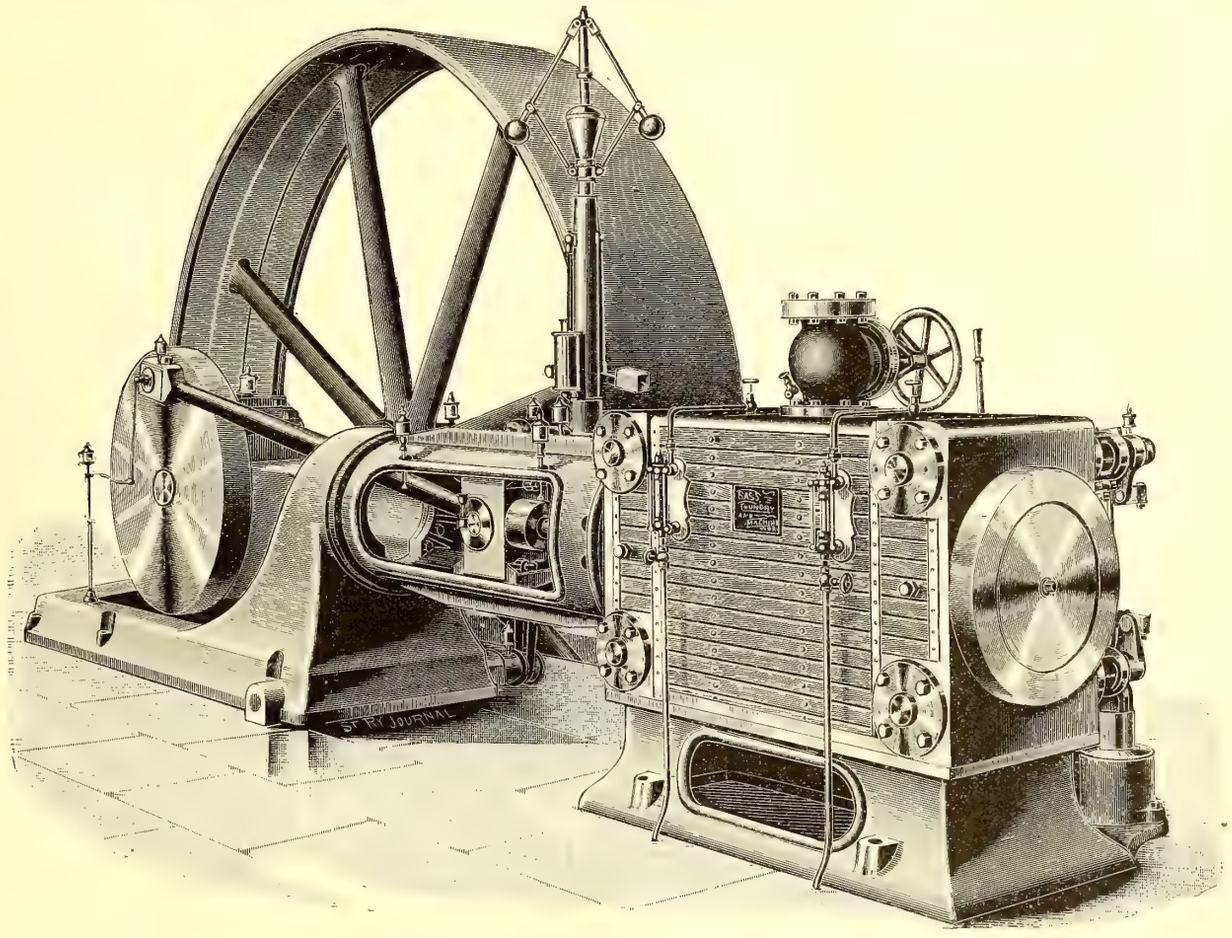
THE Gloucester & Rockport Street Railway Company, Gloucester, Mass., with a capital of $40,000, has been formed to construct a street railway from this city across Good Harbor Beach to Brier Neck, to the line dividing Gloucester from Rockport. The board of directors are D. S. Presson, A. B. Hallowell, F. W. Homans and D. A. White, of Gloucester; W. B. Fergusen, of Malden; A. D. Bosson and J. A. Cunningham, of Chelsea.

A Corliss Engine for Street Railway Work.

The accompanying engraving illustrates a new Corliss engine recently placed on the market by the Bass Foundry & Machine Works of Fort Wayne, Ind. This engine was designed especially for street railway and electrical work and is built to withstand sudden and severe strains.

The general appearance of the engine is shown in the engraving. The cylinders are eighteen inches in diameter with forty-two inches stroke. One of the new and important features is the large ports, they being twenty and three-quarters inches long. The improved valve gear for quickly opening the valve together with the large ports afford perfect steam distribution, there is very little loss in the initial pressure of the steam on entering the cylinder. The steam and exhaust valves are accurately ground on dead centers and the valve gear has a minimum number of parts and is easy of accesss. The governor is of the well known Porter type and is accurately made and highly finished throughout and thoroughly tested.

The construction of the cylinder base and that of the main bearings are such as to give an extra large bearing surface on the foundation. The girder is that portion of the engine bed between crosshead guides, and the pillow block is of very heavy design giving great strength and preventing any torsional strains. The bearings are exceptionally large, the main journal being of a length equal to twice its diameter.



CORLISS ENGINE—BASS FOUNDRY & MACHINE WORKS.

The boxes are adjusted for taking up wear, by means of set screws, and a steel plate is placed between the set screws and the box to receive the thrust of the screws.

The company has recently commenced the manufacture of a special type of engines which embraces all the essential features of the Corliss engine with improved valve gears which admits of a much higher rotative speed than is possible with the ordinary valve gear.

This engine was designed to meet the requirements where space is limited and a high degree of ecomony is necessary. Among the recent orders received by this company are two 30 × 60 in. rolling mill engines for the Newcastle Steel & Fire Plate Company of Newcastle and 36 × 70 × 60 in. tandem engine, with flywheel thirty feet in diameter and seventy eight face turned for rope drive. In addition to these an order has just been received through the New York office for two cross compound engines for the Williams & Clark Fertilizer Company, of Carteret, N. J.

The Bass Foundry & Machine Works has acquired high reputations for condensers, feedwater heaters, engines and boilers.

The Eastern interests of the company are ably represented by H. Ruel Baldwin who has an office in Cortland Street, New York.

WORK on the new electric railway connecting Phillipsburg, (Pa.) Osceola, Houtzdale, Morrisdale, Munson and other neighboring towns and villages has been begun.

New Trolley Head.

We illustrate herewith a trolley harp and wheel which has been recently put on the market. It has been designed after a most careful study of the conditions which this important element of the car equipment has to meet, and, it is claimed, has special advantages.

It is made of the best malleable iron, and also of the highest grade bronze, with steel flange. The crescent section of the side bars adds strength to lightness, and affords a rounded surface which will not catch or dent the trolley wire. They are shaped to give ample room for the edges of the wheel and perfect protection to the contact springs. The pin is fastened by an improved method, giving a large bearing and avoiding sharp corners. The metal is so distributed in the body that the wheel may be entirely worn out; and the wire can never be worn by coming in contact with the harp—an important point.

The wheel is designed to give a greater amount of service than any yet produced. The desired result is obtained by using the highest grade of bearing bronze, and in the proper distribution of the metal. Many of these wheels are still in service after making the excellent record of 10,000 miles, and their merit has been established on some of the leading electric railways in the country. The wheel is one of the the specialties of the Hubley Manufacturing Company, of Lancaster, Pa., which manufactures complete equipments for electric railway and lighting plants. This company is at present doubling the capacity of its works to accommodate the enormous increase in the demand for its apparatus.



NEW TROLLEY HEAD.

Direct Connected Engine and Generator.

The new Mather generator was illustrated and its important features described in our last issue. We present herewith a view of an improved Mather 100 K. W.. direct connected generator and 150 H. P. Ideal engine. The construction of the generator is claimed to be such as to make it particularly adapted to direct connection. The electrical design lends itself very readily to the best mechanical construction, and full advantage of this fact has been taken, the result being a machine perfect in its mechanical details.

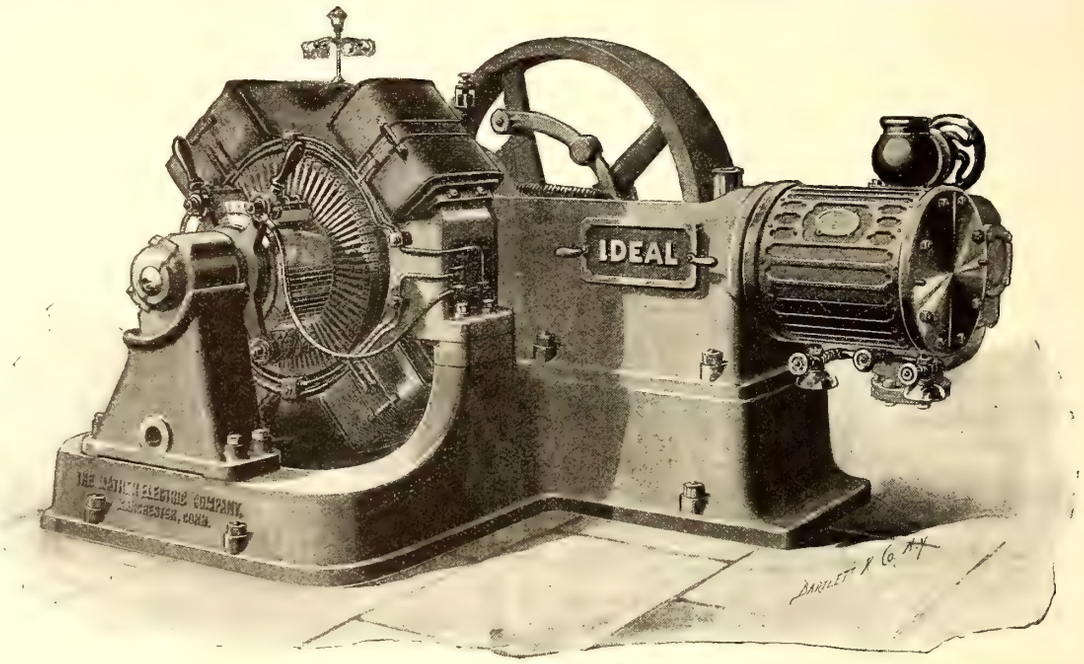
One peculiar advantage of this type of generator over others is that on account of the fields being cast in four pieces, and entirely separate from the frame, all being bolted together, the assembling or taking apart of the generator, or the removal of the armature, is accomplished in an exceedingly short time and with the greatest ease.

They are designed to be directly connected to any first class type of engine adapted for this work, and are exceedingly compact. They are self oiling, self exciting, perfectly self regulating, and after being started, completely self attendant. They are compound wound and manufactured to be equally well adapted for electric lighting, electric railway, or power purposes.

A common difficulty with a generator is sparking at the brushes, which is usually caused by the points of commutation shifting with the variations in the load. It has been the aim of the Mather Company to overcome this difficulty, and that it has been done is proved by the fact that after the brushes have once been adjusted, further change in their position is not necessary, no matter how sudden or how great may be the variations in the amount of current supplied by the generator. One of the tests to which the generators are subjected at the factory is to throw on and off heavy loads, always leaving the brushes in the same position. No sparking, it is said, is caused even by a current in excess of the rated capacity of the machine, and it is impossible to distinguish by watching the brushes whether the generator is loaded or not. All these generators can be operated for an indefinite period at their full rated capacity without any undue or dangerous heating of any of the parts.

One great advantage of these generators is that on account of the field and armature being practically identical with those of the company's standard multipolar generators, it has been able to design testing frames, upon which before shipping, every generator can be set up and run under conditions similar to those it is intended to meet in actual practice, and no machine is allowed to leave the factory unless meeting all requirements as to its mechanical and electrical perfection.

Four or more sets of brushes, as may be required, according to the conditions, are used. Each is held in an independent holder; hence any single brush can be raised from the commutator without disturbing the others, and each, having its own spring, may be perfectly adjusted. The diametrically opposite brushes are of the same polarity and are connected. The rocker arm of the brush holder is of rigid construction, and the different parts are perfectly insulated; it is designed so that it will adjust all the brushes simultaneously.



DIRECTED CONNECTED ENGINE AND GENERATOR.

The Siemens & Halske Company Ready for Work.

On August 1, there occurred in Chicago a disastrous fire which destroyed the plants of the Siemens & Halske Company, the Wells-French Car Company and other important plants. Fortunately the most important plans and patterns of the Siemens & Halske Company were saved, and immediately after the fire the directors voted to resume manufacturing as soon as possible. The results of the fire will be quite important. The Siemens & Halske Company and the Wells-French Company have made an arrangement together with the revived Grant Locomotive Works of Cicero, near Chicago, to be combined in a new corporation to be known as the Siemens Company, with a capital of $2,000,000. Operations will be begun at once at the old Grant Locomotive Works. Motors, railway cars and all kinds of electrical devices will be manufactured. Every separate product of each of the three old companies will be turned out by the new company, and it is predicted that the new concern will develop into one of the largest manufacturing corporations in the world. It is probable that the new company will engage between 1,000 and 2,000 men, and over 600 will be put to work immediately, while an investment of several thousand dollars will be made in enlarging the Grant Works. The company promises to deliver electrical apparatus within sixty days.

Among the first orders which the company will complete will be the dynamos for the West Chicago Street Railway Company and the Garden City Street Railway Company, which will supply power for the electric cars of the West and North Side Yerkes' system in Chicago.

The West Side station is to be located at the corner of Washington Boulevard and Western Avenue, where the repair shops and stables are located. The Siemens & Halske Company will build three 2,000 H. P. and one 1,000 H. P. generators for immediate use, but the ultimate capacity of this central plant will require five dynamos of 2,000 H. P. each and one of 1,000 H. P.

A corporation to be known as the Milton & Boston Street Railway is being formed in Milton, Mass., with a capital stock of $50,000. The company will build an electric street railway from East Milton to Mattapan, a distance of about four miles, and connect with the Dedham Street Railway at Mattapan. A preliminary organization has been made with A. A. Brackett, J. R. Lawrence, D. J. Brown, W. H. Rice, of Milton; J. A. Duggan, T. H. McDonnell and W. P. Pinel, of Quincy, as directors.

A New System of Transportation.

We show on this page a new type of electric car, the invention of Charles H. Barrows, of Willimantic, Conn., who is also the inventor of the Barrows' elevated and surface railway system now being constructed in Baltimore County, Md., by the Randallstown, Granite & Harrisonville Rapid Transit Company. The car embodies some new and valuable features which will be of interest.

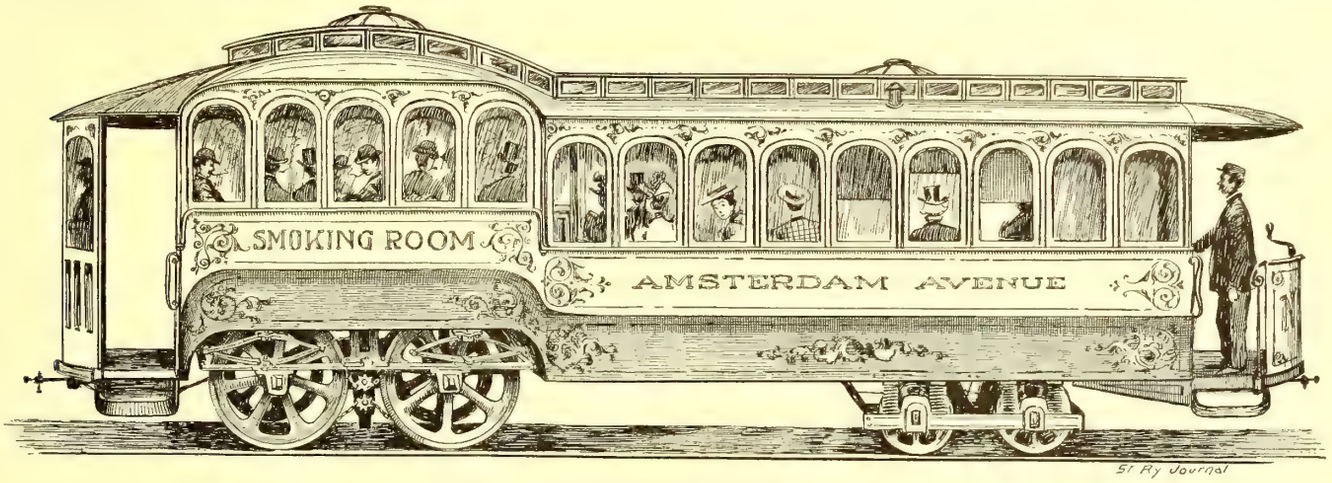


FIG. 1.—THE BARROWS ELECTRIC CAR.

Fig. 1, gives a perspective view of a double truck car, thirty-two feet over all. These cars can be built, of course, in any length with either double trucks or single trucks, and can be run as motor cars or in trains. The motor is directly connected with all four driving wheels, and as 75 per cent. of the total weight is on these wheels there is ample tractive force to haul a heavy load.

The truck, as will be seen from Figs, 2 and 3, is of novel and ingenious design. The single motor is fixed in the center of the truck, and elastically supported by hangers and bars from the sides and ends of the truck frame, having no contact or connection with the axles which are entirely free from any friction, except at the boxes, where they are journaled in anti-friction bearings. The motors for these cars are built for high speed, and the higher the better, for the greater the number of revolutions the greater will be the leverage for a given speed of the car, and with this sprocket chain driving mechanism, with a sufficient speed of the motor the diameter of the driving pinions might be reduced to simply a couple of spurs on the armature shaft.

Each end of the armature shaft of the motor is provided with one or more small spur driving pinions which engage with the one or more sprocket driving chains which encircle the driving drums of the driving wheels. Each driving drum is provided with a groove in which is seated a yielding or elastic filling, which furnishes a soft bearing for the chains and increases the frictional contact between the chains and the drums. The sprocket chains are endless and completely encircle the driving drums of the driving wheels, and are in like engagement with the driving pinions on the armature shaft of the one motor. The proper tension of the chains is created and maintained by means of adjustable idle pulleys under the chains and over which the chains run, as may be seen in the cut.

The application of the power of the motor to the propulsion of the car is by a direct pull on a line from near the periphery of the driving wheels to very near the center of the armature shaft, and may be likened to the act of pulling on a rope hand over hand with the rope

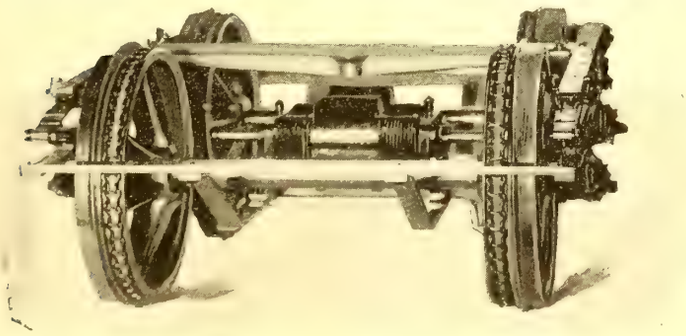


FIG. 2.—END VIEW—BARROWS ELECTRIC TRUCK.

around the circumference of the wheel to be turned. In this manner the power of a fast speed motor is utilized, a point of considerable advantage, as the weight of the motor can be greatly reduced.

The car is supported at points very near the truck axles, the wheel base being so short, four feet or less. The absence of gearing and all the heavy parts of the usual equipments obviates the necessity of heavy truck work, and reduces the dead weight of iron to a minimum.

The car body is of the lightest possible structure consistent with the necessary strength to sustain the load. The short wheel base creates very little friction on curves. The central situation of the motor admits of its being enclosed in a light dustproof and watertight case. The compartment for smokers is a feature that will be very popular with the public. The general contour of the car is pleasing to the eye. Its outlines are graceful and its furnishings of the latest improved styles. It is claimed that there will be no end teetering or jolting when starting, an account of the long leverage available, and it may be put into full speed from a dead stop almost immediately. The body is low and of easy access, and the entire car has an attractive and business like appearance.

The Chicago General Street Railway Company's Car House Competition.

The Chicago General Street Railway Company, whose offer inviting drawings and specifications of a model plant for the use of

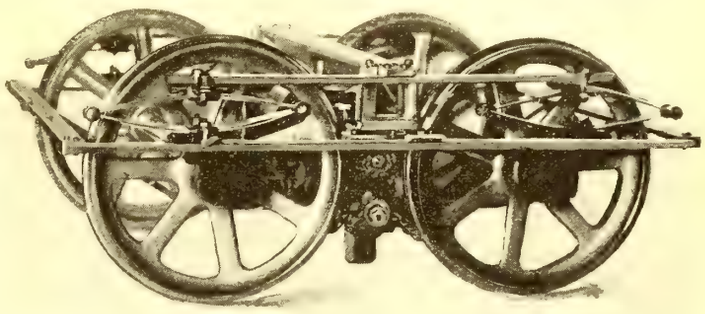


FIG. 3.—SIDE VIEW—BARROWS ELECTRIC TRUCK.

forty cars, was published in the STREET RAILWAY JOURNAL, has awarded the prizes in its competition. The first prize of $100 was awarded to J. R. Cravath, electrical editor of the *Street Railway Review*; the second prize of $75 to Caywood & Ritter, contracting engineers, Chicago; third prize of $50 to A. S. Krotz, an engineer of Springfield, O.; fourth prize of $25 to E. W. Goss, superintendent of the Amesbury Electric Light, Heat & Power Company, Amesbury, Mass.

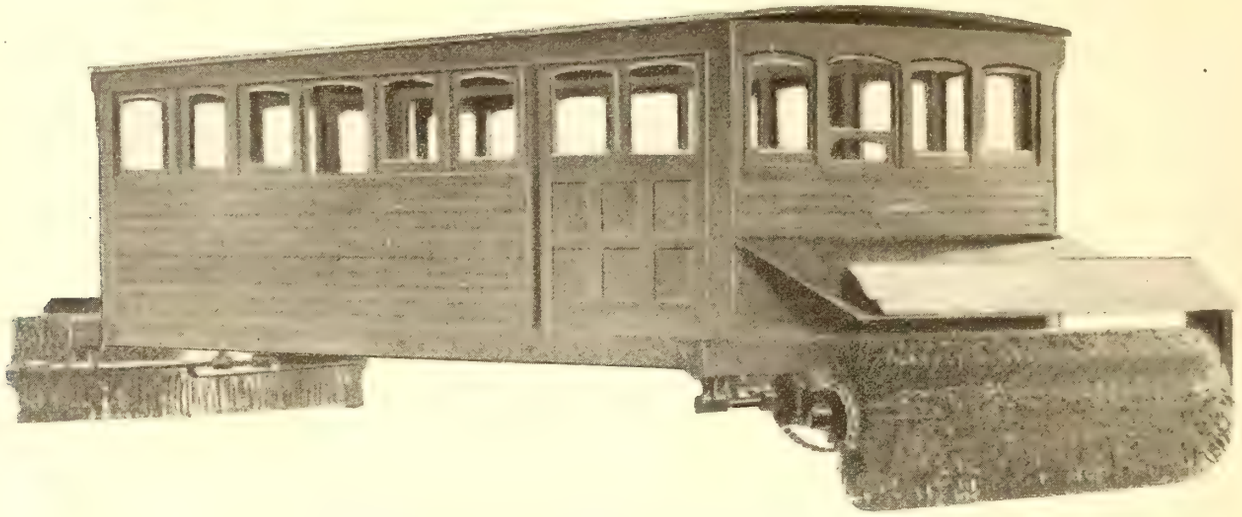
None of the plans selected will be used in full, but ideas will be adopted from each. The site selected for the new power plant is a four acre lot corner of Kedzie Avenue and 31st Street. It is expected that a car shed 125 × 300 ft., engine room 100 × 100 ft. and boiler room 100 × 60 ft. will be constructed this fall, the other buildings to follow as rapidly as the work will permit. The operation of the present lines will be under the management of the president, Congressman McCann, and the superintendent, W. F. Brennan, while C. L. Bonney, vice-president, will have charge of the construction of the new lines and power plant.

Extensive Contract at Lancaster, Pa.

The Lancaster Railway Construction Company, has been awarded a contract by the Pennsylvania Traction Company, for building forty-three miles of electric railway in Lancaster County. The lines will run from Lancaster to Manheim, Lancaster to Mechanicsburg, New Holland, Blue Ball and Terre Hill, with an eight mile branch from Mechanicsburg to Ephrata. The specifications call for Pennsylvania Railroad standard construction, including switch and signal system. The overhead construction, and all equipment will be of the highest grade, and must be completed, ready for service, within ninety days. The Lancaster Railway Construction Company is a chartered corporation with the following officers: Henry Baumgardner, president; Michael Reilly, vice-president; F. H, Steacy, secretary; J. E. Hubley, treasurer; H. E. Crilly, superintendent of construction.

A New Type of Electric Railway Sweeper.

We present herewith an engraving of a new electric sweeper for street railways built by the Brooklyn Railway Supply Company, of Stamford, Conn. The sweeper possesses a number of very novel features, which, it is claimed, will add greatly to its practical usefulness, and we have no doubt that the sweeper will make an excellent record during this winter.



ELECTRIC RAILWAY SWEEPER—WITH ADJUSTABLE BROOMS.

One striking feature of the sweeper is that the forward end of the cab, instead of being at right angles with the sides, as in an ordinary car, is inclined to the sides at the same angle as the revolving broom, *i. e.*, about 45 degs. There are a number of advantages gained by this construction. The brooms are brought entirely out from under the car, and they can be raised and lowered as desired. They can also be very easily inspected by the operator from the car window. Another advantage gained by this arrangement is ease in attaching and detaching the broom, the brackets holding the main shaft to the sweeper being bolted directly to the frame.

Another advantage of the sweeper is that, owing to the removal of the revolving brush from under the car body, the cab can be placed as low or as high above the track as desired. In other words, the cab does not require a special truck, but can be mounted on any truck owned by the railway company, saving in this way an entire electric equipment. The connection between the revolving brush and main shafts is made by an intermediate sprocket, which affords perfect freedom to the brooms while being raised or lowered. The main shaft is driven by a sprocket chain from a motor carried in the cab. Access is provided by a door at the side, as shown in the engraving.

The Falkeneau Engineering Company has just been organized in Philadelphia, as consulting and constructing mechanical and electrical engineers. The company is composed of Messrs. Keller, Willyoung and Pike, all formerly connected with Queen & Company, and Mr. Falkeneau, a well known Philadelphia engineer.

A New Car Fender.

The fender shown in the accompanying engravings on this page was invented by Oswald W. Routh, of Greenville, N. J. The engravings show the fender attached to a car of the Newark (N. J.) & South Orange Electric Railway.

Fig. 1 shows the fender ready for operation. As will be seen, there is a curved pick-up in front of the car, provided at its outer end with a roller, so that it will not dig into the ground even when the car enters upon a steep grade. Fig. 2 shows the fender just after a person has been picked up.

The most important claim made for the invention is in the use of the auxiliary screen carried just behind the main pick-up, making it practically impossible for a person who is struck to be crushed by the wheels. If by any accident, the person struck should fall forward on the track, so that the front screen would pass over him, the auxiliary screen or fender, which is three feet in the rear and which works automatically, would drop down and push him off the track. This is an important point in favor of the device.



FIG 1.—FENDER READY FOR USE.



FIG. 2.—FENDER IN OPERATION.

The International Register Company of Chicago, seems to have no difficulty in securing a constant supply of orders for registers. The machine of this company has achieved such a wide reputation that it is regarded as indispensable by many leading street railway managers. One of the notable contracts received by this company recently was from the Kansas City Cable Railway, of Kansas City, Mo., for 100 portable machines for equipping the Grand Avenue division of the Consolidated system. The lines of some of the divisions of the Kansas City Railway have been long users of registers, and have given them a thorough test, so that the adoption of the International type after such a trial means a strong endorsement for the machine. The International register is becoming recognized more and more every day as a standard, high grade register, and the record made by it is one which reflects great credit on the manufacturers.

The New York Wood Vulcanizing Company and Its Process for Preserving Ties, Poles, Cross-arms, etc.

The extensive works where this company carries on its process of vulcanizing wood for the purpose of preserving and strengthening it, are located at 155th Street, and the Harlem River, New York City, where they occupy a plot of ground 600 × 250 ft. with a water frontage of 250 ft. There are excellent dock facilites with sufficient depth of water for large lumber schooners. An exterior view of the works is shown in one of the accompanying illustrations.

The main building is of brick 125 × 152 ft. The boiler room is 30 × 125 ft., and contains two Campbell & Zell water tube boilers of 150 H. P. each. In this room are also the heating and cooling tanks, circulating engines and air compressors. There are two "straight line" compressors built by the Ingersoll Sergent Company. The steam cylinders are thirty inches in diameter and the air cylinders twenty inches with a thirty inch stroke. The heating and cooling tanks are each twelve feet long by forty inches in diameter. Steam from the boiler is superheated and passes through tubes in the air heating tank from which the air is forced to the vulcanizing tanks and is kept in motion by the circulating engine.

Adjoining the engine room is the vulcanizing room where there are four vulcanizing tanks of three-quarter inch steel each 103 ft. long and six feet six inches in diameter with a capacity of 18,000 ft. of lumber each. Inside of these huge tanks, the end doors of which are shown in one of our illustrations, are placed suitable tracks on which the cars, loaded with lumber are run. These cars are of iron 8 × 3 ft. and trains are operated by a hoisting engine and steel cables. There is a transfer table which will shift cars to sixteen different tracks running to the wharves, so that excellent facilities are afforded for handling large orders.

In the process of vulcanizing the wood is heated in these closed cylinders from eight to twelve hours at a temperature ranging from 280 degs. to 400 degs. Fahrenheit and under a pressure of from 80 to 150 lbs. to the square inch. A circulation of superheated and dried compressed air removes the surface moisture and any water that does not take part in the reaction and combine with the woody constituents. Hence, wood or timber, in any condition, may be immediately treated. As the treatment penetrates to the heart of the timber, considerable time is required for cooling, which is, of course, done in the cylinder and under pressure. Timber is introduced and treated while upon the cars which run into the cylinder upon small tracks.

As vulcanizing changes the sap from the liquid to the solid or semi-solid state, does not char or make the wood brittle, saturates and seals up the pores of timber with solid matter instead of liquid soluble matter which nature provides, considerable strength and durability are added by vulcanizing, the wood being rendered more cohesive, harder and denser. The spike-holding quality is naturally much increased, and even after ten years' service railroad spikes seem to be as firmly imbedded as when just driven.

The life of vulcanized timber is not known; none of the timber or ties used in railway construction during the past ten years have been known to decay. Timber placed on the Manhattan elevated roads of New York City, as far back as 1883, shows no signs of decay, and is as sound and sweet as if fresh from the tree, while untreated timber laid at the same time has rotted away and has been replaced.

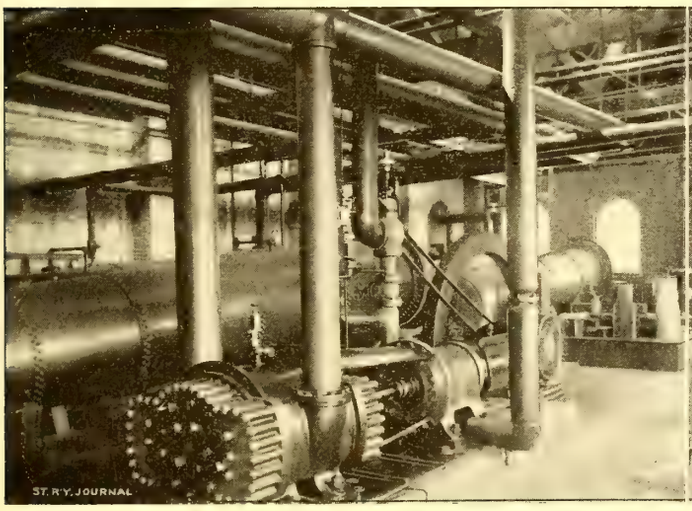
In 1883 about 1,000,000 ft. of lumber was treated for the Manhattan Elevated Railroad Company, with no charge for treatment, as a the test of the preservation from decay of vulcanized wood. This the company had in use six years before a comparative and critical examination was given it. The result of this investigation proved that while the average life of untreated wood was between five and six years, this treated wood, at the expiration of six years, showed no evidence of decay. From that time up to the present the Manhattan Company has used nothing but vulcanized lumber for ties, guard rails and slatting, and has had vulcanized since that date, nearly 20,000,000 ft. of lumber. From March, 1891, to March, 1893, the Manhattan Company had vulcanized 5,500,000 ft., and since March, 1893, about 4,500,000 ft. The timber that was first put in in June, 1883, is still in use and in perfect condition, and this fact is well attested by authoritative statements made by Colonel Hain, general manager of the Manhattan Company, and R. Black, superintendent of tracks.



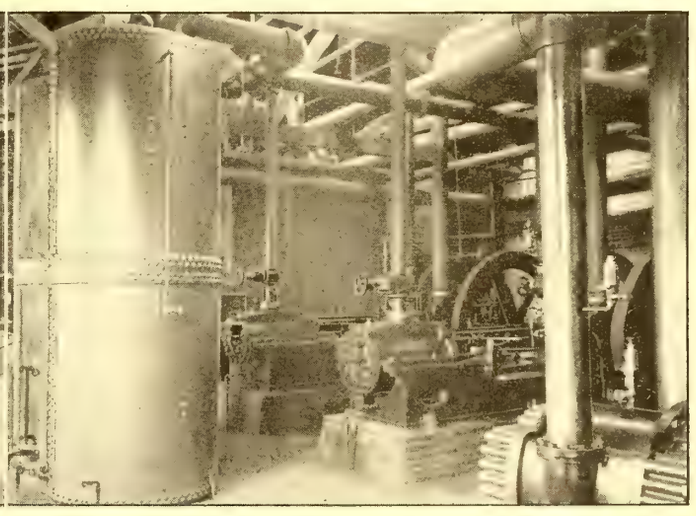
WORKS AND CARS LOADED FOR VULCANIZING.

In the fall of 1883 six yellow pine ties were laid in the switch-yard of the New York Central & Hudson River Railroad. In 1891 two of these ties were taken up for examination and found to be perfectly solid, the spikes having held as firmly as they were when first driven. In 1893 three of these ties were taken up and found to be in perfect condition. There was unusually severe wear on the ties in the switch-yard, and their life is ordinarily but three to four years.

In June, 1883, eighteen yellow pine ties were laid on the Newark branch of the New York, Lake Erie & Western Railroad near Bergen tunnel. At the same time, white oak, untreated ties were laid adjoining them. The latter have all been replaced once, and some of them twice. Twelve of these yellow pine ties are still in use in their original position and are as good and sound to-day as when first laid. One of the ties has been taken up by the railroad comoany for examination and found to be in good condition.



CIRCULATING ENGINE, HEATING AND COOLING TANKS



AIR COMPRESSORS

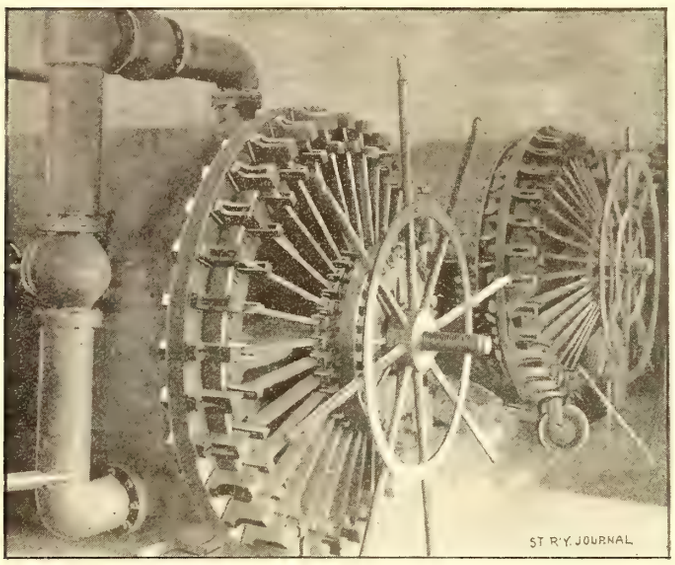
To the increased weight on single locomotive driving wheels within the past eight years—from 16,000 to 24,000 lbs. upon one road—is due 50 per cent. of the renewals. The other 50 per cent. is due to decay. Up to the time railroads commenced using this heavy equipment, the renewals were almost entirely due to decay. After the weight of locomotives was increased 50 per cent., an increased weight of rail was demanded, and this increased the rail base from four inches to five inches, overcoming the resistance about 25 per cent.

From tests made by Prof. Alfred Trautwein, the process of vulcanizing increases the compression strength of yellow pine 25 per cent. Therefore, it will be seen that by the increase of one inch of rail base and of 25 per cent. in strength by the process of vulcanizing, it brings the tie back to its original condition, when renewals were mainly due to decay.

This company has also sold quite a quantity of vulcanized yellow pine to the Edison Electric Illuminating Companies of New York and

Brooklyn for subway purposes, and to the Cleveland, O., and New England Telephone and Telegraph companies. About 500,000 ft. of cross-arms have also been vulcanized, among the purchasers of which are the Southern New England Telephone Company and the New York & New Jersey Telephone Company.

Besides these strong recommendations as to the value of vulcanizing, excellent results were obtained from tests made by Dr. R. H.



DOORS OF VULCANIZING TANKS.

Thurston, Director of Sibley College, and by Prof. C. F. Chandler, of Columbia College, indicating its value when applied to the treating of cross-arms, poles and ties.

The Demand for Emergency Wagons.

Owing to a constantly increasing business, the Gleason & Bailey Manufacturing Company, of New York, has found it necessary to greatly enlarge its already extensive works.

One of the specialties manufactured is a wrecking wagon for cable and electric street railways. These wagons are especially designed to meet the requirements of street railways, and are constructed through out with the same high class of workmanship and material that is required in the manufacture of fire department apparatus. The wagons are provided with end and side entrances. A central tool box with removable cover extending the full length furnishes seats for the crew. Arranged along the sides of the tool box are spring sockets for holding axes, picks and small crowbars. There are also lockers under the driver's seat and underneath the wagon body, filled with pulley blocks and tackle and all apparatus necessary to meet any emergency. The wheels are of the Sarven type with overlapping steel tires and open hubs. Bronze nuts are used and are fastened with steel cotter pins. The springs are of the best quality of steel and oil tempered.

Powerful self releasing brakes are provided, which can be operated from either side of the driver's seat. An alarm bell of the locomotive type is attached to the front of the wagon body and is operated by the driver's foot. In addition to the wrecking tools the wagons are provided with "needles" for building temporary bridges to support the hose over the car tracks.

In electric railway service strong and light extension ladders for repairing overhead wires are included in the equipment.

Important Purchase by the Fort Wayne Company.

The Fort Wayne Electric Corporation has purchased the factory, patterns, patents, etc., of the Wenstrom Electric Company of Baltimore, Md. The Wenstrom patents, it is claimed, cover some important points in dynamo and motor construction. It is said that the Fort Wayne Corporation will extend its business so as to include street railway work, and that the purchase of the Wenstrom plant is the first move in that direction.

Large Truck Order Awarded.

As our last form is on the press the announcement is made of the award of a large order of 120 trucks by the Chicago City Railway Company.

The type of truck selected is the Columbian, manufactured by the McGuire Manufacturing Company, of Chicago. This is the third order received by this company for trucks from the Chicago City Railway Company, a fact which speaks volumes for McGuire trucks.

Street Railway News.

New Roads.

Anderson, Ind.—The company proposing to connect several gas belt cities by electric railway has petitioned the Madison County Commissioners for right of way on thirty miles of pike road.

Annapolis, Md.—An electric railway is proposed to connect Annapolis with Bay Ridge. The incorporators so far agreed upon are Thomas C, Musgrove, Luther H. Gadd, George T. Melvin, James H. Vansant, Daniel J. Saunders and L. H. Rehn. The capital stock is placed at $20,000. The road will be entitled the Annapolis, Brighton Beach & Bay Ridge Electric Railway of Anne Arundel County.

Arundel, Md.—It is reported that certain citizens of Annapolis, in connection with Philadelphia capitalists, will build and equip an electric railway from Annapolis to Bay Ridge and Arundel-on-the-Bay. Thomas C. Musgrove, of Philadelphia, is said to be interested in the enterprise.

Braddock, Pa.—The Braddock Electric Street Railway Company has been granted the right of way over Talbot Avenue and Eighth Street. The company had the right of way over these streets three years ago, but allowed it to lapse.

Braintree, Mass.—The Board of Selectmen has granted a location for a street railway to the Braintree Street Railway Company.

Brooklyn, N. Y.—The Rockaway line of the Nassau Electric Company, to operate between Broadway and Jamaica Bay, is being rapidly pushed to completion.

Charleston, S. C.—Julian Fishburne and associates have petitioned for permission to build a trolley line through the main streets, the same to be completed in eighteen months.

Chicago, Ill.—The Northern Electric Railway Company has been granted a franchise by the city of Chicago, giving it the right to lay tracks from West 47th Street and Lake Street, north to Cragin Street, and west to Hansen Park. Paul Dickinson will be president, and will have charge of the purchase of all supplies for the new company. His address will be 68 Churchill Street, Chicago. The company is in the market for eight miles of track and all equipments, such as engines, generators, cars, trucks and line material.

An ordinance has been introduced in the County Board, providing for the granting of a franchise to the Morgan Park Electric Street Railway Company, for an electric line between West Pullman and Morgan Park.

C. E. Loss, 621 Pullman Building, Chicago, has secured a contract to build two miles of road and will buy all equipment outside of the power plant, which is already built. Mr. Loss is in the market for cars, trucks and overhead material for this line.

Cohoes, N. Y.—The Cohoes City Railway Company was incorporated lately with a capital of $50,000. The directors are Urban Weldon, Murry Hubbard, G. W. Lansing, George E. Simmons and others.

Columbus, O.—It is stated that a movement has been started here to build an electric railroad to Cincinnati. The County Commissioners have granted the right of way on certain conditions, one of which is that work is to begin on the road by December 1 next, and that it must be in operation by December, 1896. The following parties are interested: L. D. Hagerty, Columbus; Henry B. Moorehead and Dennis Dwyer, Cincinnati and O. B. Brown, Dayton.

The question of granting the Columbus & Buckeye Street Railway Company the right of way along the old National road between this city and Hebron, with a three mile branch along the shore of Buckeye Lake, came recently before the County Commissioners. The company has a capital stock of $100,000. The incorporators are James H. Anderson, C. B. Cowan. DeWittC. Jones T. J. Keating, George J. Converse, R. R. Dubois and William F. Simonton.

Doylestown, Pa.—The Bucks County Railway Company was incorporated August 3, with a capital stock of $100,000, to construct and operate an electric railway at Doylestown, Bucks County, Pa. Francis Fenimore, of St. Davids, Delaware County, Pa., is the president of the company. Other stockholders are Wm. Jenks Fell, 131 South 5th Street, Philadelphia, and Marshall S. Lynch, of Philadelphia.

Gaithersburg, Md.—The Chevy Chase & Kensington Rail way Company has been organized to construct an electric railway from the present terminus of the Rock Creek Railway to Kensington. The following are the officers: President, Oliver R. Harr; vice-president, Alfred Ray; secretary and treasurer, W. H. Walker.

Hammond, Ind.—A movement is on foot for the building of another electric line between this city and Chicago. The line will run through West Hammond, Burnham, and will connect with the Calumet electric line and 108th Street. Talford Burnham is one of the projectors.

Hanover, Mass.—The Selectmen have granted the petition of the directors of the Hanover Street Railway Company for a franchise to lay tracks from a point near the boundary line between Rockland and Hanover through Webster Street to the Norwell line, a distance of three miles.

Hartford, Conn.—The directors of the Hartford, Manchester & Rockville Tramway Company have authorized M. S. Chapman, the president of the company, to let the contract for building the line to Manchester.

Lockport, N. Y.—The Lockport City & Olcott Electric Railroad Company was incorporated August 18, to construct an electric railway about twenty miles in length from Lockport to the village of Olcott, on the south shore of Lake Ontario. The capital is $200,000, and among the directors are, William T. Holt, Noel Gale, George E. Dunscombe and F. Eugene Crasson, of New York City.

Marlboro, Mass.—At a special meeting of the Aldermen recently, the location of the proposed electric railroad between this city and Hudson was defined and the franchise for the road granted.

Milford, N. Y.—The Milford Town Council has granted the Delaware Valley Electric Railway the right of way through the borough.

New Bedford, Mass.—The question is being discussed among residents of Mattapoisett and Marion, of an electric railway to connect these towns with Fairhaven and thence to this city.

Pawtucket, R. I.—The petition of the Moshassuck Valley Railroad Company, for permission from the Town Council of Lincoln, to operate an electric railway line from Saylesville through Branch Avenue and the Smithfield Pike to the Pawtucket line, was lately presented to the Board of Aldermen. The Board also received a petition from the Pawtucket Street Railway Company covering the same district.

Philadelphia, Pa.—The Philadelphia, Cheltenham & Willow Grove Electric Railway Company has awarded the contract to build the line from Rising Sun to Jenkintown, over the York turnpike, to William Wharton, Jr., & Company. Work is to be completed through the borough of Jenkintown by November 1.

THE Aramingo Avenue Passenger Railway Company was incorporated August 6, with a capital stock of $12,000. Henry C. Moore, of 624 N. 22d Street, is the president of the company. Others interested are Henry M. DuBois and David C. Golden, of Philadelphia.

ON August 20 there was chartered the Chestnut Hill & Spring House Passenger Railway Company, of Philadelphia; capital $48,000. The incorporators are Henry C. Moore, David C. Golden, Joseph C. Lugar, Hyland C. Murphy, Robert C. Shelmerdine and Nelson Sailer.

Port Carbon, Pa.—The Tamaqua & Pottsville Electric Railway Company has filed a declaration of its intention to extend its main line from Port Carbon to St. Clair, and thence to New Castle and Frackville and down to Maizeville in the Mahanoy Valley.

Pottsville, Pa.—The Pottsville Traction Company was incorporated July 30, with a capital stock of $200,000, to construct and operate an electric railway at Pottsville. Wilbur F. Sadler, of Carlisle, is the president of the company; other stockholders are W. F. Sadler, Jr., and L. S. Sadler, of Carlisle.

S. B. EDWARDS, solicitor for the Pottsville, St. Clair & Minersville Railway Company, is reported to have declared that the company will be ready to commence the road immediately after the right of way has been granted. The road is to be ten miles in length, and has a capital of over $150,000.

Poughkeepsie, N. Y.—It is stated that the electric road between Poughkeepsie and Wappinger's Falls, which is approaching completion, is only one of a chain of electric railways connecting all the inland towns between New York and Albany, and that a road connecting Wappinger's Falls with Fishkill will next be constructed.

St. Paul, Minn.—The Assembly has extended for one year the franchise of the Fifth Ward Transfer Railway Company. The original franchise was given two years ago, and the company was to have completed fifty miles of road into St. Paul by August 1 of this year. The promoters are Mayor Smith, C. H. Petsch, M. D. Munn and others.

Sandusky, O.—The Sandusky Valley Electric Railroad Company, of Upper Sandusky, was incorporated July 31 by John O. Wirick, Frank Dunn R. R. Dunn, G. H. Reynolds and Thos. Carroll. The company will build an electric road from Marion through Upper Sandusky, Tiffin and Fremont to Fort Clinton. The capital stock is $10,000.

Taneytown, Md.—At a meeting held in this place recently a permanent organization was effected in the interests of the electric road which is projected from Baltimore to Gettysburg. A. H. Zollickoffer was elected president, and Martin Hess secretary.

Taylor, Pa.—The Scranton & Pittston Traction Company has been granted the right of way through the borough of Taylor.

West Chester, Pa.—The West Chester & Philadelphia Turnpike Company has procured a charter for an electric railway, and contemplates the construction of a trolley system from Philadelphia to West Chester via Newtown Square, with a branch line from the latter point to Paoli and various other points.

Westerly, R. I.—A meeting of citizens was recently held here to further the project of the Westerly & Jewett City Railroad, and the extension of the electric railway system through White Rock to Ashaway.

Westminster, Md.—At a meeting of the citizens of Westminster interested in the building of an electric railway between Union Mills and Reisterstown, Herbert T. Shriver, Chas. E. Stewart, John L. Reifsnider, Charles Gorsuch, George Albaugh, William B. Thomas, George W. Webb, E. J. Sawyer and Governor Brown were named as the incorporators of the Westminster & Union Mills Electric Railway Company. The capital stock was fixed at $250,000.

Worcester, Mass.—A new street railway corporation is being formed by Boston and Worcester capitalists to build a new line of electric road within the city limits. The capital is $100,000. It is understood that two of the leading spirits in the movement are G. F. Brooks, of Boston and Edw. Buxton, of Worcester.

The Acme Cable Grip.

The Hell Gate Machine Works of New York, Geo. Rothenbücher, proprietor, have designed and put on the market, a new cable grip entitled the Acme cable grip. This cable grip permits the crossing of all cable car tracks, without the attention of the motorman, thereby making it more safe, as no damage or accidents can occur at junctions or crossings through the negligence of the motorman. As soon as a car comes to a junction or a crossing of another cable car track, the grip opens automatically and, releasing its hold, passes the crossing or junction without the special attention of the motorman which is now necessary. It again takes hold when the crossing is passed. It can be attached to any regular cable car with little loss of time and expense. It is a very simply constructed affair, yet very strong and durable. The factory of the Hell Gate Machine Works, is at 304–306 East 95th Street.

New Publications.

The Twenty-seventh Annual Number of Poor's Manual of Railroads. Published by H. V. and H. W. Poor, 44 Broad Street, New York. Price $7.50.

"Poor's Manual of Railroads" has come to be recognized as an authority on the subjects upon which it treats, and we believe that the twenty-seventh annual report will be as popular, if not more so, among investors, as previous numbers. Data in regard to street railway corporations are included now in the manual, and the book contains some 300 pages more of reading matter than that of last year.

The Banker's Almanac and Register and Legal Directory for 1894. 663 pages, cloth. Price $4 or $7 per year. (July edition.) Published by the Homans Publishing Company, New York.

The July number of this valuable compilation, which is issued half yearly, has just been published, and contains the usual data corrected to date. This almanac and register is published under the supervision of the "Banker's Magazine," and covers the entire banking field, giving a list of the national, state and private bankers of the United States, with president, cashier, capital, etc., the banks and bankers of Canada and the principal cities of Europe, the savings banks, trust companies and safe deposit companies of the United States, and other allied information. The work has been published for forty-four years, and is properly regarded as the standard in the field which it covers.

Personal.

Mr. Albion E. Lang, of Toledo, O., sailed for Europe last month.

Mr. P. S. Bemis, Jr., is no longer Western representative of the Peckham Motor Truck & Wheel Company.

Mr. H. M. Littell, general manager of the New Orleans Traction Company, was in New York last month on a business trip.

Mr. E. S. Goodrich, president of the Hartford Street Railway Company, of Hartford, Conn., was in New York last month.

Mr. B. J. Jones has resigned his office of superintendent of the Riverside Park Railway and the Sioux City & Leeds Electric Railway.

Mr. T. H. McLean, general manager of the Citizens, Street Railway Company, of Indianapolis, was in New York for a short time during August.

Mr. John Brolles, assistant secretary of the Third Avenue Railway Company, New York, was united in marriage August 26, to Miss Jennie E. Jourdan.

Mr. F. A. Christensen, owner of the Christensen Air Brake Company patents has entered the employment of the Edward P. Allis Company, of Milwaukee.

Mr. F. H. Stanwood, of the Stanwood Manufacturing Company, of Chicago, was in New York last month, and visited the office of the STREET RAILWAY JOURNAL.

Mr. R. T. White, of Boston, well known by street railway men as the inventor and promoter of an elevated railway system of certain types of track specialties, died about the middle of August.

Mr. G. E. Pratt, was in New York last month. Mr. Pratt reports an increasing demand for the Jackson & Sharp cars especially in the New England States and Michigan, and that an order from any company is usually followed by a second order for cars.

Major H. C. Evans, the well known representative of the Johnson Company, in New York, met a sad bereavement last month in the death of his only child, John Evans, 2d, at the age of ten months. This death occurred at Lawrence Beach, L. I., and was caused by inflammatory rheumatism.

Messrs. R. T. Baker, president of the Columbia Railway Company, W. B. Upton, engineer of the Columbia Railway Company, and W. Y. Stephenson, president of the Metropolitan Railway Company, R. D. Weaver and O. C. Green, all of Washington, D. C., were in New York last month, and called at our office.

Mr. W. C. Wood, who is well known to street railway men throughout the country by his work in the design of special track work, has recently taken a position with the New York Frog & Switch

Works, at Hoboken, N. J. This company has added a street railway department of which Mr. Wood will be in charge.

Mr. W. E. Cooke, engineer and sales agent of the Peckham Motor Truck & Wheel Company, is now in charge of the Chicago office of that company in place of the former agent, Mr. P. S. Bemis, Jr., who recently resigned. Mr. Cooke is thoroughly acquainted with the mechanical as well as the commercial branch of the street railway business, and will undoubtedly meet with a cordial reception from the Western trade.

Mr. D. W. Sharpe, who resigned his position as superintendent of the Consolidated Traction Company, of New Jersey, last month, was tendered a complimentary by his friends and former associates, August 9. About 100 guests were present and before the close of the evening Mr. Sharpe was presented a handsome gold watch and chain. We understand that Mr. Sharpe will soon accept the management of another electric railway company.

Mr. Frank A. Rogers, who for the past twelve years has been connected with the Brush Electric Company and the Short Electric Company, of Cleveland, O., as special sales agent, has associated himself with the Fulton Truck & Foundry Company, of Mansfield, O., in the same capacity, with headquarters at Cleveland. Mr. Rogers has an extensive experience in the street railway and electrical business, and he is well known to street railway people.

Mr. W. Frank Carr, general manager and superintendent of the Roanoke Street Railway Company, resigned that position on August 10. Mr. Carr went to Roanoke in April, 1892, and since his connection with the company has changed the system from horse cars and steam to electricity. Mr. Carr was for a number of years connected with the St. Paul and Minneapolis system as chief engineer. He expects to return North during the fall or early spring.

Mr. H. J. Quigg, has recently been appointed general superintendent of the entire system of street railways in Jersey City, Newark, Elizabeth, Orange and adjacent cities, operated by the Consolidated Traction Company of New Jersey. Mr. Quigg has had long experience in railroading and is well qualified to fill the important and responsible position which he now holds.

Mr. Quigg is a native of New York City, and was born in January, 1857. He studied at the New York public schools where he was graduated in 1873, and in March of the following year entered the service of the Long Island Railroad Company, in its transportation department. Here he remained in continuous service for eighteen years, during the last four of which he had entire charge of this department with complete supervision of 325 miles of track, operating over 900 trains daily.



H. J. QUIGG.

In August, 1891, Mr. Quigg received a flattering offer from the New York, Lake Erie & Western Railroad Company which he accepted, that of superintendent of the Erie Terminal at Newburgh. Two years later, in May, 1893, he resigned this position to accept that of superintendent of the western division of the New York & New England Railroad. In this capacity he had entire supervision of the New England Railroad, from Springfield Mass., to Hartford, Conn., and from that city to Fishkill, N. Y., also the line from Waterbury to Cromwell, Conn. Mr. Quigg's record here was excellent, showing a decrease in operating expenses and accidents together with a noted improvement in freight and passenger service, as well as in the discipline and condition of the employees. He also introduced improved methods of handling the freight and passenger business, which met with special commendation, and the physical condition oft he road was improved in a marked degree.

He is a man of pleasing personality and combines the qualities of a good organizer and disciplinarian with those of popularity among his employes.

Obituary.

THOMAS M. SAYRE.

Thomas M. Sayre, for fourteen years superintendent of the Jersey City & Bergen system of street railroads, died July 28 of typhoid pneumonia. Mr. Sayre was born at Madison, N. J., fifty-five years ago, and entered the office of the Jersey City & Bergen Railroad Company thirty-one years ago as a clerk. At that time the company ran lines of stages. He later filled the office of paymaster before being appointed superintendent.

A Drawn Steel Trolley Pole.

The United States Projectile Company, of Brooklyn, N. Y., which is the manufacturer of the patent hot pressed motor pinion, which has met with such marked success, has, after much experimenting, perfected a decided improvement in trolley poles. The process is unique and original. The poles are made in the same way that the company makes its bicycle tubing, and of the same material. The pole is started from a solid block of steel, three and three-quarters inches in diameter and is seven inches long, and is gradually drawn out until it is the standard length, *i. e.*, twelve to thirteen feet. It is tapered, making a very neat looking pole, very smooth and clean. The steel used being a very fine grade of Swedish, very tough and strong, the poles are 25 per cent. lighter than those now in use, and are very much stronger. This alone is quite an item, as it relieves the tension on the wire just this much, which will certainly make the life of the wire greater. The Brooklyn Heights Railroad Company, which, is probably the hardest road on trolley poles in this country on account of the elevated structures, reports that, while with the common poles it has often from six to ten a day broken, with these poles, during all the time they have been used, which is now about six months, and upwards of 200 have been in service, only one pole has been broken so that it could not be used again. The reason for this is, that on account of the tough and tenacious material from which the poles are made, if a pole is bent, it is very easily straightened without injuring the metal.

Decision on Car Heaters.

Judge Swan, of the United States Circuit Court, at Detroit, in a decision rendered August 21, denied the motion for rehearing in the Cody patent case, thereby affirming a previous decision of the same court in favor of the Consolidated Car Heating Company, of Albany, N. Y.

Equipment Notes.

The Graham Equipment Company, of Boston and Philadelphia, is sending out a postal card giving a few verses from the *Providence News* upon the jolting of electric cars, and illustrated by an engraving of the way a man feels after leaving a pounding car. The company says, "All this bangerty business is avoided by using the Graham truck."

The Washburn & Moen Manufacturing Company, of Worcester, reports that the Chicago rail bond has been adopted by the Chicago City Railway Company, the Chicago North Shore Street Railway Company, the North Chicago Street Railroad Company and the West Chicago Street Railroad Company. A total of 450 miles of electric railway now under construction will use this bond.

The Storm Manufacturing Company, of 161–3 Washington Street, Newark, N. J., has recently purchased a controlling interest in the "H & C" trolley wheel for the United States and Canada. This wheel can now be obtained only from the Storm Manufacturing Company in the United States, and from Robert Mitchell & Company, of Montreal, for the Canadian provinces. This last named firm is manufacturing the wheel in Montreal under a royalty which it pays to the Storm Company.

Chas. A. Schieren & Company, of New York, write us that they have recently received orders for the following: Two forty-six inch, three-ply belts, each about 110 ft. long, and about twenty-four dynamo belts for the Citizens' Electric Illuminating Company, DeKalb Avenue and Rockwell Place, Brooklyn, N. Y.; forty-eight inch, three-ply belts, and some other belts, for the Capital City Gas & Electric Company, Des Moines, Ia.; four thirty-six inch, double belts for the Union Light & Power Company, Nashville, Tenn. The demand for Schieren belts seems to be constantly improving.

The Fuel Economizer Company, of Matteawan, N. Y., reports the following additional street railroads as using its economizers: Toronto Street Railroad Company, of Toronto, Ont., 3,000 H. P.; St. John Railroad Company, of St. John, N. B., 1,500 H. P.; Springfield, Street Railroad Company, Springfield, Mass., 500 H. P.; Jamestown Street Railroad Company, Jamestown, N. Y., 400 H. P. Orders have recently been taken for equipping the Boston pumping station and a number of mills in the New England States. The company is fortunate in being able to keep its works running full time during the dull season.

The Fiberite Company, of Mechanicville, N. Y., is kept busy supplying the Medbery insulating material which is now in use on a large number of the principal street railway companies in the country, including the Electric Traction Company, of Philadelphia; the Buffalo City Railway Company, of Buffalo; the New Jersey Traction Company, the Brooklyn City Railway Company; the Union Railway Company, of Providence; the Consolidated Traction Company, of New Jersey, and many others. The metal used in this material is claimed to be of a very high grade of aluminum bronze, showing a tensile strength of 90,000 lbs. to the square inch. This insulation is also claimed to show a higher heat test and greater strength than any similar composition.

Ford & Bacon is the name of a new firm of electrical engineers whose headquarters are at 421 Chestnut Street, Philadelphia. The company's New York office is at 203 Broadway, in the *Mail and Ex-*

press Building. The firm is composed of Frank R. Ford, well known to electrical engineers through his former connection with the Brush and Short companies, of Cleveland, and the La Roche Company, of Philadelphia, and George W. Bacon, who is in charge of the Philadelphia office. The new firm will do business as consulting electrical engineers. Mr. Ford will be in charge of the New York office. They are making a specialty of railway work, and have already been retained by several companies.

The Correspondence School of Mechanics and Industrial Sciences, of Scranton, Pa., is doing an excellent work, and one which seems to meet a public need. We understand that a large number of students have availed themselves of the advantages afforded by this school, which was started especially for those who are now in practical work and who cannot spare the time necessary for taking a regular course of instruction in the usual scientific schools. For these, the next best thing is to study at home during their leisure hours. A valuable feature of the Scranton school is that the managers guarantee instruction until the student is proficient in his scholarship, no matter how long it may take. The instruction courses are prepared by those actively engaged in teaching in schools.

The Electric Storage Battery Company, of Philadelphia, Pa., has contracted with the New York Edison Electrical Illuminating Company for a large storage battery installation. The installation will consist of 150 elements of chloride accumulators, type G, forty-one plates, having a capacity of 8,000 ampere hours at 150 volts, at normal rates, or a total capacity of 1,200 kilowatt hours. The installation will be furnished with the most modern and complete appliances for the control and operation of the battery, and everything possible will be done to make it a model, and at the same time the most modern and complete battery plant ever installed. The battery is to be installed immediately, to be ready for the heavy winter load.

The Wilson-Whiting-Davis Oiling Company, of New York, of which Morton E. Davis is first vice-president and general manager, is receiving excellent testimonials from those who are using its system of oiling for engines and dynamos. The chief engineer of the plant in the Equitable Building, New York City, which was illustrated and described in the August issue of the STREET RAILWAY JOURNAL, refers to its working as entirely satisfactory, as does also the chief engineer of the plant in the Women's Temple Building, Chicago, where the Wilson Whiting-Davis system is in use. Mr. Davis, whose New York office is at Broadway and Duane Street, is making every effort to bring the system to the attention of the engineers of power plants.

William H. Hopper, of Paterson, N. J., proprietor of the Paterson Handle Works, is well known throughout the country for the excellent handles for mechanics' tools which he manufactures. The Hopper works are over half a century old, having been founded in 1840 by Henry Hopper, father of the present proprietor. The premises are quite extensive, and mechanics' tool handles of every description are made here. Mr. Hopper makes a specialty of work for railroads, mining and coal companies and street railway companies in making handles to order. He supplies a considerable number of railroads and other large corporations with handles for their tools, and the material used by Mr. Hopper is the best of New Jersey white heart hickory, and any size or shaped handle can be made to order.

The New Process Raw Hide Company, of Syracuse, N. Y., is meeting with its usual success in the sale of raw hide pinions. A recent letter received by the company is from Henry P. Merriam, master mechanic of the Albany Railway Company. The grade of State Street Hill, Albany, is one of the longest and heaviest that any surface railway in this country has to contend with. Mr. Merriam says: "Regarding the two raw hide pinions sent us on trial, I can say that they were put on a car running on State Street Hill soon after your last call at Albany, and have been running every day since. I have examined them frequently, and they appear to be good for some time longer. The cast iron gears put on at the same time are as good as new. The result has been a great surprise to me. The bill for the two pinions has been approved and entered for payment."

Geo. S. Whipp, formerly with the J. W. Fowler Car Company, is now connected with the Lewis & Fowler Manufacturing Company. Mr. Whipp was formerly prominently identified with the latter company before his connection with the J. W. Fowler Company and is well and popularly known among the street railway fraternity. He reports an excellent demand for Lewis & Fowler appliances. He has just sold to the Hartford Street Railway Company, of Hartford, Conn., eight electric snow sweepers and fourteen Acme jacks. He has also a contract to equip all the cars of the Bridgeport Traction Company, of Bridgeport, Conn., with the Lewis & Fowler Company's improved register. 100 improved registers also go to the Newark & South Orange Street Railway Company, and 200 to the Providence Street Railway Company, of Providence, R. I.

The Joseph Dixon Crucible Company, of Jersey City, N. J., manufacturers of lead pencils and other graphite products, has felt the necessity of stiffening the backbones of its salesmen who have complained of competitors' cut prices and do it after the following fashion. In times like these when work is none too plenty, and the manufacturer is anxious for orders and the salesman likewise, there is great temptation to cut prices for the sake of getting a quantity of business and thereby deluding ourselves into the idea that we are prosperous because we are busy, forgetful of the fact that the more business one does at a loss the slimmer will be the bank account at the end of the year. There is neither money nor reputation to be gained in doing work for less than a fair price, and the very men who profit by beating the salesman down, respect him and his house less than if he had stuck manfully to the principle that first class goods demand a fair price.

The Berlin Iron Bridge Company, of East Berlin, Conn., writes us that the Worthington Hydraulic Works at Brooklyn, N. Y., have decided to make large additions to their already extensive plant, and have placed the contract for this work with them. The Berlin Iron Bridge Company is also putting up a gas house roof for the New Jersey Gas & Construction Company, at South Amboy, N. J., and for the new boiler and dynamo room for the Larchmont Electric Company at Mamaroneck, N. Y. The Geo. W. Helme Company, at Helmetta, N. J., has also placed the contract for its new roasting house with the Berlin Iron Bridge Company. The roof will be covered with the Berlin Company's patent, anti-condensation, corrugated iron roof covering. This company has also received the contract for the new plant of the Fairfield Copper Company, at Monroe, Conn. The plant will be entirely of iron and steel, no woodwork being used about the construction. The new power station for the Hartford Street Railway Company, at Hartford, Conn., will also be designed and built by the Berlin Iron Bridge Company. It will be 66 × 233 ft., with a steel frame covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron covering. When completed, it will be one of the most complete stations of the kind in the country, and will be absolutely fireproof.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., whose safety appliances are so well known has closed a number of orders recently, among them being pick-up fenders for the North End Street Railway Company, of Worcester, Mass. Apropos of the meeting of the Pennsylvania Street Railway Association at Reading this month, on September 5, the success of the Crawford Company in its native state of Pennsylvania is interesting. Philadelphia and Pittsburgh, the two largest cities in the state, have purchased liberally of Crawford fenders. In Philadelphia about 1,000 wheel guard fenders are now in use, in Pittsburgh 250 wheel guards and 400 pick-up fenders are employed. The Williamsport (Pa.) Railway Company is another line which is equipped with the wheel guard fenders. In Pennsylvania over 40 lives have been saved since February 1 by the use of Crawford fenders. The fenders are manufactured in Pittsburgh, and are the invention of a native born Pittsburger. The sales and delivery of fenders, it is claimed, have exceeded all other manufacturers, and the fenders have been adopted in all sections of the country. Since February 1, the Crawford Company has delivered over 2,500 fenders, and the company tells us that its correspondence is rapidly increasing with the various street railway companies throughout the United States, Canada and Europe. Among the recent inquiries was one from Tokio, Japan, indicating that a good fender is in demand all over the world, and that the fenders of the R. A. Crawford Manufacturing Company are giving full satisfaction and receiving the endorsements of the leading railway men.

The Industrial Mutual Insurance Company, of Boston, Mass., seems to possess the confidence of the owners of electric light and street railway properties in a remarkable degree, as many of them have insured in this company. The first electric policy was written October 1, 1893, and in ten months, or up to August 1, the policies written amounted to $6,199,286. A partial list of the street railway companies is given below: Altoona (Pa.) & Logan Valley Street Railway Company, Augusta (Ga.) Railway Company, Aurora (Ill.) Street Railway Company, Chester (Pa.) Traction Company, South Chicago City Railway Company, Cayadutta Electric Railroad Company, Consolidated Street Railway Company, of Grand Rapids, Mich., Hamilton (O.) & Lindenwald Electric Transit Company, Ithaca Street Railway Company, Johnson City (Tenn.) & Carnegie Street Railway Company, Kokomo (Ind.) City Street Railway Company, Twin City Rapid Transit Company, of Minneapolis, Central Railway & Electric Company, of New Britain, Conn., Omaha Street Railway Company, St. Joe (Mich.) & Benton Harbor Street Railway Company, City & Suburban Street Railway Company, of Savannah, Ga., Winston (N. C.) & Salem Railway & Electric Company, Worcester (Mass.), Leicester & Spencer Street Railway Company. The directors of the company are: Henry C. Morse, Boston, Mass; O. H. Sampson, Boston, Mass.; Robert Batchellor, No. Brookfield; B. F. Taft, Ayer, Mass.; Benj. Taft, Ayer, Mass.; E. H. Clark, Hartford, Conn.; C. T. Plunkett, Adams, Mass.; J. J. Banigan, Providence, R. I.; Benj. F. Peach, Jr., Boston, Mass.; C. G. Goodrich, Minneapolis, Minn.; F. A. Gilbert, Boston, Mass.; H. A. Royce, Malden, Mass.; J. Howard Nichols, Boston, Mass.; C. C. Fry, Lynn, Mass.; Lester Leeland, Malden, Mass. Since October 1, 1893, the company received for premiums $65,477.64, and paid losses $1,069.

W. R. Fleming & Company, representatives of the Harrisburg Foundry & Machine Works, in New York and New England, have handed us a list of engines and engineering work which they have taken contracts for since May 1. A few of the sales made are given below: One 200 H. P. Ideal tandem compound engine, direct connected to a Siemens-Halske generator, for the Broadway cable road; two 40 H. P. simple engines for friction driving Thomson-Houston dynamos, for the new 250,000,000 C. P. lamp for the Fire Island lighthouse; one 60 H. P., standard Ideal engine, boiler and complete steam plant for electric sewerage purification, for the city of Danbury, Conn.; two 60 H. P. Ideal engines arranged for direct connection to General Electric apparatus for the new City Hall building, Brockton, Mass; one 70 H. P., standard Ideal engine for the Bangor Steamship Company, Boston, Mass.; two 40 H. P., standard Ideal engines for the new steamships just built for the Old Dominion Steamship Company; two 100 H. P. Ideal engines for the electric plant of the United States Post Office, Brooklyn, N. Y.; one 50 H. P. Ideal engine sold to the Brooklyn Electric Equipment Company, Brooklyn, N. Y.; two 80 H. P., direct connected engines for the New York Electric Equipment Company, New York; one 150 H. P., two 100 H. P. and one 60 H. P. Ideal engines for the General Electric Company, New York; two 100 H. P., standard

Ideal engines for the Morrison Southern Electric Construction Company, Baltimore, Md. The contract has also been awarded to Messrs. W. R. Fleming & Company for supplying the station equipment of the complete central lighting and power station plant for the Port of Spain, Island of Trinidad, West Indies. This plant consists of four 250 H. P., tandem compound Ideal engines, four Harrisburg high pressure, steel tubular boilers with Weitmeyer furnaces, 2,000 light, incandescent dynamos, two 50 arc machines, and one 100 K. W. railway generator. The entire equipment of this plant is in the hands of Messrs. W. R. Fleming & Company, who are to erect the same and turn over to the owners, an Anglo-American syndicate, in complete operation.

WESTERN NOTES.

The Hill Clutch Works Company, of Cleveland, O., has been incorporated to carry and extend the business formerly done by the Hill Clutch Works, at Cleveland, O. H. W. Hill is president and general manager of the new organization.

The Correspondence School of Technology, of Cleveland, O., has engaged J. N. Dodd, a graduate of Princeton and last year Fellow in Mathematics at Princeton, as Instructor in Mathematics. The school reports growth even though the times are so exceedingly bad, and also has received letters from its students commending the work.

W. R. Garton, inventor of the Garton lightning arrester, has been appointed manager of the railway department of the Central Electric Company, of Chicago. Mr. Garton is well qualified for the position, on account of his ability and experience in electrical work, as well as on account of his hustling qualities, and the Central Electric Company is to be congratulated upon having secured his services.

C. E. Loss & Company, of Chicago, are doing good business, having lately received some very flattering orders. This progressive contracting firm is now busy closing up the work on the Indianapolis & Broadripple Street Railway, where it is doing all the track and overhead construction at Hartford City, Ind. The firm is building the entire plant and furnishing all the cars and trucks, which have been bought of the J. G. Brill Company.

The Wallace Electric Company, of Chicago, has been especially busy recently in its railway department, notwithstanding the dull times. The company's combination pole bracket, which affords a flexible support for the insulator, is meeting with a ready sale and with great success. The various devices for overhead construction handled by the company are also favorites with railway superintendents, as the different forms give perfect protection against moisture at all points.

The Bass Foundry & Machine Works, Ft. Wayne, Ind., reports that it has under construction for New Castle, Pa., a tandem compound, condensing Corliss engine with high pressure cylinder 36 in., low pressure cylinder 70 in. with 60 in. stroke. The driving pulley is 25 ft. in diameter, has a 9 ft. face, and is designed for rope transmission, having 32 2 in. grooves to accommodate the ropes. The engine is rated at 200 H. P., being the largest tandem engine ever built. The pulley weighs 120 tons.

The Lodge & Davis Machine Tool Company, of Cincinnati, writes us that the plant of the R. R. Howell & Company, Minneapolis, Minn., which was recently destroyed by fire, is now being rebuilt and that it will be equipped, among other machinery, with a Lodge & Davis fifty four inch planer and thirty inch lathe. The Company has also made shipment to Arequipa, Peru, and Santiago, Chili, on orders received from its salesman, who is now traveling in South America. It has also made shipment of one of its large engine lathes to the port of Odessa, Russia.

The Scarritt Furniture Company, of St. Louis, Mo., has appointed Harry O. Nourse as the representative at Chicago of the old and reliable Scarritt car chairs and seats, which have done so much towards making life worth living in furnishing comfortable seats to a discriminating public. Mr. Nourse was born and bred a railroad man, and is well known and highly esteemed in the department of steam roads. With the high reputation of the Scarritt's seats to back him, we are confident he will soon be favorably known to the trade.

The Hoppes Manufacturing Company, of Springfield, O., is now busily engaged installing four of its live steam feedwater purifiers of 3,000 H. P. total capacity in the new electric railway station of the Lindell Railway Company at St. Louis, Mo. The Hoppes Company justly feels somewhat elated in securing this contract, as it was only secured after a hard fight, and in the face of very strong competition. Among other recent sales we note the following: Live steam feedwater purifiers of 500 H. P. to the Proctor & Gamble Company, of Ivorydale, O.; 1,500 H. P. to the Indianapolis (Ind.) Light & Power Company; 150 H. P. to Wm. Coombs, of Coldwater, Mich.; 400 H. P. to the National Milling Company, of Toledo, O.; 150 H. P. to the Cincinnati Street Railway Company; 150 H. P. to Chas. H. Suppes, of Johnstown, Pa.

The Aultman & Taylor Machinery Company, of Mansfield, O., is meeting with excellent success in the sale of its boilers. Among its latest customers for two 150 H. P. boilers is the Citizens' Street Railway, Light & Power Company, of Mansfield. This company states that the saving in fuel with these boilers, in comparison with an excellent battery of horizonal tubular boilers that was in use, is in the neighborhood of 15 per cent. We understand that a large plant will be built in Mansfield for constructing these boilers. An arrangement has recently been made with H. E. Collins & Company, of Pittsburgh, by which the firm will have the exclusive sale agency of the boilers for the United States. This firm comprises among its members William C. Temple, formerly the agent for the Babcock & Wilcox Company, at Pittsburgh.

The Standard Railway Supply Company, of Chicago, reports that orders for "Standard" stoves have been coming in during the last month. In, fact more orders were received during the month of August than last year, principally from companies that were customers in 1893. This goes to show that they were thoroughly satisfied with the result of the stoves in use last winter, and that they will continue to use them wherever they have an opportunity. The company also reports that it is selling its share of steel gongs, and has recently taken several very good orders for line material and track scrapers. Very gratifying results are also met with introducing the Nuttall Company's gears and pinions. The sales in this territory have been the best the company has had, so far in the month of August, and indications are that the trade will increase.

Frank J. Lewis, of Cleveland, O., formerly manager of the Steel Motor Company, and subsequently vice president and manager of the Eastern Electrical Equipment Company, has sold out his interest in the latter business. He is now maturing plans for the establishment of a general supply business on an extensive scale, with headquarters at Cleveland, O. The company will publish a monthly journal entitled *The Magnet*, devoted principally to the interests of purchasing agents, containing bargains in every thing electrical. In the same journal will be published news and articles of instruction and interest to the electrical world. The company invites correspondence from parties having any second hand or new equipment to dispose of. All such goods are advertised in *The Magnet* free of cost. Frank J. Lewis will be president and manager of the company, and together with two brothers retain the controlling interest.

The Phœnix Iron Works, of Cleveland, O., has completed the two story addition to its works, and has added a number of new machines, greatly increasing its capacity. It is interesting to note that this company never had so prosperous a year as the present, and now has orders to keep it busy for several months. This seems remarkable considering the dullness of trade throughout the country. The company's long experience in crane building has earned for it a world wide reputation, and owing to the largely increasing Western trade, the company has established a Chicago office, under the management of Jas. T. Gardner, at 932 The Rookery Building. The company's manufacture embraces every style of cranes, foundry ladles, crab winches, hydraulic presses and machinery and railroad turntables. Correspondence is invited in regard to the designing and building of special machinery. A new crane catalogue, which is now in press, will be issued shortly, and will be sent free on application.

Fisher & Porter, of Chicago, write us that they have just installed two eighty horse power M. A. Green engines in the Leland Hotel, where they are running two National dynamos for incandescent lighting. They have sold one 150 H. P. M. A. Green engine to the Freeport Electric Company, of Freeport, Ill., for electric street railway work, and one 300 H. P., improved Greene engine to the Hammond, Whiting & East Chicago Electric Railroad Company, at East Chicago, Ind. Messrs. Fisher & Porter are Western representatives of the Altoona Manufacturing Company, building the M. A. Green engine, and of the Providence Steam Engine Company, building the improved Greene engine, and report that the works of both companies are running full time, and that they see prospects ahead for a good business. This firm has received the following letter from the Farmington Electric Company, of Farmington, Ill., where was installed last fall, the first M. A. Green engine which had then been placed west of Pittsburgh: "Your letter enquiring about our plant received. In reply would say that everything is running smoothly. The M. A. Green engine is a dandy, keeps right along doing its work without a jar or stop, giving us a steady, uniform light. We consider that our plant, purchased through and put in by Albert Fisher last winter, is one of the best in the West outside of the large cities. We are satisfied that we could not have done better. (Signed) E. M. Rose, secretary."

The Ohio Brass Company, of Mansfield, O., reports orders of considerable size during the month of July for its type W material from the following roads: Middletown (N. Y.) & Goshen Traction Company; Elyria (O.)-Lorain Electric Railway Company; Consolidated Street Railway Company, of Toledo, O.; Cincinnati (O.) Street Railway Company; Toledo (O.) & Maumee Railway Company; Keokuk (Ia.) E. L. & Power Company; Des Moines (Ia.) Railway Company; East Liverpool (O.) & Wellsville Railway Company; Beaver Valley (Pa.) Traction Company; Lake Cities Electric Railway Company, of Michigan City, Ind.; Consumers' Electric Light & Street Railway, of Tampa, Fla.; Citizens' Street Railway Company, of Memphis, Tenn.; Ft. Wayne (Ind.) Electric Railway Company; Warren (Pa.) Street Railway Company; Chillicothe (O.) Electric Railway Company; Akron (O.) Street Railway Company; Punxsutawaney (Pa.) Passenger Railway Company; Union Street Railway Company, of Saginaw, Mich; West End Street Railway Company, of Knoxville, Tenn.; Riverside Park Street Railway Company, of Saginaw, Mich.; Brightwood Railway Company, of Washington, D. C.; Nashville (Tenn.) Traction Company; Delaware (O.) Electric Railway Company; Marion (O.) Street Railway Company; West End & Riverside Electric Railway Company, of Montgomery, Ala.; Columbus (O.) Street Railway Company; Lansing (Mich.) City Electric Railway Company. This company has had a large increase in the number of its orders of motor bearings, owing to the superior workmanship and quality of the metal which is employed, and the company numbers among its patrons many of the largest roads in the country. These bearings are made of guaranteed bell metal, and are turned and trued up, and milled by special machines lately installed for this purpose. The extraordinary care taken with the finish of these insures a perfect fit and an even and smooth bearing for the shaft. The Ohio Brass Company, has prepared a revised list of bearings, and the figures at which these are now offered to the trade will, no doubt largely increase their output.

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.	100	750,000	Q Feb.	1½	1890	116	120
Watervliet Turnpike & R. R. Co.	100	240,000	.....	...	1863	10	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort.	1865	40,000	J. & J.	5	1905	101½	.....
" " " 2d Mort.	1873	20,000	M. & N.	7	1893	101½	.....
" " " 3d Mort.	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort.	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort.	1888	50,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	102½	.....
" " " Debenture.	1891	200,000	M. & N.	6	1901	111	.....
Watervliet Turnpike & R. R., 1st Mort.	1889	350,000	M. & N.	6	1919	112	114
Watervliet Turnpike & R. R., 2d Mort.	1889	150,000	M. & N.	6	1919	111½	113

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Aug. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	2,500,000	Sem-an	4	.....	58	59
City & Suburban Ry. Co.	50	3,000,000	.....	1	.....	33	35
Central Pass. Ry. Co.	50	300,000	.....	...	.....	67	69
Balto. Traction Co. (Cable).	25	5,000,000	Quart.	1	.....	14½	15

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort.	1892	500,000	.....	5	.....	111½	112
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	106½	107
Balto. Traction Co. (Cable).	1889	1,500,000	M. & N.	5	1929	106	107
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	99½	101
" " "	1891	1,250,000	M. & S.	6	1901	102¾	103¼
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	113	113½

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange, Aug. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.	50	$6,400,000	J. & J.	4	1887	78⅛	78¼
West End Com'n.	50	9,085,000	J. & J.	3	1890–1892	54¼	54½

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Aug. 23. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	165	170
Brooklyn Traction Co., pref.	100	3,000,000	.....	...	1893	65	.....
" " common.	100	6,000,000	.....	...	1893	14	.....
Coney Island & Brooklyn R. R. Co.	100	500,000	Oct. 1.	4	.....	147	.....
Long Island Traction Co.	100	30,000,000			1893	14	17

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co.	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	102	.....
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	.....	107
South Brooklyn Central R. R. Co. 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	112	115

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Aug. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.	50	$100,000	J. & J.	0	.....	.....	70
Enterprise Ry. Co.	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co.	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 148 LaSalle Street, Chicago, Ill., Aug. 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	306	310
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	236½	238
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	126¾	127¼

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	101½	101¾
Chicago Passenger	1883	400,000	F. & A.	6	1903	105	110
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	....	101
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	.....	103½
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101⅞	102½
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	100	101½
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	102	103½

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Aug. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$7,500,000	Q.—J.	5	.....	105⅝	105⅞
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	106½	107
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry.	100	500,000	.....	...	.....	59¾	60¼
" " " Pref.	100	100,000	.....	6	.....	98	99
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....		.....	22½	24

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati St. Ry.	.....	50,000	J. & J.	7	July, 1895	101½	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	99¼	100
	.....	150,000	J. & J.	5	.....	100¾	101¼
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	110½	111½
" " 10-20's	.....	200,000	J. & D.	6	De. '94-1924	102½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	104⅞	105¼
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	107	108
" " " "	.....	300,000	J. & J.	6	Jan. 1914	105	106
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	90
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap.'93-1908	.....	.....
S. Covington & Cincinnati.	.....	250,000	M. & S.	6	Mar. 1912	114	115
S.Cov.& Cin. 2d Mort. gold 6's	.....	250,000	J. & J.	...	1932	113½	114½

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co	100	12,000,000	.....	....	1893	46½	47½
The Cleveland City Ry. Co.	100	8,000,000	.....	....	1893	56	57½

BONDS.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	100	102½
" " City " "	1893	2,349,000	.....			100	102

DETROIT STOCKS.—Corrected by Cameron Currie & Co., Bankers and Brokers, 82 Griswold Street, Detroit, Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. Mackintosh & Co., Bankers, Holyoke, Mass., Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	200	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	125	150

LOUISVILLE STOCKS AND BONDS.—Corrected by Almstedt Bros. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref...	100	$2,000,000	A. & O.	5	Jan. 1891	86	87
Louisville St. Ry. Co., com....	100	4,000,000	.....	...	Jan. 1891	36	38

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	100	100½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	116	117
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	116	117
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. Warren & Co., Bankers and Brokers, New Haven, Conn. Aug. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$600,000	J. & J.	4	.....	45	47
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	...	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

Bonds.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
New Haven Street Ry. Co.....	1894	600,000	J. & J.	5	Jan. 1919	.....	100
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Traction Co.....	1893	2,000,000	J. & J.	5	July, 1923	95	100
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by George Le Sassier, 188 Common Street, New Orleans, La., Aug. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.	100	1,200,000	Quart.	1½	1867	119	123
Crescent City R. Co.....	100	1,150,000	"	3	.866	75	85
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	36	40
New Orleans City & Lake Co.	100	1,500,000	Quart.	2½	1860	104	.....
Orleans R. R. Co.....	50	185,000	"	2	1868	.....	38
St. Charles Street R. R. Co..	50	600,000	"	2½	1865	54½	56

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	.....	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	.....	.....
do do	1893	2,000,000	J & J	6	1913	85	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	113½	.....
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	85	.....
St. Charles Street R. R. Co...	1881	105,000	J & D	6	'95-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by Gordon Strathy & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, Aug. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (old stock)	50	$2,000,000	M. & N.	4	May, '91.	153¼	154
" " (new stock)	50	2,000,000	.....	...	May, '94.	149	149¾

Bonds.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by James McGovern & Co., 6 Wall St., New York, Aug. 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	.....	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	180	184
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	1 2	155
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	150	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	132	135
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4½	.....	300	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	49	52
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	132	135
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	200	206
Third Avenue.....	100	5,000,000	M.—N.	4½	.....	184	186
23d St.....	100	600,000	Q.—F.	2½	.....	290	.....
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	139	.....
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	108	111
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	106	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	106	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	106	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	103	.....
Broadway Consolidated.....	.....	7,650,000	J. & J.	5	 1943	109¾	110
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	110	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	115	120
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	109	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	100	101
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	53	.....
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue.....	.....	7,000,000	J. & J.	5	Jan., 1937	117	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	.....

PHILADELPHIA SECURITIES.—Corrected by Huhn & Glendinning, 143 South Fourth st. (Bullitt Building), Philadelphia, Aug. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	260	265
Continental.....	50	1,000,000	J.—J.	6	1873	124½	126
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	310½	312
Germantown.....	50	1,500,000	Q.—J.	2½	1858	110½	112
Green & Coates...	50	500,000	Q.—J.	3	1868	124½	126
Hestonville...	50	2,050,000	.....	...	1859	47	49
Lombard & South.....	25	500,000	A.—O.	8	1861	90	91
People's Traction Co.....	50	10,000,000	.....	...	.....	52½	52¾
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	155	160
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	80	85
*Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	95	95½
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	227	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	209½	213
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	225	230
Union.....	50	1,250,000	J.—J.	9½	1864	199	200
West Philadelphia.....	50	750,000	J.—J.	10	1857	195	200
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	116½	117¼
Baltimore Traction.....	25	5,000,000	.....	1	1889	14	14¼
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co. *Ex. Allotments.	50	3,000,000	J.—J.	...	.....	12⅞	12¾

Bonds.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	107¾	108¾
" Imp.	1892	1,250,000	M.—S.	6	1901	101	102
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100¾	102
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	103½	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort..... ...	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 306 Times Bldg., Pittsburgh, Pa., Aug. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	..	.....	19½	20
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	59¾	60
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	12⅝	12¾
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	...	63½
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	...	.....	19⅝	20¼
Pittsburgh, Allegheny & Man	50	3,000,000	...	...	.....	35	38½
West End R. R. Co.	50	1,000,000	J. & J.	1	.....	16	20
Second Avenue R. R. Co.	50	1,000,000	J. & J.	2	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	...	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	100,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	26	26½
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O	5	1927	107	110
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	106	110
Pitts. & Birmingham Traction Co	1892	.....	.....	5	.....	90	92
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500 000	J. & J.	5	1931	104¾	104½
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	101¾	.....
Second Ave. Electric R. R. Co		500,000	J. & J.	5	1923	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	...	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.		500,000	J. & J.	5	1922	101	102
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	.....
Suburban Rapid Transit.	.....	.....	.....	6	.....	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	...	.....
Penn Incl'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	200,000	J. & J.	6	1910–19	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS Bankers, Providence, Aug. 24.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	..	.....
BONDS.	Date of Issue	Amo'nt Out-stand'g	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	95	100
Newport St. Ry. Co.	.....	50,000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Aug. 23.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	25	29
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	57	59
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	13	20
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	37	40
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	65	75
do do Common.	100	4,000,000	.....	...	1892	18	20
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	70	80
do do Common.	100	3,000,000	.....	...	1892	13	18
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	36	38
BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	95	96
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	99	101
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	95
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	97	98
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	90	95
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	86	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Aug. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	...	.....	98½	.....
Geary St., Park & Ocean R.R.Co	100	1,000,000	Monthly	...	.....	.....	105
Market Street Cable Co.	.....	18,750,000	.....	...	.....	40¼	41
Metropolitan Electric	.....	1,000,000	Monthly	...	.....	22½	27
Oakland, S. L. & Haywards	.....	.....	.....	...	.....	.....	100
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	12½	14
Sutter St. R. R. Co.	.....	2,000,000	Quart'ly	...	.....	90	.....
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	J. & J.	5	.....	105	.....
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	107	110
Geary St., Park & Ocean.	.....	671,000	A. & O.	5	.....	104½	105¼
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	.....	120
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	.....	117
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	112	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	99	.....
Powell Street R. R.	.....	700,000	M. & S.	6	1912	112	.....
Sutter St. Cable Co.	.....	900,000	M. & N.	5	.....	104½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, Rialto Building, 218 N. 4th St., Aug. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	55	60
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue.	100	112,000	Dec. '88	2	1885	125	135
Lindell	100	2,500,000	.....	...	1890	90	92
Missouri.	100	2,000,000	Q.—J.	2	1891	200	210
People's.	50	1,000,000	Dec. '89	50c	1899	20	25
St. Louis.	100	2,000,000	J. & J.	3½	1890	148	151
Fourth Street & Arsenal.	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban.	100	2,500,000	.....	...	1891	13	15
Southern, Pfd.	.....	800,000	Jan. '94	3	.....	80	85
" Com.	.....	700,000	.....	...	.....	15	25
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	98	100
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	105	107
Fourth St. & Arsenal.	1888	50,000	J. & J.	6	1898–1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895–1910	101½	102½
Missouri Cable.	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	99	100
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable.	1889	800,000	J. & J.	6	1889–1914	90	95
St. Louis Cable.	1890	1,500,000	M. & N.	5	1900–1910	101	103
Union Depot.	1890	4,000,000	A. & O.	6	1900–1910	104	105
Southern.	1884	200,000	M. & N.	6	1904	103	105
Southern.	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban.	1891	1,400,000	F. & A.	5	1921	84	86
St. Louis & Suburban (Incomes)	1891	300,000	.....	6	.....	70	80

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Aug. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	285	310
Metropolitan R. R.	50	750,000	Q. J.	2	1864	85	90
Columbia R. R.	50	400,000	Q. M.	1	1870	61	65
Belt R.R.	50	500,000	Q. J.	...	1875	..	30
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	30	40
Georgetown & Tenallytown.	50	200,000	.....	...	.....	..	35
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'tn & Geo'tn conv't. 1st.	'83–'99	3,000,000	J. & J.	6	1899-1929	134	137
" " " 2d.	.....	500,000	J. & J.	6	1903–1943	134	137
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	99	102
Belt.	1921	240,000	J. & J.	6	1921	.....	80
Metropolitan R. R. convert.	1901	200,000	J. & J	5	1901	101	103½
Anacostia R. R.	.....	200,000	A. & O.	6	1901-1931	.....	.....

Financial.

THE Bowling Green (Ky.) Street Railway Company has been leased to George and Clarence Claypool of that city.

$ $ $

THE net earnings of the North Shore Traction Company for the nine months ending June 30 were $263,372, an increase of $105,090.

$ $ $

AT a meeting of the board of directors of the Lebanon & Ann-

ville Street Railway Company, held July 25, a semi-annual dividend of 2½ per cent. was declared.

$ $ $

THE Carbondale (Pa.) Traction Company line, it is reported, has been sold to the Lackawanna Valley Rapid Transit Company. H. B. Jadwin is president of the latter company.

$ $ $

THE Atlantic Avenue Railroad Company, Brooklyn (N. Y.), statement for the quarter ended June 30: Gross earnings, $241,484; operating expenses, $151,131; other income, $8,221; fixed charges, $71,221; net income, $27,352; cash on hand, $63,587.

$ $ $

HOWARD CALE, receiver of the Queen City Electric Street Railway, of Marion, Ind., in his first report filed in the United States Court, shows that the receipts of the company from March 27 to June 30 were $2,045.69, and the disbursements $2 054.84.

$ $ $

THE Eighth Avenue Railroad Company of New York City, makes the following report for the quarter ending June 30: Earnings, $207,892; expenses, $144,139; net, $61,753; other income, $416; charges, $24,095; surplus, $38,074; cash on hand, $27,324; profit and loss surplus, $16,984.

$ $ $

THE statement of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railroad (New York) for the quarter ended June 30, shows: Gross earnings, $170.900; operating expenses, $128,632; other income, $1,000; charges, $30,687; surplus, $12,581; cash on hand, $9,136; profit and loss, $56,821.

$ $ $

THE 22d Street line of the Chicago General Street Railway Company carried 283,947 passengers during the year ending June 30, 1894. The report by weeks shows a steady increase in the traffic on the road from 352 passengers during the week ending July 8, 1893, to 22,989 during the week ending June 30, 1894.

$ $ $

A. M. BILLINGS, of Chicago, Ill., who owns and operates the street railway system of Memphis, Tenn., has recently purchased the Memphis & Raleigh Springs Railroad for $110,000. It is believed that Mr. Billings will convert the road to the electric system and run it in connection with the street railway system which he operates.

$ $ $

THE following is a comparative statement of the operations of the Scranton Traction Company for the month of June: Gross earnings, 1894, $22.082.06; 1893, $20.185 62; increase, $1,896.44. Operating expenses, 1894, $12,142.89; 1893, $12,286.68; decrease, $143.79. Net earnings, 1894, $9,939.17; 1893, $7,898.94; increase, $2,040.23.

$ $ $

THE recent change in the management of the Lake Street Elevated Company of Chicago, has been followed by a general reduction of expenses in every department. Director Lauderback, who is mainly responsible for the policy of retrenchment, says that he estimates the saving at the rate of $60,000 a year. This sum would pay the interest at 5 per cent. on $1,200,000 of bonds, and is a matter, therefore, of a good deal of moment to the stockholders.

$ $ $

THE Northwestern Elevated Railroad Company, of Chicago, has placed on record a mortgage for $15,000,000 in favor of the Illinois Trust & Savings Bank as trustee to secure an equal amount of bonds. A mortgage for $1,000,000 was placed on record by the North Chicago Electric Railway Company, and still another mortgage for $2,000,000 was recorded by the Chicago Electric Transit Company. The trustee in each instance was the Illinois Trust & Savings Bank.

$ $ $

REDMOND, KERR & COMPANY, of New York, offer $1,300,000, of a total issue of $2,000,000, 5 per cent. thirty year gold bonds of the Bridgeport (Conn.) Traction Company. The remaining $700,000 is reserved in the treasury of the company, and can only be issued for improvements at 75 per cent., the actual cost thereof. The bonds are a first mortgage on the entire street railway system in the city of Bridgeport, covering thirty-two miles in operation or under construction.

$ $ $

THE following is a comparative statement of the operations of the Buffalo Railway Company for the month of July: Gross earnings, 1894, $139,797.20; 1893, $147,286.86; decrease, $7,489.66. Operating expenses, 1894, $73,607.56; 1963, $81,731.58; decrease, $8,124,02. Net earnings, 1894, $66,189.64; 1893, $65.555.28; increase, $634.36.

Seven months ending July 31: Gross earnings, 1894, $866,964,21; 1893, $834,949.63; increase, $32,014.58. Operating expenses, 1894, $498,741,69; 1893, 534,954.77; decrease, $36.213.08. Net earnings, 1894, $368,222.52; 1893, $299,994.86; increase, $68,227.66.

$ $ $

THE following is a statement of the earnings for the month of July of the companies operated by the Brooklyn Traction Company: Gross earnings, Atlantic Avenue Railroad, $86,027.66; Brooklyn, Bath & West End Railroad, $24,950.58; total, $110,978.24. Operating expenses, Atlantic Avenue Railroad, $51,017.64; Brooklyn, Bath & West End Railroad, $11,022.20; total, $62.039 84. Net from operation, $48,938.40. Miscellaneous earnings, Atlantic Avenue Railroad, $6,485.67; total net earnings, $55,424.07. The gross earnings of the above system increased $7,577.30 on the corresponding month of 1893.

$ $ $

As announced in the STREET RAILWAY JOURNAL, the capital stock of the Cincinnati Street Railway Company will be increased $500,000 on September 1. The increase is to be apportioned and paid for as follows: The stockholders of record on September 1, 1894, and who make remittance for the same, which shall reach the office of the company not later than September 3, shall be entitled to purchase at par, $50 per share, one share for each fifteen shares owned. Stockholders owning less than fifteen shares will be permitted to purchase at par one share only. The books for the transfer of stock will be closed from Thursday, August 30, to Thursday September 6, inclusive.

$ $ $

THE operations of the Worcester Traction Company for the month of July during the last two years is given as follows: Gross earnings, 1894, $37,495.49; 1893, $31,998 79; increase, $5,496.70. Operating expenses, 1894, $16,636.36; 1893, $24 181.89; decrease, $7,545.53. Net earnings, 1894, $20,859.13; 1893, $7.816.90; increase, $13,042.23.

For the ten months ending July 31 the company's report states: Gross earnings, 1894, $285,169.48; 1893, 280,142.71; increase, $5,026.77. Operating expenses, 1894, $168,502.86; 1893, $211,189,97; decrease, $42,687.11. Net earnings, 1894, $116,666.62; 1893, $68,952.74; increase, $47,713.88.

$ $ $

A COMPARATIVE statement of the operations of the Columbus Street Railway Company for the month of July is presented in the following: Gross earnings, 1894, $51,287.72; 1893, $49,882.99; increase, $1.404.73. Operating expenses, 1894, $22,924.96; 1893, 28,155.18; decrease, $5,230.22. Net earnings, 1894, $28,362.76; 1893, $21,727.81; increase, $6,634.95.

For the seven months ending July 31 the operations were as follows: Gross earnings, 1894, $315,560.02; 1893, $310,445.04; increase, $5,114.98. Operating expenses, 1894, $151,200.93; 1893, $199,293.48; decrease, $48,092.55. Net earnings, 1894, $164,359.09; 1893, $111,151.56; increase, $53,207.53.

$ $ $

AT a meeting of the directors of the People's Traction Company of Philadelphia, held August 10, it was decided to give the stockholders the privilege to subscribe to the 40,000 shares now in the treasury. The new shares will have the same status as those now outstanding, and will be issued to stockholders at $47.50, netting thereby to the company a premium of $22.50 per share. The right to subscribe will expire on September 15, and any of the shares not subscribed for at that time will be taken by an underwriting syndicate, composed of the banking houses of Drexel & Company, George S. Fox & Sons and C. & H. Borie. The money realized from this stock, together with that in the treasury, will, it is stated by a director of the company, be more than sufficient to complete all the work now under contemplation.

$ $ $

THE Binghamton (N. Y.) Railroad Company presents the following table of earnings and operating expenses for the fiscal year ending June 30:

	1893.	1894.
Receipts	$90,217.35	$108,710.18
Operating expenses	50 275.50	64 585.40
	$39,941.85	$44,124.78
Taxes and interest on funded debt	14,078.73	21,001.55
Surplus for stock	$25,863.12	$23,123.23

The earnings from June 30 to August 6 (thirty-six days) were, 1893, $14,562.38; 1894, $16,633.20; gain, $2,070.82. The receipts for the year ending August 5, 1894, were $111,371.69. It is estimated that upon the completion of the electrical equipment of the system the gross earnings will amount to $150,000; operating expenses and taxes, $82,000; $68,000. Interest (when entire system is completed), $37,500, leaving as a surplus for stock $30,500.

Balance Sheet, July 1, 1894.

Assets:	
Cost of road and equipment	$1,020,097.05
Due on open accounts	2,068.67
Supplies on hand	1,651.83
Cash on hand and in bank	7,864.20
	$1,031,681.75
Liabilities:	
Capital stock	$324,810.00
Funded debt	590,000.00
Loans and bills payable	98,200,00
Accrued interest	3,000.00
Due on open accounts	9,857.99
Profit and loss	5,813.76
	$1,031,681.75

A stock dividend of 20 per cent. was declared during the past year, the same being the surplus earnings which were expended in construction of the road.

The total amount of bonds authorized to be issued, and upon which interest is to be paid under the $900,000 5 per cent. mortgage, is $700,000. Until the road shows net earnings sufficient to pay twice the amount of interest on all bonds outstanding, together with the amount to be taken from the $200,000 remaining in escrow, the escrow bonds cannot be used and then only to the extent of 85 per cent. of the actual amount expended in construction and equipping, and then only upon the presentation of sworn certificates of expenditures to the trustee as provided in the mortgage.

$590,000 of the $700,000 have been issued, the remaining $110,000 being held in the treasury to provide for bills payable and contracts at present under way for construction.

More Comments on Our New Publication, "American Street Railway Investments."

The North East Street Railway Company of Kansas City, writes, "We have examined it carefully and must pronounce it an excellent work."

"This is a large work, giving a great deal of information to those interested in street railroad securities, etc. * * * We should think it would be invaluable to street railroad officers and investors."—*Locomotive Engineering.*

Francis R. Cooley, dealer in investment securities, Hartford, Conn., says: "I have looked over the copy of 'American Street Railway Investments' sent me, and think it very valuable to dealers and investors in street railway securities."

J. & W. Seligman & Company, bankers, Mills Building, New York City, say: "We have examined with interest your publication, 'American Street Railway Investments.' It seems to have been compiled with much care and thoroughly to cover the field."

"The importance of the street railway has led to the publication of a new annual devoted exclusively to that industry, the first issue of which has just been published. It is called 'American Street Railway Investments,' and deals with the history, capitalization, equipment and management of the surface roads of the American cities, whether operated by horse, cable or electric power."—*The Argonaut* (San Francisco).

Emerson McMillin & Company, bankers, of 40 Wall Street, New York write: "We are in receipt of a copy of your manual 'American Street Railway Investments,' and hasten to congratulate you on the conception and execution of so valuable a work. The information contained in your manual is at once concise and comprehensive, and while you are entirely justified in feeling proud of your effort, the investing public has every reason to be grateful for the opportunity to avail itself of the result of your enterprising labors."

Joel Hurt, president Atlanta Consolidated Street Railway Company, Atlanta, Ga., says: "Since examining your supplement, the 'American Street Railway Investments,' I desire to thank you for furnishing this very valuable work to all investors in street railways. You have given very full information touching the operation of companies, and it is quite interesting to note the results of operations from different systems and managements. This publication is destined to fill a long felt want and is worth many times the price of same."

"The first issue of this volume, which is hereafter to be published annually, is corrected up to June 15, 1894, and (presuming that we are safe in assuming the figures presented to be correct) it is a most creditable and ought to be a valuable publication. * * * * * It is reasonably certain that street railways are destined every year to attract more and more attention from investors, and their securities, both here and abroad, will be very much more largely dealt in than they are at present. With each year the demand for such a volume as this will increase, and the completeness with which the essential statistics are presented in the book before us ought to commend it to very general use as a book of reference."—*Railway Age and Northwestern Railroader.*

The *Engineering Magazine*, August issue, says: "Nothing that could be asked for in a reference book for the use of investors and intending investors in street railway securities, has been omitted in the compilation of 'American Street Railway Investments.' The utmost pains seem to have been taken in compiling the statistics of capitalization, the physical condition and the details of operation of all the street railways in the United States. This field, though but recently developed, is a most promising one for judicious investors, and this volume is the first comprehensive guide to those who are interested in this field. The book will be found none the less valuable to engineers who are engaged in street railway construction or are contemplating such work."

Consolidation at Yonkers.

A consolidation of the two lines of street railway in Yonkers, N. Y., was brought about recently. At a late meeting of the directors of the Yonkers Railroad Company and the North & South Electric Railway at the banking house of T. R. Wilson & Company, 35 Wall Street, Charles H. Montague, having sold all his securities to R. T. Wilson & Company, resigned as director and president of the Yonkers Railroad Company. The Messrs. Wilson & Company, having purchased a controlling interest in both companies, the directors of both resigned and a new board was named, of which R. T. Wilson, R. T. Wilson, Jr., Albert L. Johnson and James M. Edwards are the leading members. Albert L. Johnson was elected president.

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LINE CONSTRUCTION MATERIAL.

Recent Shipments of the Ball Engine Company.

The Ball Engine Company's shops, at Erie, Pa., present a scene of activity, in spite of the unfavorable condition of trade generally, and are running full time. There have been shipped from the works lately the following: Edison Electric Light & Power Company, Erie, Pa., one 350 H. P., vertical compound engine and one 300 H. P., cross compound engine; Eureka Light Company, Eureka, Cal., one 300 H. P. engine; Industrial Home for the Blind, Chicago, Ill., one 80 H. P. engine; J. H. Houghton, Boston, Mass., one 50 H. P. engine; Minneapolis General Electric Company, Minneapolis, Minn., one 35 H. P. engine; Bronx Gas & Electric Light Company, Van Nest, N. Y., two 250 H. P., tandem compound engines; Hotel Newcomb, Quincy, Ill., one 60 H. P., engine; Gen. A. J. Bushnell Building, Springfield, O., one 60 H. P. engine; Lexington Electric Light Company, Lexington, N. C., one 50 H. P. engine; Greenwich Gas & Electric Light Company, Greenwich, Conn., one 150 H. P. engine, and one 125 H. P. engine; Kennard House Company, Cleveland, O., one 50 H. P. engine; City of Griffin, Griffin, Ga., one 135 H. P. engine; Howe Pump & Engine Company, Ladd, Ill., one 50 H. P. engine; Sykes & Wagner, Minneapolis, Minn., one 80 H. P. engine; F. F. Vater & Company, Minneapolis, Minn., one 35 H. P. engine; Risdon Iron Works, San Francisco, Cal., one 150 H. P. engine; Electric Supply & Engineering Company, Detroit, Mich., one 70 H. P. engine.

To the Trade.

Please take notice that P. S. Bemis, Jr., our former Chicago agent, is no longer in our employ, and we caution everybody against cashing any drafts for or advancing any money to him on our account.

The Peckham Motor Truck & Wheel Company.

Map of the United States.

A large handsome Map of the United States, mounted and suitable for office or home use, is issued by the Burlington Route. Copies will be mailed to any address on receipt of fifteen cents in postage by P. S. Eustis, General Passenger Agent, C., B. & Q. R. R., Chicago, Ill. ***

Cheap Excursions to the West.

An exceptionally favorable opportunity for visiting the richest and most productive sections of the West and Northwest will be afforded by the Home Seekers, low rate excursions which have been arranged by the North Western Line. Tickets for these excursions will be sold on September 11, and 25, and October 9, to points in northwestern Iowa, western Minnesota, North Dakota, South Dakota, Manitoba, Nebraska, Colorado, Wyoming, Utah, Montana and Idaho, and will be good for return passage within twenty days from date of sale. Stop-over privileges will be allowed on going trip in territory to which the tickets are sold.

For further information call on or address ticket agents of connecting lines. Circulars giving rates and detailed information will be mailed, free, upon application to W. A. Thrall General Passenger and Ticket Agent, Chicago & North Western Railway, Chicago.***

The Lake Shore Route.

The Lake Shore Route, between Buffalo and Chicago, is celebrated all over the world as affording the embodiment of luxury in travel. Its new Day Coaches are sixty feet in length, and will seat fifty-eight people, comfortably. They are fitted with the Gould platform and automatic coupler, Westinghouse air brakes and signal, heated with steam taken from the locomotive, and at night are brilliantly lighted with Pintsch gas, for which purpose five elegant bronze chandeliers depend from the roof of the car.

The interior of the coaches is finished in mahogany, highly polished and paneled. Each coach has a nice lavatory and toilet. The latest models contain separate toilet rooms—one for ladies and one for gentlemen. The car seats are of the style known as the Mason tilting, with high spring backs and broad seats. They are richly upholstered in crimson plush. The windows, which are of plate glass, are large, and each is fitted with a spring-roller curtain, in shade to blend with the interior finish, and every feature is of the best.

The dining cars in service on the trains of the Lake Shore & Michigan Southern Railway are operated by the company. The cars are neat and tasty in all their appointments. Great care is exercised to provide the patrons of the Lake Shore Route with a service which shall prove satisfactory. As a result, dining on the trains of the road is accomplished in a very satisfactory and comfortable way.

The sleeping cars in service on the Lake Shore Route are of Wagner build. Ordinarily, they contain twelve sections a state-room, a smoking apartment, and toilets for ladies and gentlemen. In some instances, however, there are cars containing sixteen sections, the state-room being omitted. Every valuable device is embodied in their construction.

The Lake Shore operates a most perfect sleeping car service between the cities of Chicago, Cleveland Buffalo, New York and Boston, in connection with the New York Central and Boston & Albany Railways. This is not only the direct, best and only double track route between the cities mentioned, but the Lake Shore is the only line from Chicago conveying passengers into New York City without a ferry transfer.***

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THE STREET RAILWAY JOURNAL

Vol. X. *NEW YORK & CHICAGO, OCTOBER.* *No. 10.*

The Newark & South Orange Railway.

For the last eighteen months the lines of the Newark & South Orange Railway have been operated entirely by electricity with marked success. The company owns fifteen miles of double track through the business and residence districts of Newark and the Oranges.

The power station and offices are located at South Orange Avenue and South 19th Street. The building is of brick, one story in height, and 490 × 125 ft.

The engine room is located on the 19th Street side of the building and is 110 × 50 ft. The power plant consists of four simple, non-condensing engines with cylinder dimensions 26½ × 48 ft., built by Cyrus Currier & Sons, of Newark N. J., and belted direct to four Westinghouse multipolar generators of 250 H. P. each. The engines are provided with the Woodberg automatic cut-off governor as shown in Fig. 1. This device is a combination of trip cut-off gear and a governor for regulating the same, and is attached to the steam inlet nozzle of slide valve and similar engines to regulate the speed. It consists of a double beat poppet valve, operated by a double trip mechanism. A sensitive regulator sets the point of cut-off according to the demand of steam. The cut-off gear is operated by an independent eccentric, and the regulator is driven by a belt. It is claimed that the range of cut-off obtainable is from 0 to ⅞ of stroke.

The belts are two ply, thirty-six inches wide, and were furnished by the Hoyt Belting Company.

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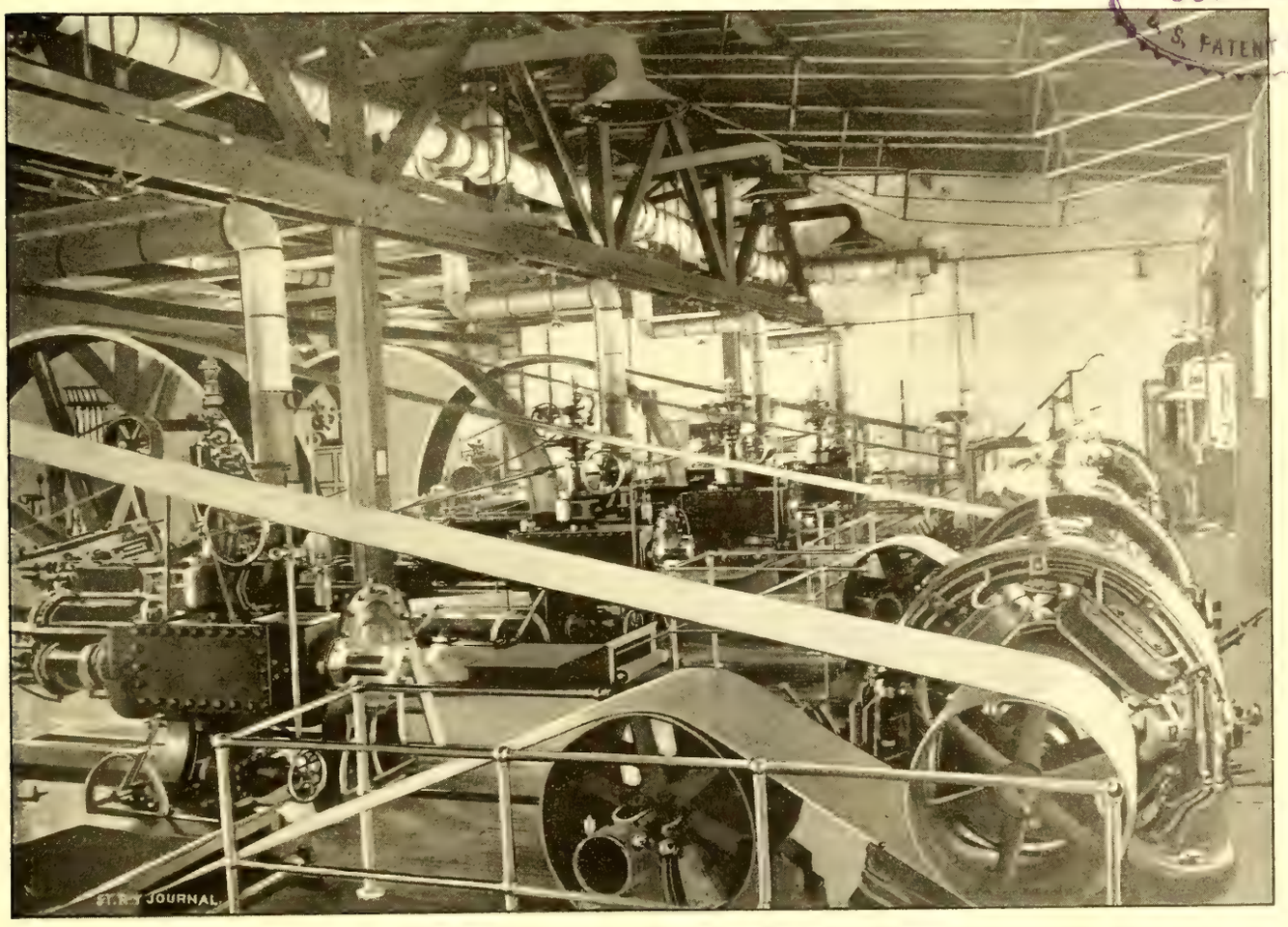


FIG. 1.—INTERIOR OF POWER STATION—NEWARK & SOUTH ORANGE RAILWAY CO., NEWARK, N. J.

The steam generating plant consists of eight horizontal tubular boilers of 125 H. P. each, built by Cyrus Currier & Sons, of Newark, N. J. The boiler room is directly in the rear of the engine room, and the dimensions are 50 × 110 ft. A duplicate system of steam piping is provided so that any section may be cut out and the other used. The H. W. Johns pipe covering is employed throughout. The stack is 166 ft. in height with a tapering flue seven feet in diameter at the base and five feet in diameter at the top.

The plant is equipped with the Taylor improved draught and ventilating device. It is claimed that with this system a cheaper grade of fuel can be used, and the

insuring of absolute combustion of all particles of carbon in the fuel.

The ventilating system consists of a number of funnels located near the roof of the engine room, and connected to the stack by pipes which carry off the heated air from



FIG. 2.—BOILER ROOM—NEWARK & SOUTH ORANGE RAILWAY CO.

the upper part of the room and, it is claimed, reduce the temperature from 10 to 11 degs. National feedwater heaters and Deane feed pumps are provided.

The switchboard is conveniently located in the center of the engine room and is of marbleized slate mounted with Westinghouse instruments. It is of a double desk form with station controlling instruments and feeder switches and ammeters located on opposite sides. A complete fire apparatus is provided. Reels of hose are attached to the walls throughout the building, and connected to a 12 × 7 × 12 Smith-Vaile duplex fire pump.

The interior of the station presents a particularly neat appearance. The engines and generators are tastefully ornamented and surrounded by polished brass railings.



FIG. 3.—PRIVATE CAR—NEWARK & SOUTH ORANGE RAILWAY CO.

Adjoining the engine room is the car barn which extends the entire length of the building, a distance of 490 ft. There are eleven tracks extending the full length of the building, and all repairs, except armature winding, are made on the premises.

The track construction consists of Wharton girder rails, weighing ninety pounds to the yard, spiked directly to the ties and connected by eight-bolt fishplates. The rails are bonded with copper wire and channel pins and cross bonded at every third rail. Side poles furnished by the Syracuse Tube Company are used on the greater portion of the line.

The trolley wire is of No. 0000 hard drawn copper, and was supplied by John A. Roebling's Sons Company. The overhead appliances were furnished by the H. W. Johns Company. The hangers for the brass shell, round tips and the pull-offs are of the regular Giant pattern. The Brooklyn strain insulators are used at the poles, and the No. 1 solid moulded mica pole insulators are used for carrying the lighter feed wires. The heavy feed wires are carried by iron clad insulators.

The company is operating thirty-six closed and twenty-five open cars. The cars are of the Stephenson make mounted on Brill trucks, and are equipped with two Westinghouse motors. Lewis & Fowler fare registers and Pittsburgh Steel Hollow Ware and patent rachet gongs are employed. The cars are equipped with sand boxes and ratchet brakes.

Included in the equipment are seven snow plows, sweepers and levelers and Davis tower wagons.

A very handsome private car, built by the John Stephenson Company, is shown in Fig. 3. The car has an eighteen foot body with vestibules, and is painted maroon color with gold letters and ornaments. The interior is handsomely furnished in birdseye maple with delicate scroll work ornaments. The chairs are of rattan, with olive green cushions.

The offices of the company are located in a comfortable suite of rooms in the north east corner of the building. A very simple and complete system of booking has been adopted by which the receipts and expenses for any day, month or year can be easily ascertained. A safe is located in the receiving department and is connected with the conductors' room by chutes in which the envelopes containing the receipts are deposited. On the face of the envelopes blank forms are printed on which the conductor's number, trip and car number are entered together with the number of full and half fares and tickets. The safe is divided in the center and has compartments for two days' receipts.

Since the starting of the road by electricity in February, 1893, there has never been a shutdown through any fault of the power equipment.

The officers of the company are: E. S. Ward, president; G. Kreuger, vice president; W. Scheerer, secretary and treasurer; A. Radel, general manager and superintendent; J. McDonough, assistant superintendent.

Large Order in Chicago.

Last month the Chicago City Railway Company placed an order with the Westinghouse Electric & Manufacturing Company for six multipolar generators of 700 H. P. each, which will be used for rope transmission. Another order was also placed for 240 No. 12, single reduction, twenty-five horse power Westinghouse motors. An addition or extension to the switchboard in the company's power station will also be built by the Westinghouse Company, and will consist of sixteen feeder and six dynamo panels, constructed of black enameled slate, with the necessary parts, etc.

Work has been begun at Ashland, Mass., on the Ashland & Hopkinton Electric Railroad.

Electric Railway Construction in Philadelphia.

The city of Philadelphia has probably shown more activing during the last year in electric railway construction than any other in the country. The extensive rights accorded the railway companies in that city a year ago or more were immediately acted upon, and track and station construction was promptly commenced upon the different lines. The work to be done, however, was so extensive as to require a great deal of time for its completion, and although a large proportion of the total track has been laid, many of the streets are still torn up, and on a great deal of the mileage the old horse cars are still in operation.

THE PHILADELPHIA TRACTION COMPANY.

The Philadelphia Traction Company, the largest of all the railway companies in Philadelphia, has proceeded farther with the work of electrical equipment than any of the other railway companies. The company is now supplying power from its three stations on Sutherland Avenue, 13th and Mt. Vernon Streets and Market Street near 33d, and is erecting a fourth station, which will have a capacity of 2,250 H. P., at 32d and Dauphin Streets. During the last two months the company has put in operation its 17th and 19th Streets north line, its 19th and 20th Streets south line and its Lancaster Avenue line. The next lines to be put in operation are 22d Street and Allegheny Avenue line, York and Dauphin line, Jefferson and Manchester line, Spring Garden and Walden line, West Spruce Street line and the Paddington line in West Philadelphia.

The Sutherland Avenue station, which was originally equipped with three 250 H. P. Corliss engines belted to generators, has been increased in capacity by the addition of two 750 H. P., cross compound, condensing Wetherill-Corliss engines, direct connected to Westinghouse generators. The same kind of engine is being installed in the other two stations of the company now in operation.



FIG. 1.—EXTERIOR OF DAUPHIN STREET POWER STATION—PHILADELPHIA TRACTION CO.

We present in Fig. 1 a view of the new power station of the company located on Dauphin Street. This station is of cream colored brick with stone trimmings, and presents an extremely tasteful appearance. The interior walls are also of cream colored brick, with handsome wainscoting for a distance of about five feet above the floor. The ceiling is of Georgia pine, giving the interior of the station a very bright and handsome appearance.

An interesting feature of the station is the fact that natural draft is used. The stacks are of brick and are 100 ft. in height. It will be remembered that in the stations erected by the Philadelphia Traction Company at 13th and Mt. Vernon Streets and 33d and Market Streets, the mechanical draft system was employed, and in the present station it is the intention of the company to thoroughly test the natural draft system, so as to compare the two methods of practice in actual service.

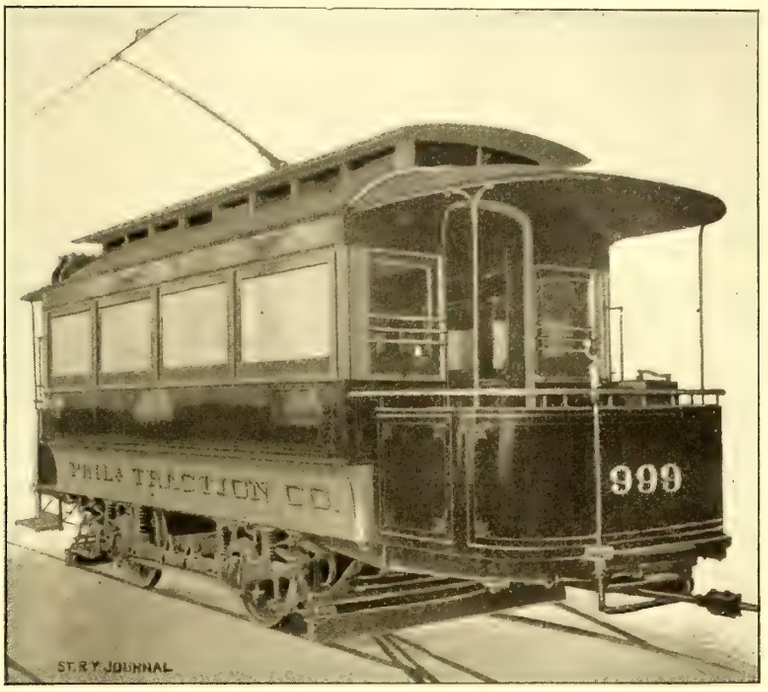


FIG. 2.—TESTING CAR NO. 999—PHILADELPHIA TRACTION CO.

The station is so arranged that the floor of the engine room is about ten feet above the street and that of the boiler room is on the street level. Upright boilers of the Berry type, manufactured by Robert Wetherill & Company, of Chester, Pa., are employed, there being eight boilers in the station, four on each side of the stack. These boilers consist of two shells, an outer and an inner joined by radial tubes. The fire is built in the inner shell, the heat passing through tubes, making the boiler essentially of the vertical tubular type.

The engine room will contain three 750 H. P., cross compound, non-condensing Wetherill-Corliss engines, direct connected to Westinghouse generators. Stratton separators and Wetherill feedwater heaters will be used. The switchboard is of the single deck panel type.

Close to the station and adjoining its old car house, the Philadelphia Traction Company has erected a new car house with a capacity of from 400 to 500 cars. The walls of the car house are of brick, one story in height and surmounted by a monitor roof, with a span of 100 ft. The floors are of concrete.

To assist in making tests on the line, Chief Engineer Uhlenhaut, of the Philadelphia Traction Company, has designed a testing car, No. 999, shown in Fig. 2. This car has somewhat the appearance of an ordinary eighteen foot closed car, but has closed platforms with folding steps, so that persons will not mistake it for an ordinary car and attempt to board it. The main panel and dashes of the car are painted in Tuscan red, a color not

used on any other car of the company, to further distinguish it. An interior view of the car is shown in Fig. 3. It is fitted with a testing table, carrying a complete equipment of voltmeters, ammeters, watt recorders, speed indicators, instruments for determining grades, the height of the trolley wire, etc. There are no benches, but chairs are provided for the engineers. The car is equipped with trolley and motors, so that it can be used as a motor car, or it can be attached as a trailer to another car. It is lighted with ten incandescent lamps.



FIG. 3.—INTERIOR OF TESTING CAR—PHILADELPHIA TRACTION CO.

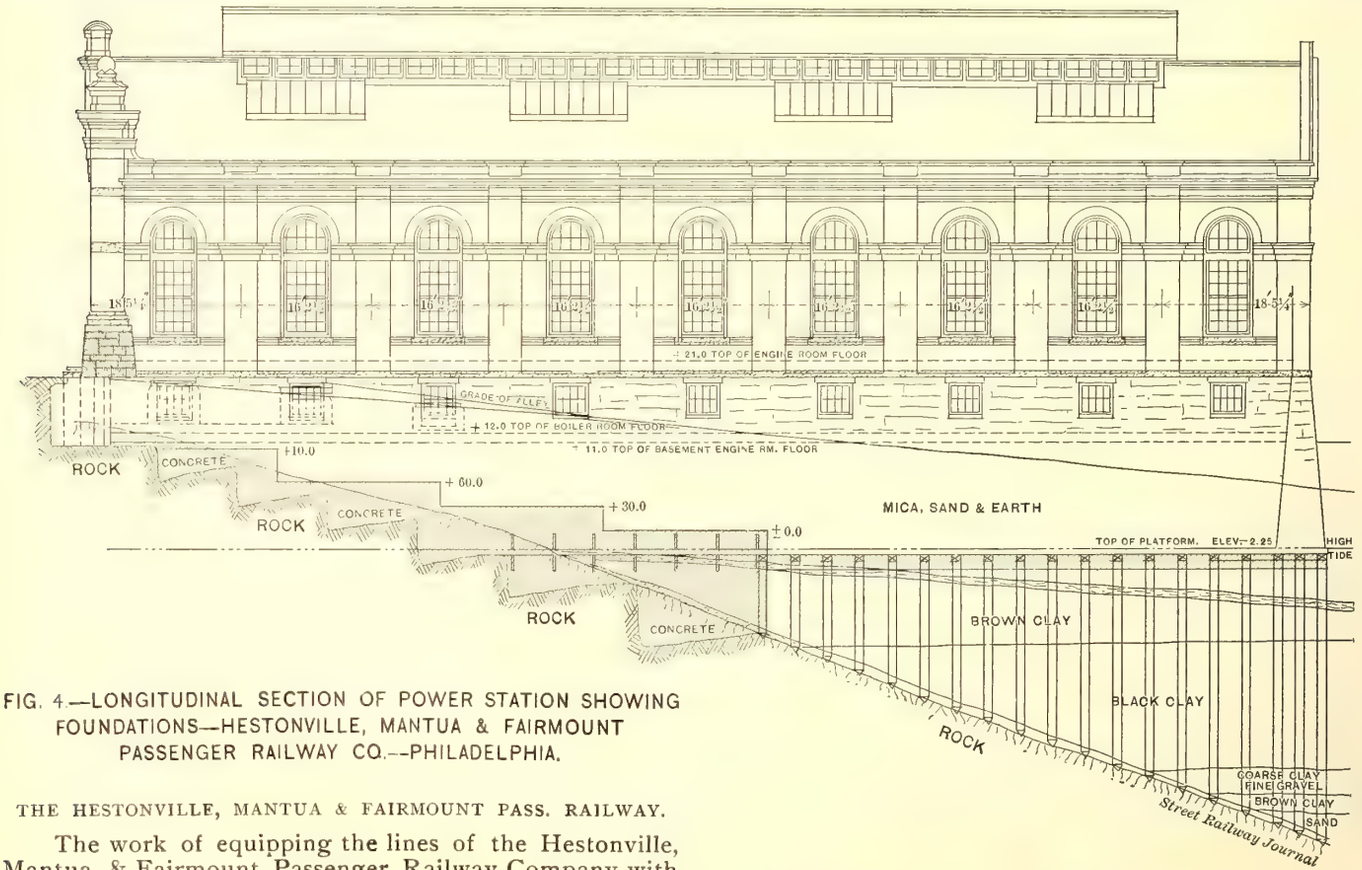


FIG. 4.—LONGITUDINAL SECTION OF POWER STATION SHOWING FOUNDATIONS—HESTONVILLE, MANTUA & FAIRMOUNT PASSENGER RAILWAY CO.—PHILADELPHIA.

THE HESTONVILLE, MANTUA & FAIRMOUNT PASS. RAILWAY.

The work of equipping the lines of the Hestonville, Mantua & Fairmount Passenger Railway Company with electricity is progressing rapidly under the direction of A. Langstaff Johnston, the chief engineer of the company.

The new power station is located on the Schuylkill River at 25th and Callowhill Streets. The building is of a very handsome design measuring 152 × 112 ft., and when completed will be one of the most attractive power houses in the city. The material used in the construction from the level of the street to the engine room floor is Hummelstown brownstone, and above this it is of brick with terra cotta trimmings. The window sills are of cream color sandstone. The roof will be slate supported by iron trusses, and will be provided with a large lantern, affording good light and ventilation.

The foundation of the north end of the building rests on solid rock which comes within six feet of the surface, while at the south end it was necessary to drive piling to a depth of fifty feet. The piling is cut off at mean low water and covered with a layer of concrete two feet thick on which the foundations for the machines are built up of Conshohocken bluestone. The general arrangement of the piling and foundations can be seen from the section Fig. 4. The building is so constructed that it can be extended in the future and the capacity doubled without disturbing the present arrangement.

The engines and generators will be located in a well lighted and ventilated room measuring 64 × 150 ft., and located in the west side of the building. The engine equipment will consist of four Greene tandem compound, condensing engines of 500 H. P. each, built by the Providence Steam Engine Company. The electrical equipment will consist of four General Electric multipolar generators of 400 K. W. capacity each, direct connected to the engine shaft, and running at 100 revolutions per minute.

The switchboard was designed by the chief engineer of the company, and will be a very handsome affair. It will be thirty feet in length with ornamental marble panels. The right hand side will contain the feeder panels, each panel being provided with a circuit breaker, ammeter and cut-out switch. The central panel will contain a recording wattmeter and a general station ammeter. The station controlling instrument for the generators will be located on the left side of the switchboard. On the extreme left is a swinging bracket containing two Weston voltmeters, which can be thrown in connection with any generator. All connections from the generators pass under to the switchboard, and from the switchboard to the line are carried under the floor to a testing room under the northwest corner of the building. A complete set of instruments will be provided here for testing the insulation,

resistance and capacity. The instruments will be mounted on a solid brick base resting on a natural rock foundation.

The boiler room is located in the east side of the building, in a room measuring 42 × 150 ft., and will contain eight Babcock & Wilcox water tube boilers, of 250 H. P. each, arranged in batteries of two each. The fronts will be of enameled brick, and brass pipe fittings will be used throughout.

The smoke flue will extend the entire length of the division wall between the engine and boiler rooms, entering a large and ornamental stack at the north end of the building. This stack will be 150 ft. in height. The base will be twelve feet square to a height of thirty-five feet; above this it will be octagonal in form, surmounted by a cap of very ornamental design.

The coal handling apparatus will be very complete. Coal is brought by boats to a substantial wharf and unloaded by means of an elevator and conveyor supplied by the Link Belt Engineering Company, and erected by Armstrong & Pringtzhoff, of Philadelphia.

The coal will be conveyed to a bin holding 300 tons, constructed alongside of the east wall of the boiler room. Chutes from this bin will pass through the wall and deposit coal in front of each boiler. The conveyors will also be arranged to store coal in the space between the boiler room and the adjoining property. This space is 36 × 200 ft., and will hold over 2,000 tons. The boiler will be provided with a narrow gauge track and coal cars for conveying the ashes to the wharf, and to deliver coal from the storage piles if necessary.

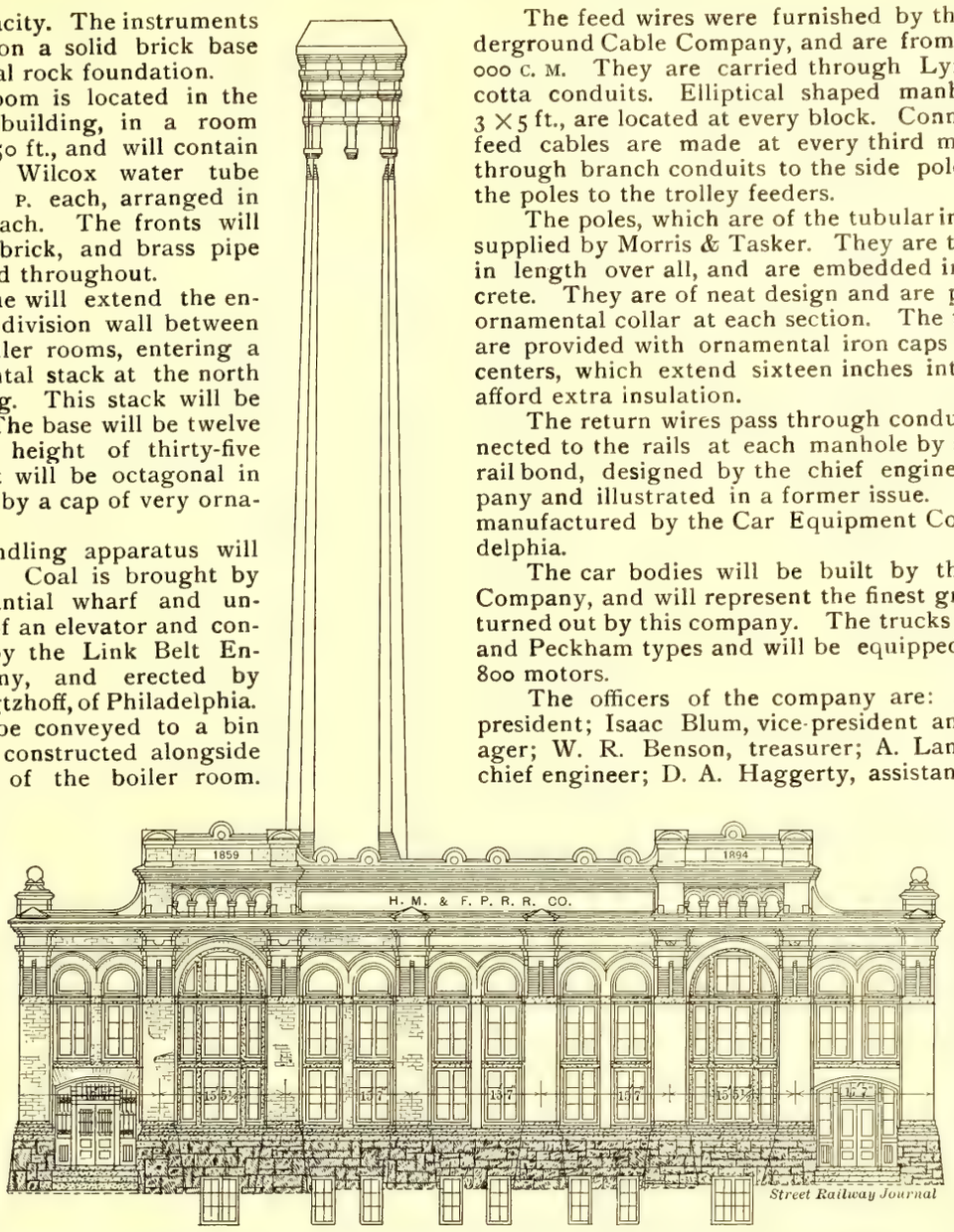


FIG. 5.—FRONT ELEVATION OF POWER STATION—HESTONVILLE, MANTUA & FAIRMOUNT PASSENGER RAILWAY CO., PHILADELPHIA.

The condensers are located under the floor of the engine room, and take water from a well, 8 × 8 ft., located in the center of the building. This well will be supplied by two Worthington duplex pumps located in a separate building. These pumps have a capacity of 20,000 gals. each. It is intended to use one at a time, the other being held in reserve. Water is taken from the Schuylkill River. A well is located inside of the wharf line and is furnished with a grating provided to protect the ends of the pipes from drift and ice. To provide for any accident to the supplementary pump, the receiving well has connections with the city mains, from which it can take its water supply.

The boiler feed pumps will be located in the center of the boiler room between the boilers, and the piping is so arranged that the water can be pumped direct from the hot well to the boilers or through the heaters. The feed pumps were furnished by Barr, of Philadelphia. Two Berryman heaters of 1,000 H. P. each are provided.

The work on the roadbed is about completed. The rails and all special work, as mentioned in a previous issue, were supplied by the Johnson Company. The rails are of the girder type and weigh ninety pounds to the yard. A very elaborate piece of special work was put in at Spring Garden and 25th Streets.

The feed wires were furnished by the Standard Underground Cable Company, and are from 300,000 to 700,000 C. M. They are carried through Lynch Lake terra cotta conduits. Elliptical shaped manholes, measuring 3 × 5 ft., are located at every block. Connections with the feed cables are made at every third manhole, and run through branch conduits to the side poles and through the poles to the trolley feeders.

The poles, which are of the tubular iron pattern, were supplied by Morris & Tasker. They are twenty-seven feet in length over all, and are embedded in six feet of concrete. They are of neat design and are provided with an ornamental collar at each section. The tops of the poles are provided with ornamental iron caps fitted with wood centers, which extend sixteen inches into the poles, and afford extra insulation.

The return wires pass through conduits and are connected to the rails at each manhole by special types of rail bond, designed by the chief engineer of the company and illustrated in a former issue. These bonds are manufactured by the Car Equipment Company of Philadelphia.

The car bodies will be built by the St. Louis Car Company, and will represent the finest grade of the work turned out by this company. The trucks are of the Bemis and Peckham types and will be equipped with two G. E. 800 motors.

The officers of the company are: Johns Hopkins, president; Isaac Blum, vice-president and general manager; W. R. Benson, treasurer; A. Langstaff Johnston, chief engineer; D. A. Haggerty, assistant chief engineer.

THE ELECTRIC TRACTION COMPANY.

The Electric Traction Company, of Philadelphia, Pa., was the second company in that city to commence operations electrically, having put the first electric cars in operation last April. It operates the lines of the Frankford & Southwark Philadelphia City Passenger Railway Company, the Citizens' Passenger Railway Company, the Second & Third Streets Passenger Railway Company, the Lehigh Avenue Railway Company and the Lombard & South Streets Passenger Railway Company. The company has at present two power stations, one located on Delaware Avenue between Beech and Laurel Streets, which has a capacity of 6,000 H. P. The other station, which has been in operation for some time, and which was described in the June issue of the STREET RAILWAY JOURNAL, is located on Hutchinson Street, near the corner of Oxford Street, and has a capacity of a little over 1,000 H. P.

We present in Fig. 7 a view of the interior of the Delaware Avenue power station of the company. It is of brick, with fronts of pressed brick. The lower part of the walls is faced with brownstone for a distance of ten feet. Brownstone sills are also used for the windows, and brownstone headstones for the doors. On the latter is cut the name of the railway company. The power house rests on piles and stone foundations, and is provided with heavy walls which are twenty-two inches in thickness for a height of ten feet. The thickness in the walls is then eighteen inches at the top. Ample windows are provided on all sides, giving plenty of light and air. The engine room roof is provided with a skylight twelve feet wide, running the entire length of the building. This is not fitted with ventilators, but both gable ends of the power station are arranged with exhaust fans run by electric

power, each of which has a capacity to effect a complete change of air in the room in fifteen minutes, thus supplying complete ventilation. The roof of the boiler house is of corrugated iron.

The engine room, which measures 200 × 80 ft., contains six Porter-Allen engines of the tandem compound, condensing type, and of 1,050 H. P. each, which are direct connected to General Electric 800 K. W. generators. One small couple of 250 H. P. is provided for the night load. The engine room is provided with a twenty ton Sellers traveling crane.

An especially interesting feature of the station is the switchboard, which is located midway between the front and back of the station and near the south wall. It is of enameled slate, and so arranged that its entire length can be that of the engine room. It is located at a distance of six feet from the wall, giving easy access to all connections.

Owing to the great distance to which power is transmitted and the distance of some of the outlying lines of the company from the power house, special provision had to be made to keep up the voltage at these outlying points. This is accomplished by means of providing the switchboard with two positive bus bars in addition to the negative bus bar, one positive bus bar being at a potential of fifty volts or more higher than the other. The connections are so arranged that any feeder can be connected with the higher or lower positive bus bar, or so that any generator can be put in connection with it. In this way the potentials of the outlying lines can be kept up by raising the potential at the station end of the feeders if there should be a drop in the voltage. By this method a large saving in copper can be effected. The switchboard panels are of the General Electric one-pole switch system. The equalizer switch is set close to the generator and the equalizer bus bar is run straight between the generators, the two connecting to the switchboard. The board is fitted with the Thomson magnetic circuit breaker, type F, manufactured by the General Electric Company, and voltmeters and ammeters which are of the Weston type. All of the switches are of the so-called quick break type, and one is a 7,000 ampere Ajax switch.

The boiler room measures 200 × 80 ft. and employs the mechanical draft system, which as our readers know, is being used extensively in Philadelphia. It will be fitted with twenty-four Babcock & Wilcox boilers, each of 250 H. P. capacity each and four economizers of the American Economizer Company's manufacture. The capacity of the economizers will be equal to the boiler horse power and so arranged that any one of the four economizers can be used with any one section of boilers. The stack, which has an inside diameter of ten feet and rises to a height of sixty feet from the ground, is provided with two direct

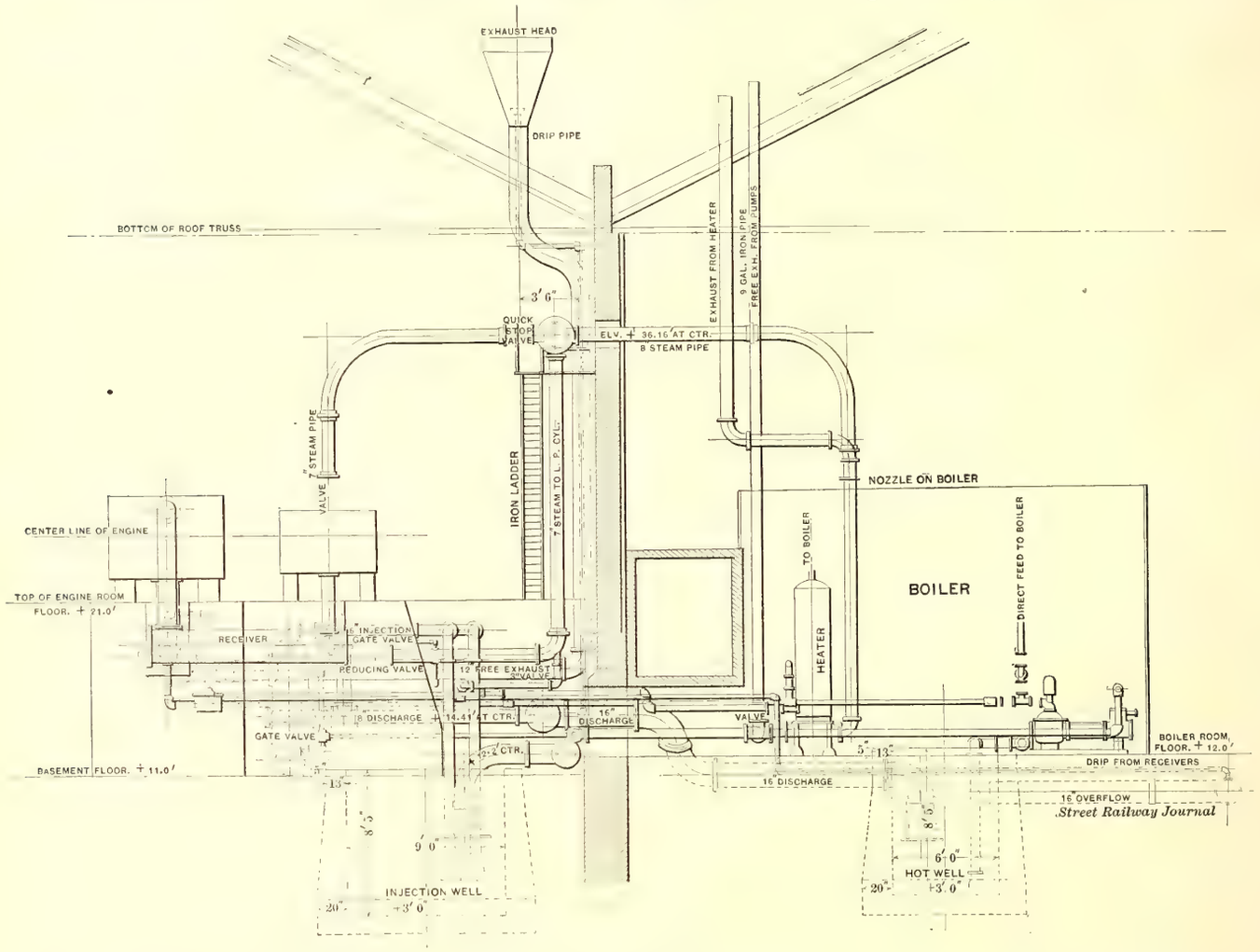


FIG. 6.—SECTION OF ENGINE AND BOILER ROOM, SHOWING PIPING—HESTONVILLE, MANTUA & FAIRMOUNT PASSENGER RAILWAY CO.

driven Sturtevant fans for the mechanical draft. Each fan has a capacity equal to taking care of all the boilers when running at their full capacity. The condensing pump is of the Blake vertical type.

The boiler house has a storage capacity for coal of 500 tons. The coal can be transferred at any time to the boilers by coal handling machinery manufactured by the Link Belt Engineering Company. Ashes will be taken from the boilers by conveying screws and elevators, thence carried to a hopper on the coal wharf so that when a car unloads coal for the station it can be reloaded with ashes which are then taken away.

For condensing water the company has laid two eighteen inch pipes to the Delaware River, one a suction and one a discharge pipe.

All the feed pumps are supplied by the Blake Manufacturing Company, and the station is fitted with two, each with a capacity equal to that of the entire station. The station is also provided with an injector manufactured by L. Schutte & Company, of Philadelphia, of a capacity equal to that of the entire station. This injector was one

shown at the World's Fair, and the object of its installation was to provide for the operation of the station in case of accident to the pumps, the latter being usually relied upon to supply feedwater to the boilers. To all bends in the steam piping or at any other place where steam might condense, piping is laid so that the condensed water is carried to the Blake pump and receiver, by which it is pumped into the boilers.

As mentioned in previous articles on the electric railway system in Philadelphia, all of the feeder and return cables are carried in underground conduits. The type of conduit of the Electric Traction Company is creosoted wooden ducts manufactured in Williamsport, Pa. The cable vaults at the power station to which all the vaults lead are lighted by windows and also by electric lights. Provision is made so that ninety cables can enter here and be hung on the walls. One end of the cable vault is utilized as a testing room. Permanent connections are made with each cable and the terminals are run to the testing room where they terminate in a switchboard. By this means connections for testing can be easily made from testing instruments to any feeder terminal.

The Electric Traction Company is rapidly completing its outside work of construction. The 10th and 11th Streets line, which is owned by the company, has been in operation for some time and is receiving power from the Hutchinson Street station. The 5th and 6th Streets line, and the 2d and 3d Streets line are almost completed and will be put in operation, it is hoped, by October 1. The Lombard & South Streets line and the Lehigh Avenue line will be the next to be put in operation. Bracket construction is employed on the 10th and 11th Streets line, and span wire construction is used elsewhere. About two-thirds of the company's track is now equipped.



FIG. 8.—VIEW OF BOILER ROOM, DELAWARE AVENUE POWER STATION—ELECTRIC TRACTION CO., PHILADELPHIA.



FIG. 7.—INTERIOR OF DELAWARE AVENUE POWER STATION—ELECTRIC TRACTION CO., PHILADELPHIA.

The track construction used consists of ninety pound, nine inch girder rails, illustrated in the January, 1894, issue of the STREET RAILWAY JOURNAL. These rails are double bonded by riveted bonds through the web. The rails are also cross bonded and connected to the return cable, which has a cross section equal to 20 per cent, of that of the outgoing feeders. The feeders are of a standard size of 650,000 circular mills and were supplied by the John A Roebling's Sons Company. They are lead covered. The return cable is of 1,000,000 circular mills, and is slightly insulated. The trolley wire is No. 00. Medbery insulation and that of McAllen type are used. From some tests made on the 10th and 11th Streets line the drop of voltage on the return circuit was found to have a maximum of 2 per cent.

As will be seen, the equipment of the Delaware Avenue station is similar in many respects to that of the Hutchinson Street power station of the company, the chief characteristics of which are Porter-Allen engines direct connected to General Electric generators, and in the steam equipment Babcock & Wilcox boilers operated with economizers and mechanical draft. The engineers of the company are well satisfied with the results secured in economy at the Hutchinson Street station of this plant. Tests made at this station show a fuel consumption of only 2.2 lbs. of coal per horse power hour on tests extending over a length of two weeks duration, when the feedwater was introduced to the heaters at 70 degs., leaving at 200 degs. to go to the economizers, and leaving the economizers at from 260 to 265 degs. For an average output of 15,000 H. P. hours per day fifteen tons of coal were used, at a cost, including wear and tear, wages, coal, oil and interest, at about $.009 per horse power hour. The depreciation is estimated at 6 per cent. and interest on capital at 6 per cent. It should also be remem-

bered that the plant is a non-condensing one. It was, however, built when material and wages were low, and at figures which probably could not be obtained in ordinary times.

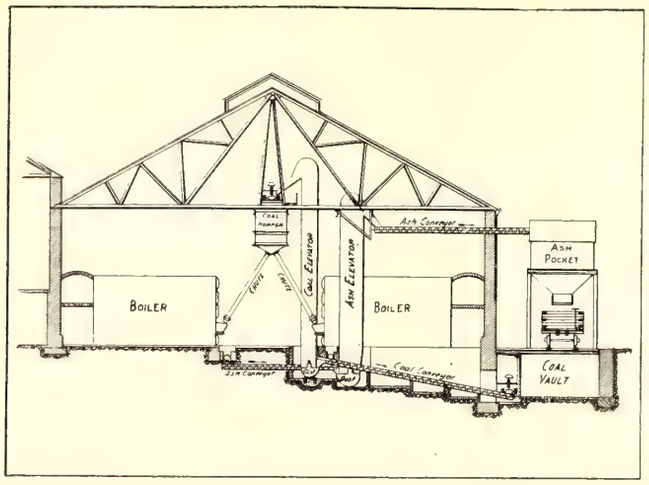


FIG. 9.—SECTION OF BOILER ROOM, SHOWING COAL AND ASH CONVEYOR.

Important Purchase in San Francisco.

An important change in ownership of San Francisco street railway property occurred last month in the purchase by the Market Street Railway Company, of almost the entire capital stock of the Metropolitan Railway Company. The capital stock of the company is $1,000,000, amount of first mortgage bonds, authorized, $250,000, of which only $200,000 have been issued. The road had but a slight floating indebtedness.

The Metropolitan has been put under the management of the Market Street Railway Company, by the appointment of M. D. Stein, as manager, and the election of N. T. Smith, treasurer, and J. L. Willcutt, secretary. The road is five miles long and was the second electric railroad constructed in this city, having been running since October 20, 1892. The first electric railway in operation was the San Francisco & San Mateo Railway which opened April 26, 1892. It is a first class road in every respect, well equipped, with ample power for much more than its present requirements. The route of the Metropolitan Railway is from the junction of Market, Powell and Eddy Streets, along Eddy Street for five blocks to Hyde Street, along Hyde for two blocks to O'Farrell Street, out O'Farrell Street to Scott, Scott to Fell, Fell to Baker, Baker to Page and along Page Street to the Stanyan Street entrance to Golden Gate Park, with a branch from the junction of Page and Clayton Streets, along Clayton, Waller, Cole, Carl via J Street and Ninth Avenue to a southerly entrance of the Park. From this it will be seen that the system works into that of the Market Street Railway Company very well.

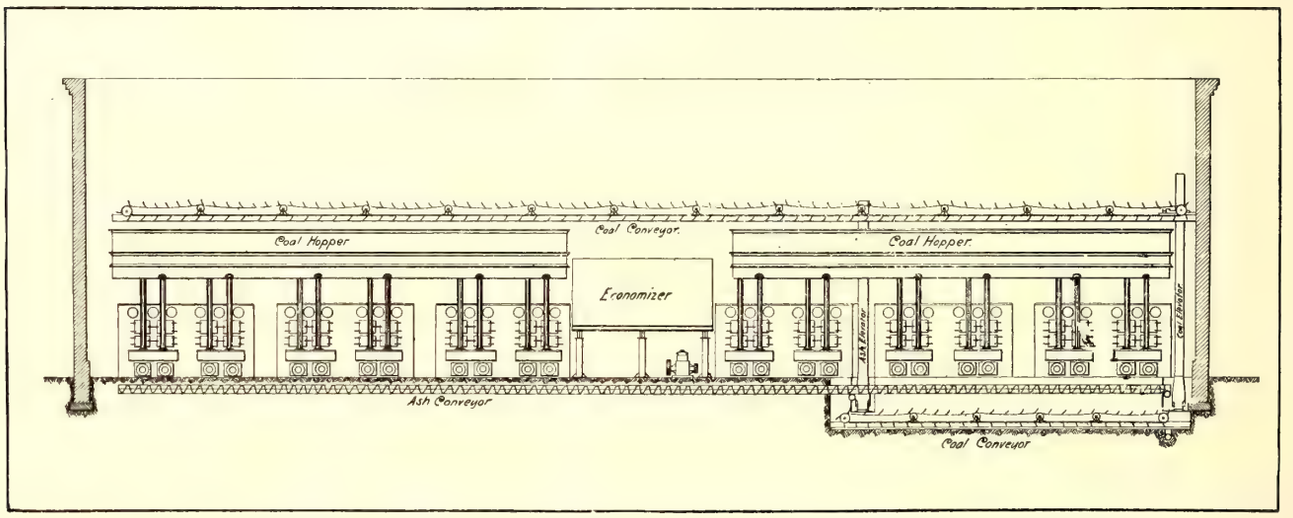


FIG. 10.—LONGITUDINAL SECTION OF BOILER ROOM—ELECTRIC TRACTION CO., PHILADELPHIA.

The chief engineer of the Electric Traction Company is Capt. Edw. B. Ives. Axel H. Engstrom has general charge of the power house construction.

Boiler Accident at Indianapolis.

A gas explosion occurred in the boiler house of the Citizens' Street Railway Company, of Indianapolis, on August 31, at 3:50 P. M. As a result the eighteen inch brick walls surrounding the boilers on three sides were blown down, as well as the steam fittings upon the outside of the brick wall. The accident is attributed to the accumulation of gas under the boilers, though the gauge showed only four ounces pressure of gas and 125 lbs. steam. The boilers were guaranteed to stand a pressure of 165 lbs., and the company was allowed to carry a pressure of eight ounces of gas.

Under direction of General Manager McLean, masons and steam fitters were immediately set at work to undertake repairs. The work was prosecuted speedily, commencing Friday evening and continuing through Friday night, Saturday and Saturday night, Sunday and Sunday night, until 2 A. M. Monday, when all was finished, and at 11 o'clock the load was again put on the station.

The amount of the loss is not yet determined, but fortunately no lives were lost. One fireman received a scalp wound, and the chief engineer, who was standing with him in front of the boiler at the time, was considerably shaken up, but is on duty again.

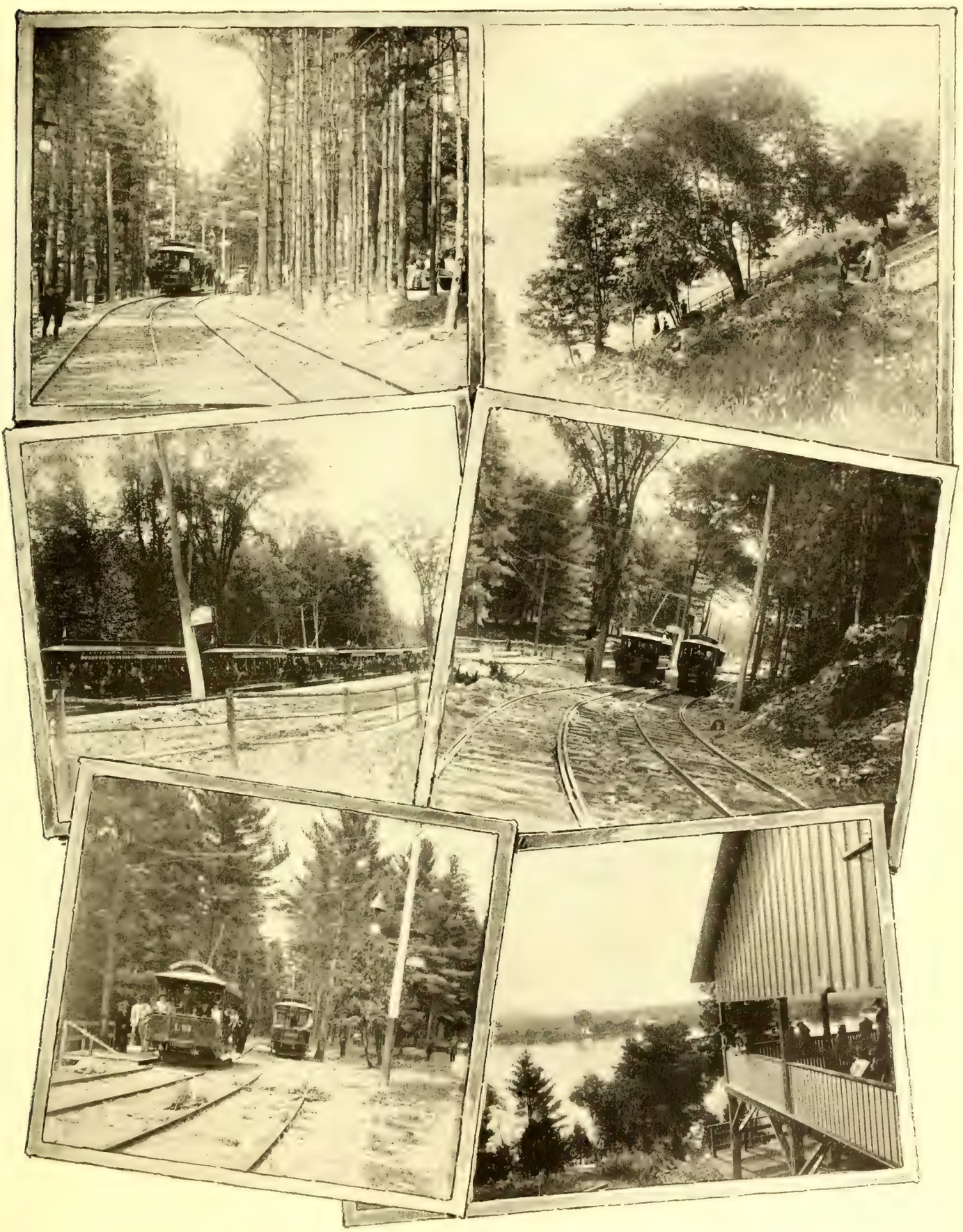
The power house of the Gettysburg (Pa.) Street Railway Company was destroyed by fire on September 10.

Rockliffe Park, the Summer Resort of the Ottawa Electric Railway Company.

The value of parks at the termini of street railway lines as traffic promoters is clearly recognized, and many street railway companies have found that an investment made in this direction is often repaid in a few years by the traffic induced. We have published in former issues views of different street railway parks, and present this month views of the Rockliffe Park, on the line of the Ottawa Electric Railway Company.

The park is situated about three miles east of Ottawa on the high bluffs overlooking the Ottawa and Gatineau Rivers, which have their confluence directly opposite the central portion of the park and thence flow through a charming country to the St. Lawrence and the ocean. The view from the park pavilion is claimed to be as fine as any on the Rhine. Looking west, the Laurentian Mountains rise to an altitude of several thousand feet, and slope gently down to the luxuriant farm lands of the Templeton district. On the mountain side is Kingsmere, the few months' home each year of Canada's Governor General, Lord Aberdeen.

The park properties, consisting of about a hundred acres of beautiful woodland, were purchased by the Ottawa board of park management this year, and will be improved from year to year without interfering with their natural beauty. The cars of the Ottawa Electric Railway run directly through Rockliffe Park, and give a three minute service during the summer. On an average, Ottawa's population of 50,000 visit the park every week. Every pleasant evening a band concert is given at the park, the announcement to the public that the band will play being made by means of pennants carried midway on the trolley poles of the cars during the day.



VIEWS AT ROCKLIFFE PARK, ON THE LINE OF THE OTTAWA ELECTRIC RAILWAY.

The Paterson, Passaic & Rutherford Electric Railway Company.

By Lemuel William Serrell, M. E.

This railway company, extending as it does from Rutherford, N. J., through Passaic and Paterson to Singac and the intermediate towns along the line, forms part of a trunk line system which will run in Hoboken from the Barclay and Christopher Street Ferries through Jersey City to Rutherford and Paterson. This line is now complete and in operation from Rutherford to Singac, which is about six miles west of Paterson, and the construction of that portion of the trunk line from Rutherford to the ferry, known as the Jersey City, Hoboken & Rutherford Electric Railway, is now nearing completion. These two roads when in operation will give a double track electric railroad all the way from Passaic to the ferries, a distance of fourteen miles; and a considerable portion of the line from Passaic to Singac is also double tracked. The entire line when completed will have its terminus at the Delaware, Lackawanna & Western Ferry, in Hoboken, to New York, and will run out into the country a distance of about twenty-six miles; and will go through fourteen cities and villages, having a population of about 400,000 people.

The president of this company is Charles A. Johnson, a banker of New York, and the treasurer is Gen. Louis Fitzgerald, president of the Mercantile Trust Company. Some of their associates in this enterprise are Charles Curie, of Curie, Smith & Mackay, New York; Ex-Senator Charles H. Russell, Thomas D. Jordan, comptroller of the Equitable Life Assurance Company, F. C. Van Dyk and James A. Morrisse, of Paterson, N. J. The company is a consolidation of five different companies, by which it secures a continuous line from Rutherford through Passaic and the heart of the city of Paterson to Little Falls and Singac.

This line was designed and built by the writer, and the accompanying illustrations were taken at various points along the route. The Westinghouse system is used, and power is taken from the Edison Electric Light Company, in Paterson, on terms favorable to both companies, the average cost for power being only a trifle more than the company could produce the same by having its own plant. The entire line from Paterson to Rutherford, a distance of nine miles, is operated from the Paterson station; thirty-six miles of No. 0000 feed wire has been put up for the operation of this portion of the road, the feed wire being arranged in lengths as shown on the accompanying diagram. The total mileage of the line from Rutherford to Singac is about twenty miles.

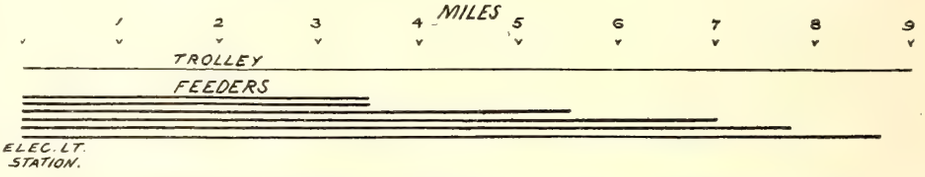


FIG. 2.—DIAGRAM OF FEEDERS—PATERSON, PASSAIC & RUTHERFORD ELECTRIC RAILWAY CO.

One of the illustrations in the group on page 613 shows the car house at Rutherford, of which there is also shown a plan view in Fig. 1. This car house was built on low ground, and about two feet of peat and bog was removed from the entire surface where the building now stands. A Howard clock in front of the building enables the conductors to set their watches without leaving the car. Each of the tracks in the building has a separate entering curve so that cars can be readily run out of the building in case of fire. The floor of the building slopes fifteen inches in 100 ft. from the rear to the front. This enables cars to run out by gravity in cases of necessity, such as fire; and the trolley wires are so arranged that the current can be cut off of the wires inside of the building by means of a switch on a pole outside at the street line. Pits are provided under the tracks the entire length of the building, and the bottoms of the pits, as well as the floor itself, are ofconcrete. The roof is of the iron trussed

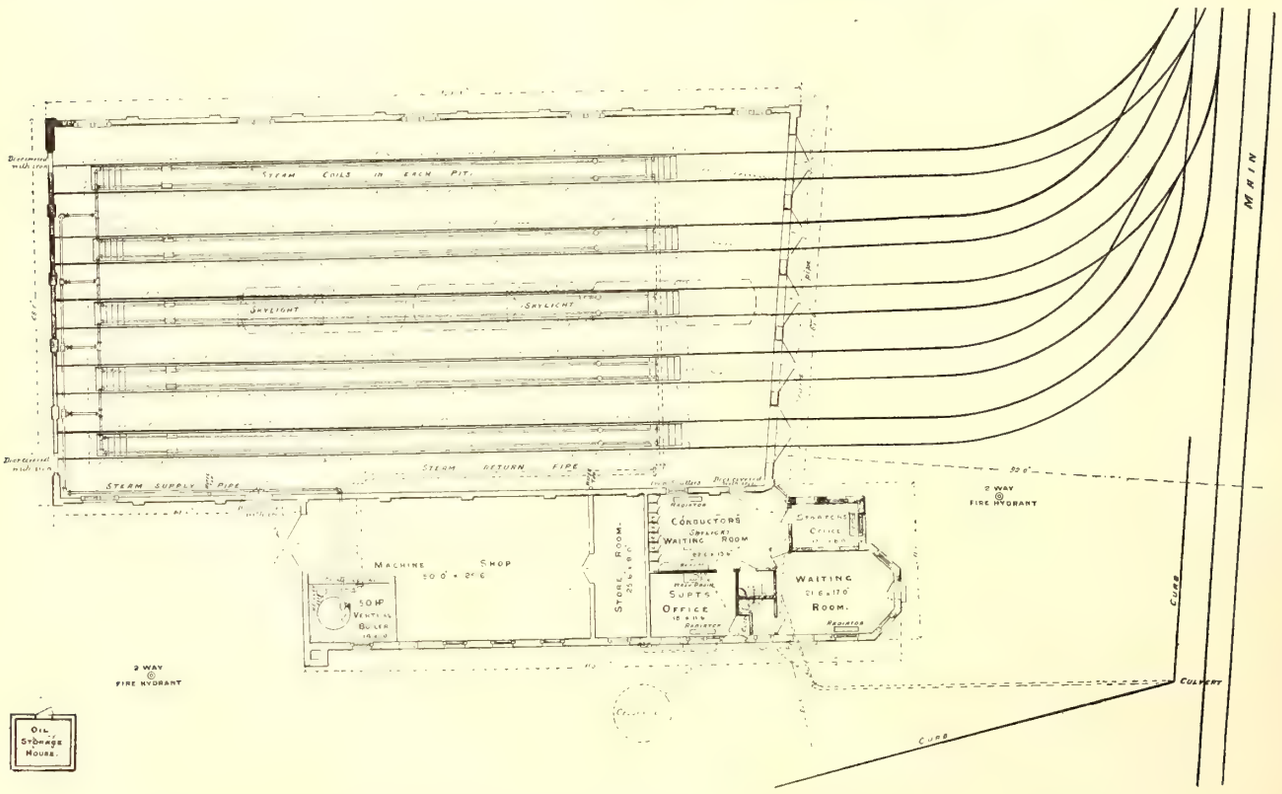


FIG. 1.—PLAN OF CAR HOUSE—PATERSON, PASSAIC & RUTHERFORD ELECTRIC RAILWAY CO.

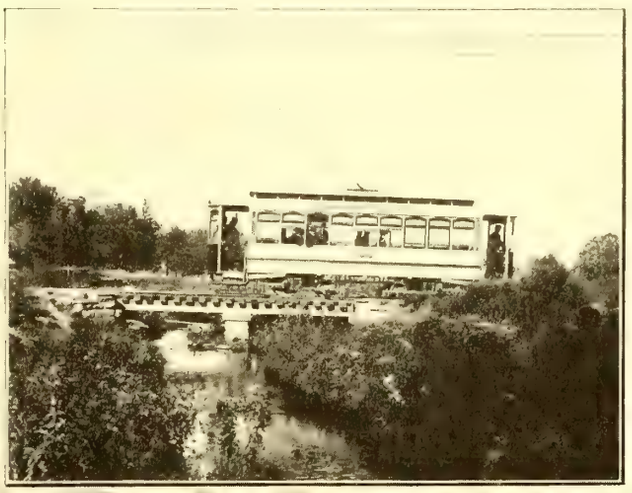
type, covered with corrugated iron, and the wing contains machine shop, store room and other rooms, as shown on the plan. A high pressure steam heating system has been put in having a gravity return. A fifty horse power, vertical boiler is used, the water being returned to the boiler by a Keiley trap. Two fire hydrants, one in the rear and one in the front of the building, are provided in case of fire, and connected with the water main in the street, which carries fifty pounds pressure. A separate building is provided for the storage of oil and other inflammable materials.

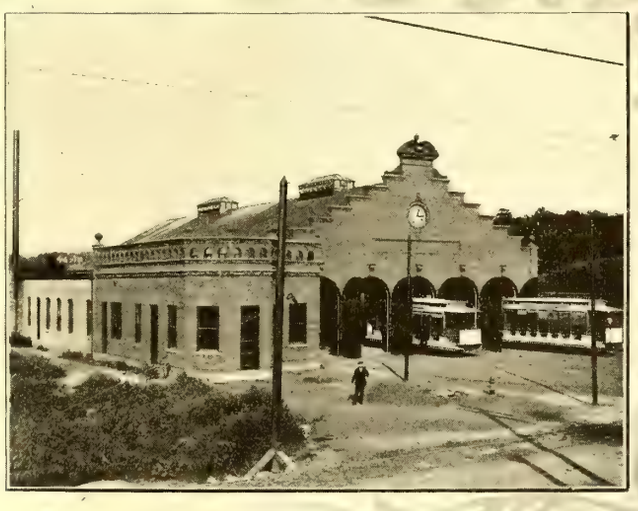
A second illustration shows a part of a retaining wall about 1,200 ft. long and ten feet high, which was built along the plank road between Rutherford and Passaic.

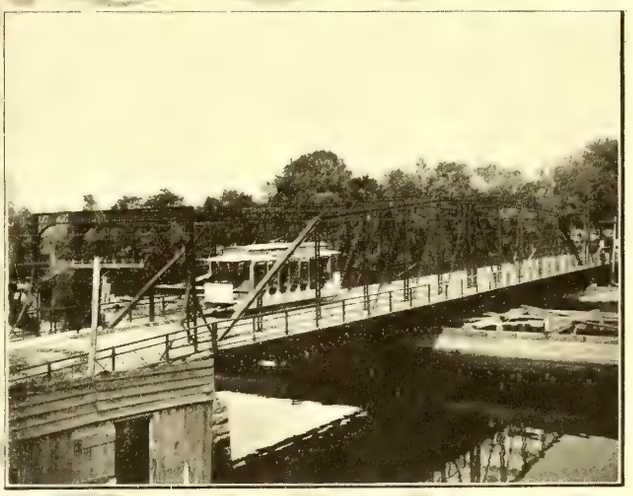
Another view shows the arrangement of the bents on the drawbridge over the Passaic River. A 500,000 circular mill, armored cable runs under the river and is connected with the feeders on each side, while a galvanized iron cable about one inch in diameter is run across the river for the ground return. Another view is taken on Main Street, in Passaic, and shows the Passaic & Newark Electric Railway lines and on the opposite side the Erie tracks.

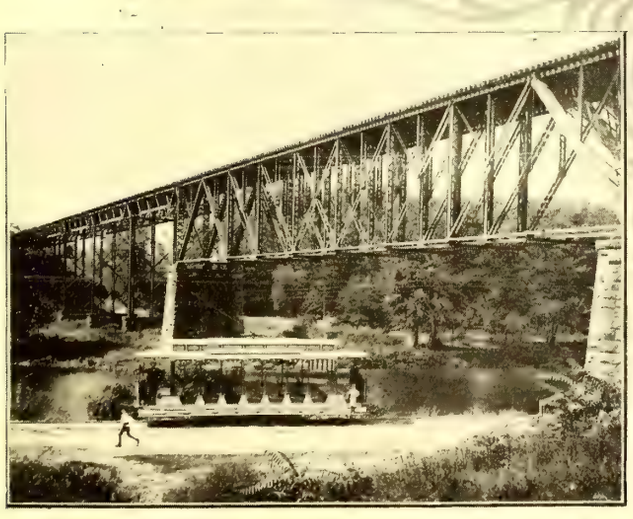
Between Passaic and Paterson for a short distance the railway company has its own right of way, and the













VIEWS ON THE LINE OF THE PATERSON, PASSAIC & RUTHERFORD ELECTRIC RAILWAY CO.

illustration in the upper right hand corner shows a small bridge built over the Weasel Creek. The line from Paterson to Little Falls and Singac runs along the bank of Passaic River and the route is very beautiful. The view in the lower left hand corner is taken on this portion of the line at the high bridge of the Delaware, Lackawanna & Western Railroad over the Passaic River.

The track in Paterson and Passaic is laid with seven and nine inch high girder rail, and the balance of the track is laid with a seventy pound T rail. 6 × 8 in. ties, seven feet long, are used. Octagonal wooden poles are used throughout for the overhead construction, except in the heart of the city of Paterson where iron poles are used.

Thirty-five cars are in use upon the line; and besides the car house at Rutherford, a car house is being built at Lake View, and is now nearly completed, which will hold twenty cars, and another car house located at Singac, now finished, which will hold twelve cars. The cars in use upon the line are of the Brill and St. Louis Car Company manufacture.

The road is capitalized for $800,000, and its earnings show a splendid income upon the investment. Some portions of the road have been running more than a year, and the entire system has now been in operation about three months. Credit for the successful carrying through of this undertaking should be given to its president, Mr. Johnson. The general manager of the road is A. H. Hayward, formerly manager of the Allentown & Bethlehem road, and under his judicious management the ultimate success of the road is well assured.

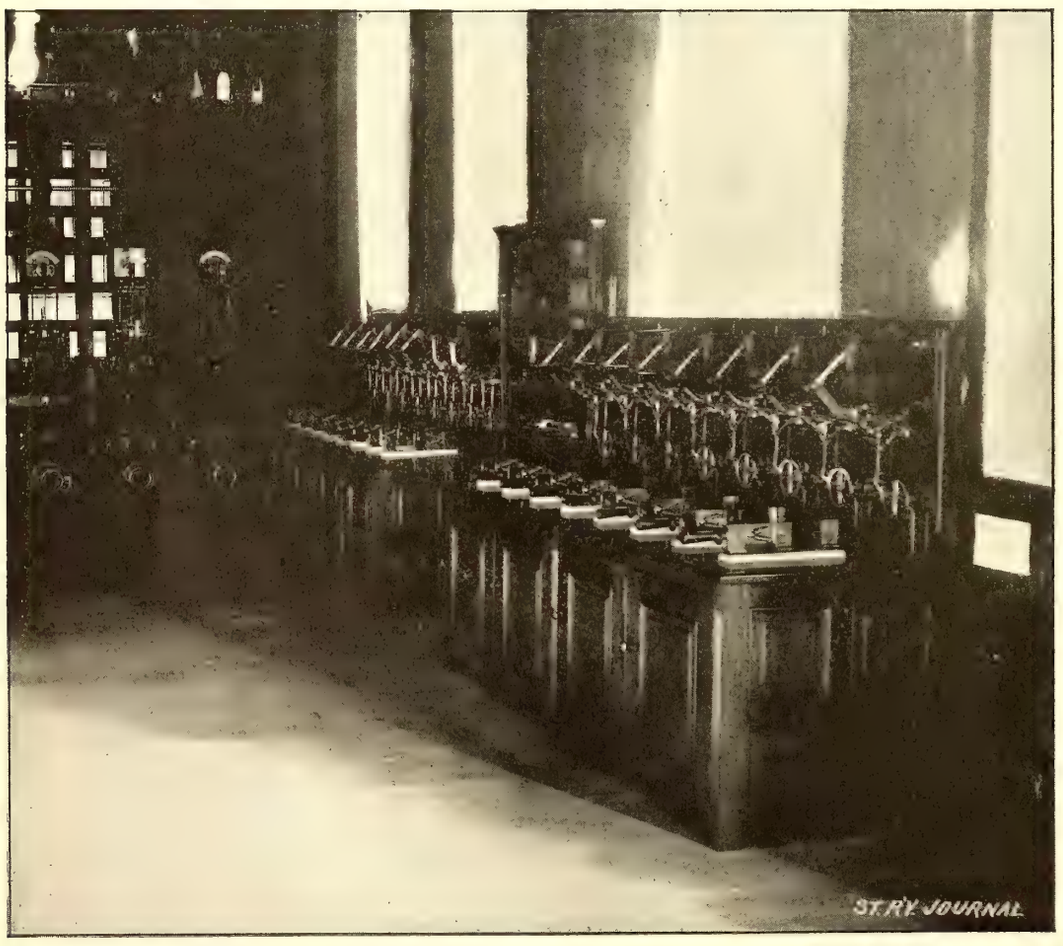


FIG. 1.—FEEDER SWITCHBOARD—NORTH HUDSON COUNTY RAILWAY, HOBOKEN.

The Toronto (Ont.) Street Railway Company reports earnings of $87,666 for the month of August. Last year in August, the earnings were $89,436, the excess of last year over this being attributed to the military tournament during August.

The Bristol Tramways & Carriage Company of Bristol, England, carried 13,000,000 passengers last year.

A New Feeder Switchboard.

A feeder switchboard, possessing several new and novel features, is shown in the accompanying illustrations. It has recently been installed in the Palisade Avenue power station of the North Hudson County Railway of Hoboken, N. J. It was designed by A. K. Bonta, the electrician and engineer of the company.

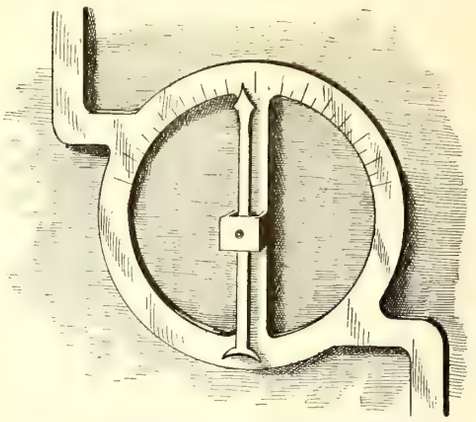


FIG. 2.—CURRENT INDICATOR—HOBOKEN.

The board is constructed of highly polished, quartered oak and is thirty-two feet long and four feet six inches high, with a horizontal shelf about two feet wide, extending the entire length. On this shelf are mounted the feeder switches. These switches were designed especially for this plant. They are of the quick releasing type and have double contact jaws with the lever hinged to the base between the jaws. One of the jaws is connected to the high speed plant and the other to the slow speed plant, both being employed in this station. There are sixteen sections, each section being provided with a circuit breaker.

Current indicators of a special design, shown in Fig. 2, are mounted on the board between the switches and circuit breakers. These indicators are circular in form, having an indicating needle mounted in agate bearings. They are calibrated to a standard instrument, and show the amount and direction of the current.

In the center of the switchboard is a desk on which is an electric call to the patrol station, and a telegraph instrument with which the man in charge can send an alarm to the patrol station in whose district trouble may occur.

All of the instruments are nickel plated, and the board presents a very attractive appearance.

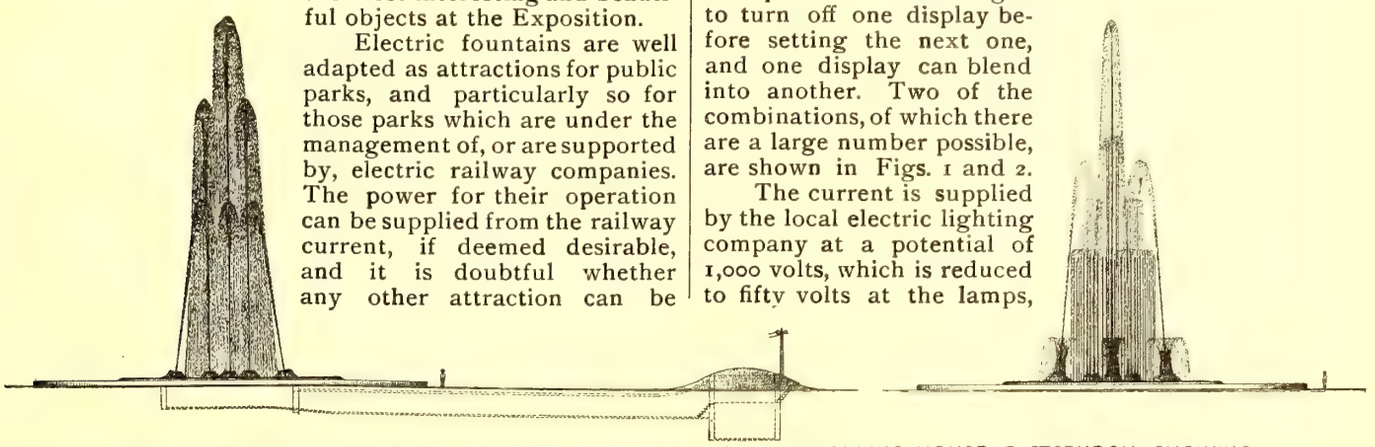
The First Electric Railway in Russia.

The first electric railway in Russia has been opened at Kiew, and has a length of about two miles, with grades as high as 9 per cent. The two generators used are of German make, each having an output of thirty kilowatts. They are driven by Otto gas engines of sixty horse power. The track is laid with stringer rails. American line appliances are used to a considerable extent.

New Electric Fountain.

All who saw the electric fountains at the World's Fair, Chicago, must have been much impressed with the beautiful effects secured by the electric arc light in connection with jets of water. While not the first electric fountains, those of the World's Fair were by far the largest and most elaborate which had at that time been constructed, and they deservedly were regarded as among the most interesting and beautiful objects at the Exposition.

Electric fountains are well adapted as attractions for public parks, and particularly so for those parks which are under the management of, or are supported by, electric railway companies. The power for their operation can be supplied from the railway current, if deemed desirable, and it is doubtful whether any other attraction can be installed for the same sum of money which would prove equally attractive. We illustrate on this page a new electric fountain, which was put in operation last month in Pittsburgh, Pa. Its cost was defrayed jointly by the Duquesne and Pittsburgh Traction Companies and the city of Pittsburgh.



FIGS 1 AND 2—ARRANGEMENT OF ELECTRIC FOUNTAIN AND CONTROLLING HOUSE, PITTSBURGH, SHOWING TWO POSSIBLE COMBINATIONS.

The fountain differs materially from those exhibited at the World's Fair. While larger than either of those at Jackson Park, Chicago, the method of operation has been much simplified so as to largely reduce the number of employes required to operate the fountains.

The fountain (Fig. 1) is located at Stanley Park, on the line of the Duquesne and Pittsburgh Traction Companies. Its approximate cost was $25,000, an amount somewhat in excess of that which would have been required had not considerable blasting been necessary. The height of the central jet is 200 ft., about fifty feet higher than that at the World's Fair.

The basin of the fountain measures 120 ft. in diameter, and the fountain jets will be lighted by fifteen 8,000 C. P. arc lamps, supplied by the Washington Electric Company, of Chicago. These lamps will operate on an alternating circuit of fifty volts. The pit under the foundation is forty feet square, and all the work required in the pit during the operation of the fountain can be done by one man instead of eight or more which were needed in the Chicago fountain.

The operating house is located at a distance of 100 ft. from the center of the fountain, as shown in Fig. 1, and one man can handle everything from that point From this house the different displays and colored lights are regulated by means of hydraulic power operating cylinders, instead of by hand power with directions telephoned from the operating house as in Chicago. The hydraulic cylinders for operating the color displays are each independent of the other and are operated by independent valves from the operating house so that a very wide variation in displays is given. Chapman valves of a special type are used.

Another important feature of the installation is that the operator is not obliged to turn off one display before setting the next one, and one display can blend into another. Two of the combinations, of which there are a large number possible, are shown in Figs. 1 and 2.

The current is supplied by the local electric lighting company at a potential of 1,000 volts, which is reduced to fifty volts at the lamps, which are put in multiple so that one does not interfere with another. The supply of water is taken from the city mains and is under pressure of 135 lbs. 13,000 gals. are used per minute.

All plans and specifications of the fountain were drawn by F. W. Darlington, of Philadelphia, who was also supervising engineer of the installation. The construction was carried on under the charge of Director Bigelow, of the Department of Public Works, of Pittsburgh. The pipe work was supplied by the Wilson, Snyder Company, of Pittsburgh.

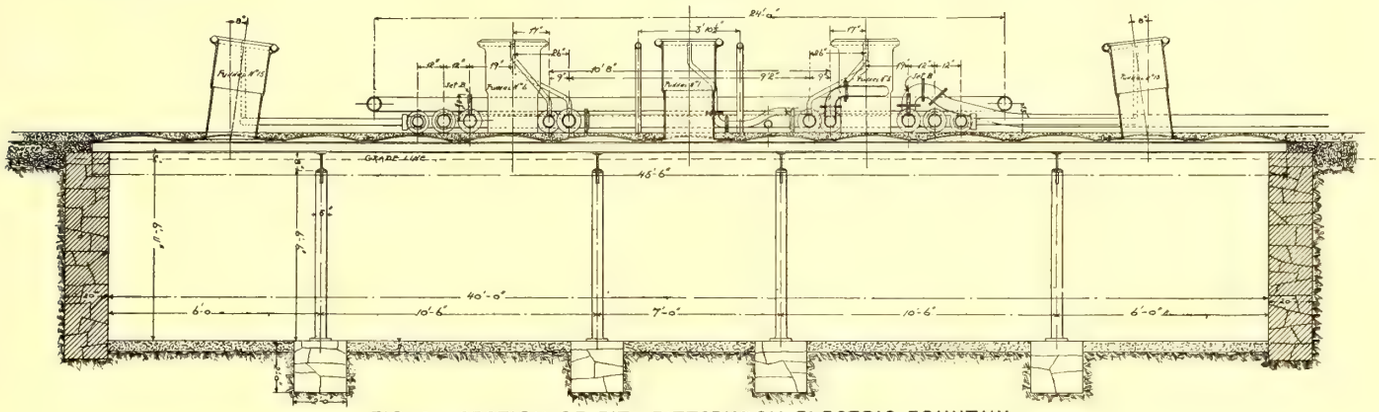


FIG. 3.—SECTION OF PIT—PITTSBURGH ELECTRIC FOUNTAIN.

A COMPARISON of passenger charges per mile on steam railways, from investigations of the Interstate Commerce Commission, shows an average in Great Britain of 4.42 cents for first class, 3.20 cents for second class, and 1.94 for third class. In France, the average is 3.85 cents for first class, 2.86 for second class, and 2.08 cents for third class. In Germany, the rate is 3.10 cents for first class, 2.32 cents second class, and 1.54 cents third class. In the United States the average charge is 2.12 cents. The average charges per ton per mile are as follows: Great Britain 2.80 cents, France 2.20 cents, Germany 1.64 cents, and in the United States one cent. The interest on capital invested in the several countries is said to be as follows: United Kingdom 4.1 per cent., France 3.8 per cent., Germany 5.1 per cent., Peru 5.3 per cent., Austria 3.1 per cent., Belgium 4.6 per cent., United States 3.1 per cent. Throughout the world it is 3.1 per cent.

First Annual Meeting of the Michigan Street Railway Association.

The Michigan Street Railway Association, which was formed in Grand Rapids last June, held its first annual meeting September 19 at Grand Rapids. Among those present were William Canham, W. L. Jenks, of Port Huron; David D. Erwin, F. W. Thompson, of Muskegon; George A. Hart, of Manistee; J. P. Lee, of Lansing; Hudson T. Morton, of Ann Arbor; David H. Jerome, of Saginaw; B. S. Hanchett, Jr., of Grand Rapids; G. S. Johnson, of Grand Rapids; A. G. Bowne, of Grand Rapids; Mr. Harry, of Bay City; W. Worth Bean, of St. Joseph; Garson Myers, of the Standard Railway Supply Company; L. E. Myers, of the Electrical Installation Company; F. C. Randall, of the J. G. Brill Company; P. F. Leach, of the Bass Foundry & Machine Company; W. S. Louttit, of Pullman's Palace Car Company; Ed. Kohler, of the Walker Manufacturing Company; Mr. Smith, of the Consolidated Car Heating Company.

The old officers were re-elected as follows: President, W. L. Jenks, of Port Huron; vice-president, W. Worth Bean, of St. Joseph; secretary and treasurer, Ben S. Hanchett, Jr., of Grand Rapids. Executive committee: The above officers and Strathearn Hendrie, of Detroit, and David H. Jerome, of Saginaw.

In the morning the guests were given a ride around the city in a special electric car, and an inspection was made of the power house and other points of interest. The meeting was called to order at 2.30 P. M. in one of the parlors of the Mansion House, and lasted until six o'clock. The subjects of the papers read were as follows: "Suburban Electric Railways and their Possibilities," by C. M. Swift, of Detroit; "Construction, Maintenance and Operation of Small Street Railways," by W. Worth Bean, of St. Joseph; "Street Railway Accident and Fire Insurance," by David D. Erwin, of Muskegon.

Each paper was discussed at length, and many new ideas in the management and maintenance of railways were developed. It was decided to hold the next annual meeting in Grand Rapids in September, 1895, and the meeting was adjourned.

In the evening the members of the Association held an informal banquet at the pavilion of the Grand Rapids Company at Reed's Lake, Mr. Bean was chosen as toastmaster, and a pleasant evening was passed by all. Speeches were made by ex-Governor Jerome, of Michigan, and Messrs. Jenks, Howard, Bowne, Kohler and Ward. Upon the return to the Mansion House after the banquet, further entertainment was offered the delegates by the supply men present.

A Change in Ownership of the Detroit Street Railway System.

The Detroit (Mich.) Street Railway system changed hands again last month, the interest of Thomas Nevins, of Orange, being purchased by a syndicate represented by R. T. Wilson & Company, of New York. The amount paid is not stated. The new directors of the company are: R. T. Wilson, M. W. O'Brien, Cameron Currie, Maj. J. M. Edwards, of New York; F. R. Pemberton, of New York; D. M. Ferry and John C. Donnelly.

The officers are as follows: President, J. M. Edwards; vice-president, M. W. O'Brien; treasurer, R. T. Wilson; assistant treasurer, George H. Russell, secretary, J. R. Sterling; general manager, J. D. Hawks.

Graphical Records of Street Railway Statistics.

By Russell Robb.

The profits of an electric road depend so largely upon the proper maintenance and operation of the power equipment that the need of keeping full records was soon appreciated. The modern plant is well systemized in all branches. It is an easy matter to collect data bearing upon the different elements of its operation, and one will usually find records of different degrees of completeness. It is very rare, however, that the full benefit of these records is taken advantage of. There is often the most complete data on coal consumption, watt hours output, car miles run and passengers carried, and yet the meaning of the figures lies buried in the records. It is there to be sure, if it is wanted, but the time never comes when there is leisure to work it up into significant shape. The superintendent may perhaps note that various items bear this or that relation to the same items in other cases, and there is, of course, better information about the running of the plant than if there were no records at all, but their full import, the evidence they give of a change of conditions or of the effect of one item upon another, is usually quite lost.

There is no doubt such a thing as getting wound up in statistics, and they do not always have the respect of practical men. The interminable calculations of "pounds of coal per kilowatt hour," "kilowatt hours per car mile," "car miles per passengers carried," etc., seem to absorb an unwarrantable amount of time, and introduce a useless amount of red tape. But if this information were easily secured, and in such shape that it could be quickly appreciated, no one would question the value of its instruction.

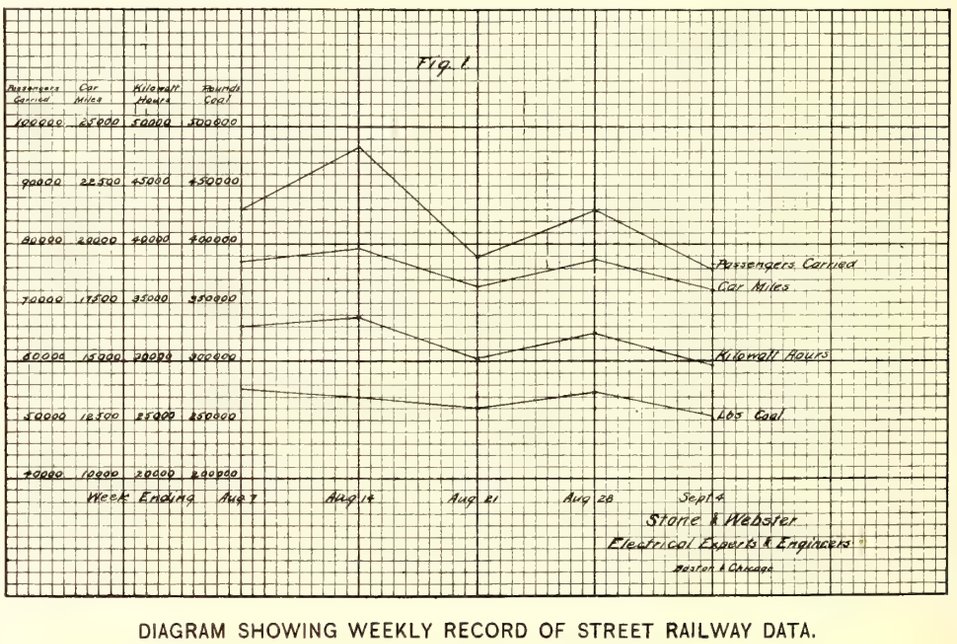


DIAGRAM SHOWING WEEKLY RECORD OF STREET RAILWAY DATA.

Graphical methods, which have so often added to the clearer understanding of other statistics, seem to give the better and simpler representation of street railway data that is needed. The plotting of the data in "curves" brings out very plainly conditions and relations that would hardly be noticed in the bare figures, and they are shown without the labor of making calculations. Those given herewith are from stations in operation, and so represent actual tests.

In Fig. 1 are plotted in four curves, passengers carried, car miles run, kilowatt hours output and coal consumption in pounds. The different curves are plotted on such a scale as will bring them conveniently near for comparison. Thus, while a unit length of an ordinate represents 50,000 lbs. of coal, it represents 5,000 kilowatt hours, 2,500 miles and 10,000 passengers carried. Each curve by itself will, of course, show the constancy or

change in the feature it represents. The growth or decrease in travel or the rise or fall in the consumption of coal, for instance, will be plainly illustrated as in any graphical representation. But by plotting the four curves together in this way additional information of an interesting and useful nature is shown quite as plainly.

Take, for example, the two lower curves, those representing the coal consumption and the kilowatt hours output. Under normal conditions these will run along together, nearly horizontal and nearly parallel. But suppose that it is found that the coal line is constantly coming nearer the kilowatt hour line (Fig. 2), and perhaps even crossing it. It is evident at once that the "pounds of coal per kilowatt hour" is increasing, that somewhere on the station side of the wattmeters there is decreasing efficiency. There may even be indications of the nature of the defect, for if the coal is changed and there is much difference in the quality, or if there is sudden depreciation of the plant in any part, there would be abrupt changes in the relative positions of the curves, while if the decreased efficiency were due to leaks in the cylinder gradually growing worse, or if accumulating scale in the boilers was gradually reducing the efficiency of the steam generation, the change in the relative positions of the curves would also be gradual.

In the same way the approach of the kilowatt hour curve to the car mile curve (Fig. 3) would indicate changes in the conditions outside the station, for it would show an increase in the kilowatt hours per car mile. This might be due to heavier traffic, and if so, evidence would be found in the relative positions of the car mile and passenger curves. It might be due to abnormal conditions of weather which could also easily be checked. But if there were a gradual decrease in the efficiency of the car equipments, or if the bonds were becoming disconnected and the losses in this way increased, the curves would give evidence of the trouble by their gradual approach.

There would be shown too, with curves of this kind, the effect on the travel when more cars were added, the effect of the passengers carried on the power required, or the effect of increased speed, and all without any tedious calculating of results which, even when found, would perhaps be made more intelligible by plotting. The labor of keeping such curves up to date would not only be far less than that of calculating "pounds of coal per kilowatt hour," "kilowatt hours per car mile," etc., but would be little more than simply copying the reports. Each day, or for the sake of average values, each week, one more point could be added to each curve and connected to the rest with a pencil. But using crayons of different colors for the different curves, the relations are more plainly seen.

Such a plot does not, of course, give exact values, and the distance between any two curves would vary somewhat with the variation in the height of the ordinates, but this could be made practically negligible, and there seems to be a genuine value in the *indications* that it can give. Such a chart would keep before a superintendent at all times, the general conditions under which his road was operating, and it would hardly be possible for serious depreciations to go on without his having immediate and striking evidence of it. There is at least one road where a chart of this kind would have shown many months before detection, serious losses in the power plant, and great increase in the output per car mile.

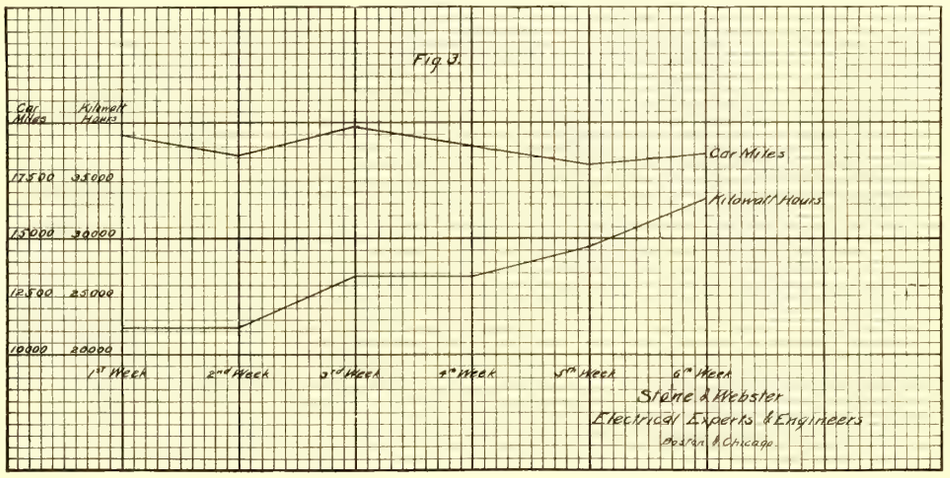


DIAGRAM SHOWING VARIATIONS IN KILOWATT HOURS AND CAR MILES.

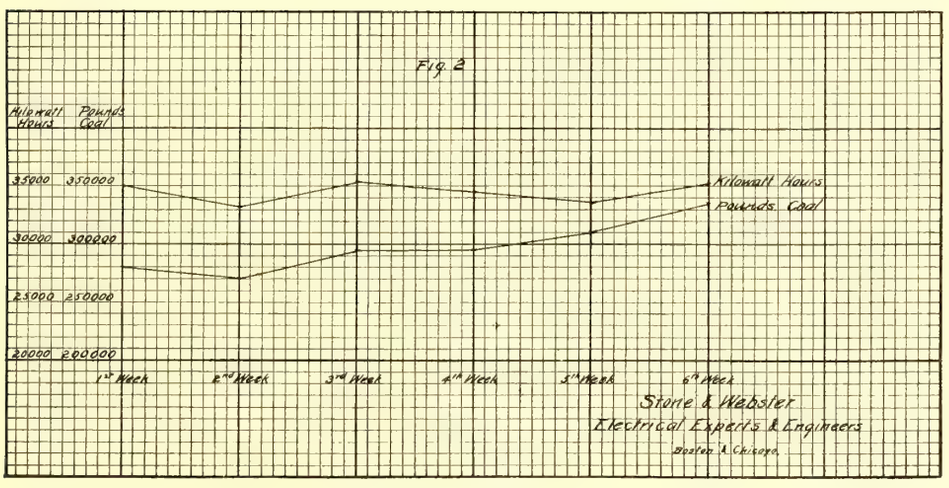


DIAGRAM SHOWING VARIATIONS IN KILOWATT HOURS AND LBS. OF COAL.

The Proposed Line of the Pennsylvania Traction Company.

The right of way between Harrisburg and Philadelphia for the high speed electric railway of the Pennsylvania Traction Company has now, it is said, been secured, with the exception of about five or six miles. The proposed line of the company extends from Harrisburg through Lancaster, Strasburg and West Chester to Philadelphia, with branches from Lancaster to Columbia, Marietta, Safe Harbor, Manheim, Terre Hill and Reading, from Strasburg to Quarryville, and from Parksburg to Oxford. The total length of the proposed line is over 400 miles, of which fifty miles are running and forty-three miles are under construction. The latter includes the lines from Lancaster to Lititz and Manheim and to Terre Hill and Ephrata. The portion now in operation includes the lines in Lancaster, and from Lancaster to Millersville, the system in Columbia, and the line from Columbia to Marietta.

The officers of the company are: President, ex-Senator John J. Patterson, of Lancaster, Pa.; secretary and treasurer, John P. Hertzler, of Lancaster, Pa.; consulting engineer, F. W. Darlington, of Philadelphia. Directors: John J. Patterson, John D. Skiles, J. Hay Brown and S. M. Patterson, of Lancaster, and Robert McMeen, of Mifflintown, Pa.

THE Rochester (N. Y.) Railway Company has leased the line of the Rochester Electric Railway Company for a term of fifty years.

The Youngstown Street Railway Strike.

Youngstown is a city of about 40,000 inhabitants, and has always given evidence of being a very good railroad town, but, unfortunately for the town and its industries, it is largely governed by trade unions. The long contest between the Youngstown Street Railway Company and Division No. 6 of the Amalgamated Association of Street Railway Employes of America, which has just terminated successfully for the railway company, has attracted more than usual attention throughout the country, so that a brief history of the affair may not be without interest.

The first strike of this year on the line of the company occurred in March, following a reduction of twenty-five cents per day in the wages of one engineer. The men were out ten days, and finally came back after accepting a reduction of 10 per cent. right straight through, from the motormen up, the engineer in question accepting his twenty-five cents a day reduction, glad to get back.

The next strike occurred on July 9. After giving the company less than eighteen hours' notice, the Association handed Mr. Anderson, the general manager, a scale of wages to sign, including the following items: Conductors, motormen and swingmen to get sixteen cents per hour on week days and eighteen cents per hour on Sundays, 12 hours to constitute a day's work; engineers to receive $2.50 per day, firemen and machinists $2.25 per day, etc. The company was told that unless the scale of wages was signed before five o'clock A. M. on July 10, the road would be tied up. It was perfectly evident to the managers of the road that the company could never concede the advance of about 15 per cent. on its employes' wages, as it had been doing a losing business for a long time, and had long felt the necessity of curtailing the expenses wherever possible. The managers politely and firmly told the men that it would be impossible to concede their demands. Two or three minor rules, that the men complained of, which the company could change just as well as not, were at once changed. At five o'clock on July 10 but one man out of 120 employes reported for work. This one man, B. R. Shover, a lineman, deserves great credit, as he stood by the company through its long and bitter fight.

The striking employes timed the strike so as to do the company the most injury possible. Two of the very best days of the year would have been July 10 and 11, as upon these days occurred the State Convention of the Christian Endeavor Society, and on July 10 Barnum's circus was in town. After due consideration General Manager Anderson and Superintendent Hazelrigg concluded to fight it out, and while it was a very costly luxury the result now justifies the means. The company now has the control of its property, which it never had before. For fourteen days not a man offered to return to his work and not a wheel turned. The company then began hiring men to take their places. It had over 200 applicants for situations. Many were men of long experience in electric motor traffic in other cities. A number came from Indianapolis, most of whom were old members of the now defunct Street Railway Employes' Union of that city. The result was that after lying idle for two weeks the company found itself with an entire new force of men, all of whom have developed into first class operators.

After being shut down for fourteen days, the company began operating its entire system. But little resistance was offered by the strikers, only one conductor was seriously injured, and, although cars were repeatedly stoned, no great damage was done. Then set in one of the most extensive boycotts ever inaugurated. While the daily papers and the business men of the town would admit the justice of the street railway company's position, they became helpless through the organized efforts made by the unions. The merchants were served notice that if they patronized the street cars the unions would withdraw their trade. In the case of the daily papers, to their credit it must be said, they did all in their power to convince the strikers that their position could not be maintained, and we wish to say that it is decidedly refreshing to find the local press for once on the side of the street railway company in its fight against a strike.

The different trade unions imposed a fine of $1 upon the members each time they were caught riding on the company's cars. To show better how much in the hands of the labor unions the city of Youngstown is, it is only necessary to call attention to the fact that the Mayor, City Clerk, all the policemen, and almost all of the other public officials have complimentary passes, but they became frightened and refused to ride.

While the company was running its full equipment, and employing over 100 men, the receipts were nominally nothing. From $60 to $75 was the average day's receipts for six weeks. The new men gave excellent satisfaction, but though the company was doing business at a fearful loss, it was not the only sufferer. The merchants in the city felt the strike very much, and sought for means to bring it to a close. All the business men of the city finally held a meeting, and passed a series of resolutions, which were submitted to the company. These requested the company to submit the entire question to the arbitration of three judges of the United States District Court, and the merchants pledged themselves morally, and otherwise, to the side which would agree to the provisions.

The managers of the railway company did not think it was exactly right to give up their position in the strike, as they knew they were in the right, as their old employes had left them without cause, and a new force of men, which was giving entire satisfaction, had been hired. This new force was operating the road as well as any set of men possibly could, but the people of the city would not ride, and it was thought that if the company could get the influence of the business men of the city, it would perhaps assist in breaking the backbone of the long continued struggle. All of these points were very carefully taken into consideration by A. A. Anderson in his answer to the merchants, in which he accepted the proposition. It was rejected by the men, however, and the pledges of the merchants counted for nothing. Thus the fight was prolonged. But dissensions began to take place among the striking employes. They saw that their positions were being well filled by strangers, some of their families began to suffer, and with some it was work or starve. A few of the men finally made written applications for their old positions. The company finally hired a few of their old men; then a regular stampede began, and the backbone of one of the most remarkable boycotts ever witnessed was broken. The union, as a union, made all kinds of overtures to have the men taken back and given their old positions, but in each case the company refused to even listen to them. Their reply was, "We have all the men we want, and until vacancies occur, will have no use for more men."

Out of 120 men now in the service of the Youngstown Street Railway Company, but twenty-seven are men that were formerly employed by it. Out of 200 applications the question of wages was only raised by two. Thus it will be seen that the men were glad to get back on any terms.

After the strike was hopelessly lost to the union, the unions of Youngstown officially declared the boycott off, and to show how successful the boycott had been, it is only necessary to make the following statement: On the last day of the strike, the company's gross receipts were $65. The first day after the boycott was declared off the receipts were $95, the second day, $160, and the third day the receipts reached their normal condition.

Thus ended one of the most useless contentions between the employer and the employed ever witnessed. The railroad company lost thousands of dollars in loss of business, the employes lost good positions and thousands of dollars in wages, while the city of Youngstown is also seriously injured both in prosperity and reputation.

Mr. Anderson, the general manager, says the new men are doing extremely well, in many cases much better than their old men did. He says their repair shop shows a decrease of nearly 50 per cent. in equipment needing repairs.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Eighth Annual Meeting of the International Street Railway Association.

ON BOARD S. S. "PERSIA,"
ATLANTIC OCEAN, September 4, 1894.

EDITOR STREET RAILWAY JOURNAL:

In this practical age of ours one must needs make an apology or give a reason for everything he does, and so at the outset my reason for writing to you is, to oblige the friend who asked me, that is, yourself. The reason I went to Europe is this: Ever since the organization of the Union Internationale Permanente de Tramways I have been annually invited by T. Nonnenberg, Esq., the general secretary, to attend the General Assembly. This union is to the continent of Europe what the American Street Railway Association is to the United States and Canada. It likewise holds one general meeting annually. A very pleasant friendship had sprung up between the secretaries of these societies, cemented by other, as well as professional, relations, and I was specially desirous of meeting my friend personally.

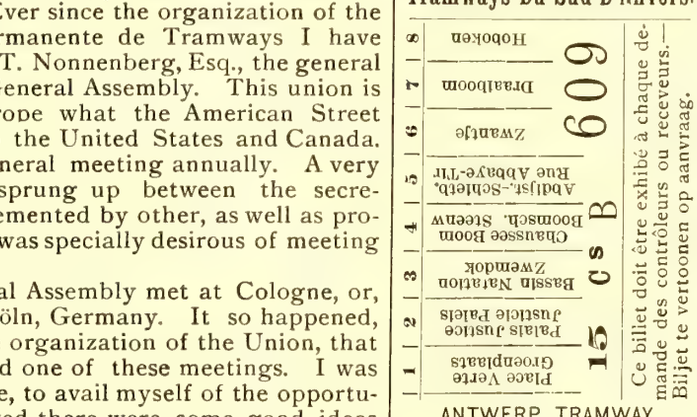
This year the General Assembly met at Cologne, or, as the Germans call it, Köln, Germany. It so happened, for the first time since the organization of the Union, that I could get away to attend one of these meetings. I was not slow, you may be sure, to avail myself of the opportunity, especially as I believed there were some good ideas to be obtained from attending the Cologne meeting, which would be helpful to our American Association.

Accordingly, I set sail for Hamburg on Friday, July 27, and after an uneventful voyage, the ship sailing, as it were, on the North River all the way, we reached Queenstown the second Sunday following. Leaving 140 steerage passengers there, we encountered the only rough sea on the whole trip, which lasted as far as the English Channel. Two days later, having sailed across the lower end of the North Sea, we arrived at Hamburg, much rested in mind and body. I say we, for I have been accompanied by my eldest son, a lad of nineteen, a six-footer, by-the-way, earnest, thoughtful and ambitious, with eyes and ears open for all that came his way.

Europe, every nook and corner of it, has been so often described by readier pens than mine, why should I stop to tell of our trip ere we reached our objective point, Cologne? And yet I cannot pass it by without so much as saying a word; perhaps more than a word. I was greatly impressed with the beauty of Hamburg. Bordering on the Outer and Inner Alsters (two connecting lakes in the heart of the city affording a circumference drive of three miles), are many very handsome residences set, as they are, in gardens of rare flowers, laid out with exquisite taste and tended with the greatest care. The Dutch cities, Amsterdam, the Hague and Rotterdam, all of which we saw hastily, are "queer, quaint and curious." Cities abounding in canals, taking the place of streets, are not plentiful in America, and they appeared very strange to us. The windmills of Holland are a characteristic feature of the Netherlands—you see them everywhere. Perhaps no country has its soil more faithfully and plentifully irrigated than Holland.

At Antwerp, that quaint old city, in its ancient Cathedral is one of the most renowned, if not indeed the most celebrated painting in the world, "The Descent From the Cross," Rubens' masterpiece. There is in progress there, as you know, an International Exposition of great merit. Not so great as our World's Fair at Chicago, to be sure, its buildings not to be mentioned in the same sentence, but notwithstanding, a great collection of the world's handiwork, such as a week would not suffice even to begin to see.

Brussels is a city beautiful in situation, in the lofty grandeur of its public buildings and charming parks. Here, as in Hamburg, electricity has a foothold in the matter of surface traction. One from America is impressed with the statement that on the whole continent there are but 260 kilometers of overhead electric construction, while in America there are 9,600 kilometers! This is the more remarkable when it is remembered that electric traction had its birth in Europe. For the most part the cars are drawn by horses; oftener one horse than two, but always with a conductor, and the cars are usually smaller than our two horse cars, though larger than the one horse car in America. When the fare is paid the conductor invariably gives a ticket to the passenger, on which is marked the point of boarding. This ticket must be kept, and is subject to inspection by a ticket examiner later on, who takes your ticket, looks at it, in some cases tearing off a small piece, and then returns it to you. I wonder how Americans would like to have this system imposed upon them. I am surprised to see how quickly the conductor is able to collect the fare, make the change, open his ticket book, mark the boarding point with his pencil, sometimes marking the point of destination also, put away his pencil, detach and hand the ticket to the passenger. A perfect system for the company, but rather too much of a good thing for an American to be obliged to carry a ticket as an evidence that he has paid his fare, under penalty of paying again, should his ticket be lost.



ANTWERP TRAMWAY TICKET.

Thus quickly have we reached Cologne and become domiciled in the Dom Hotel, one of the finest hostelries on the Continent and just under the shadow of the great Cathedral. This was the favorite hotel for the delegates from other cities, so we felt that we were "in the swim," especially when we saw our names published in the list of those present, which included representatives from no less than ten countries.

We were most cordially and hospitably received. The great sister association across the ocean was being honored in their royal treatment of one of its officers, and nothing was too good for us. To all the meetings, excursions, collations and banquets, the latchstring was always outside the door for us, and we had but to walk in and be at home, so brotherly was the greeting.

When the opportunity came at one of the banquets, I expressed my heartfelt appreciation of the kindness and courtesy so generously and considerately bestowed upon us, and recognized therein the honor paid the American Street Railway Association. I had in a measure anticipated the consideration shown me, and had learned a poem entitled "Dem Vaterland." I knew it, as we used to say when children, "by heart," and so I put my heart into its recitation. What was my delight at its conclusion to have gentlemen, and ladies too, come from all parts of the room to clink glasses with mine, in response to my toast to "The Fatherland."

One friend said: "Sie haben den Vogel geschossen," meaning as we would say, "bagged our game," while another said to me he could not find language to express his feelings, adding that he had not been so moved before in fifteen years. How was that for America and the American Street Railway Association?

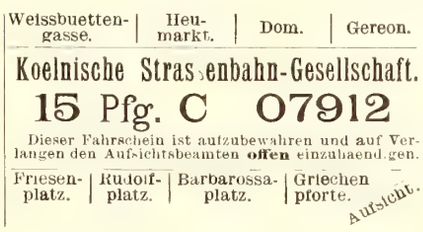
Everywhere in Europe an American is impressed with the fact that a European enjoys life as he goes along. He has learned the lesson that Young America has not yet learned, that "all work and no play makes Jack a dull boy." So in the annual Union meeting he works in the morning (neither does he play while working) and when the morning session closes, his pleasure begins. The rest of the day and evening are devoted to excursions and delightful social gatherings, in which wife and sweetheart join, to make the occasion a lasting memory through the year, and mayhap for all time.

Pardon the digression, but will the trip to Mt. Vernon and Marshall Hall ever be effaced from the memory of

those who had that rare pleasure on that perfect October day? Not while reason lasts. You will remember my conversation with you on this point in connection with the meetings of our Association, that the annual meeting should last nearly, if not quite, a week, so that the business in hand should not be made such hard work, but really all of it, business as well as the excursions, be a pleasure and delight. Instead of the hurried, rushing work we, because we are Americans, are in the habit of doing at our meetings, let us, like the Europeans, make them hereafter equally enjoyable as theirs. Why not?

Does not the man who journeys from San Francisco to Boston, to attend a two days' session, consider that he has paid rather dear for his whistle? How much more interesting too would the exposition of street railway supplies be made with a week's exhibit, than with one lasting but a third of that time!

The Continental Union started its meeting on Monday morning with an all-day excursion, visiting the electric tramway of Remscheid, the electric cog-railway of Barmen and the Barmen-Elberfeld Tramway installation. This was in every respect a delightful and memorable trip. From Tuesday through Friday there was a session every morning from 8 : 30 until 1 o'clock. An early hour to begin you will say, but that is the European way, and then there was to be but one session a day, and important subjects were to be reported upon and discussed. Under a similar plan of one session a day in America, I should be in favor of commencing at, say, 9 o'clock. Tuesday afternoon was devoted to visiting the street railways and their plants in Cologne. The newest open cars in the company's service were gaily decorated with greens and flowers. It would have done your heart good to see the horses, they looked so handsome in their new harness; and the drivers and conductors, all in new uniforms of a bluish gray, made altogether a sensation, as the party passed through the streets of the famous city. Cologne, let me say, once famed for its dirt, is now one of the handsomest cities in Europe, its new residence quarter, developed within the last fifteen years, comparing favorably with that of any other European city. The character of the pavement, its smoothness, whether of stone, wood or macadam and its scrupulous cleanliness, in nearly all foreign cities, impresses one most favorably. Surely in the matter of frequent slushing of gutters from the water mains, as well as in the building of perfect roadways, America has much to learn from Europe. If the state of civilization of a people be gauged by its roads, Europe is far in advance of America. Whatever question there may be as to the former part of the proposition, there is none at all as to the latter. Wednesday afternoon was occupied in visiting manufacturing establishments at Ehrenfeld and Dentz, which were replete with interest and instruction.



TRAMWAY TICKET—COLOGNE.

Thursday afternoon was the red letter day of the meeting. After an hour's ride to Bonn we were taken by the Bonn tramway and steam dummy road, skirting the romantic Rhine, to Mehlem, where we were ferried across the river to Königswinter in the heart of the Rhineland. From here we made the ascent by a cog railway to the summit of Drachenfels, one of the Siebengebirge (Seven Mountains), where a sumptuous lunch was provided. After making the descent, we ascended, also by a cog railway, Petersberg, another of the Seven Mountains, and from its summit obtained a never-to-be forgotten view of the Rhineland as it stretched out for miles and miles before our enraptured vision. After the banquet each carried a lighted Chinese lantern down the mountain to the river, where we all boarded the Rhine steamer "Elsa." Rockets, bombs, Greek fire and guns saluted us at different points along the river. We reached Cologne about midnight, after a day of unbounded enjoyment.

Friday afternoon was given over to individual visitation of the curiosities of Cologne, and in the evening the official banquet was given at the Casino. It is needless to say the dinner was fit for the Emperor. Ohligsberger of the vintage of 1886 and Ranenthaler of 1884! Brothers Kerper and Sage and Odell, why were you not with me on that "rich, rare and racy" occasion to help me out? "The feast of reason and flow of soul" continued long into the night, and it was a joyous occasion to me, no longer a stranger in a strange land, but one of a company of friends. Many expressed the desire that the American Street Railway Association would some time invite the Union to attend one of its annual meetings. One gentleman said to me "That would be an International Union, indeed." Were such an invitation extended, say, a year or more in advance, I have no doubt that several would make strong efforts to attend.

Saturday was devoted all day to either of two excursions, one to visit the steel works of Hoerde and the electric tramway at Dortmund, the other to visit the Phœnix Steel Works at Laar, and the electric tramway at Essen. You paid no money, and you took your choice just the same. Thus was the week spent. Briefly only have I sketched it, for even the Street Railway Journal, with its hundred or so pages, has a limit for such a communication as mine.

One feature of this Union I am led to remark upon, namely, the membership of individuals. There are active and associate members. The active members are the tramway companies only. The associate members are individuals or firms or companies, other than tramway companies. The fees for both classes are the same. The discussions are participated in by the representatives or delegates of active members only, unless associate members are requested to take part. Voting on all questions is confined to the representatives of active members only.

I made diligent inquiry in regard to this dual membership, and was assured that it was altogether satisfactory. "The proof of the pudding's in chewing the string," and hence, on the lines laid down by the European Association, associate membership may become helpful, strengthening the Association, bringing many into closer and more friendly relations by their becoming an integral, actual part of the society.

I believe that my visit to the Eighth General Assembly of the Union Internationale Permanente de Tramways has been of lasting benefit to me, and I trust will inure to the advancement of the best interests of the American Street Railway Association.

I am consciously proud of the fact that our Association deservedly stands the peer of any industrial society in the land. In the administration of its affairs, its officers have always kept it, "like Cæsar's wife, above reproach," and not only jealous of its integrity, but have steadily sought to raise the Association to the highest standard.

But as Aunt Samantha, Josiah Allen's Wife, would say: "I'm ruminatin," and as my letter is already too long, I must hasten.

From Cologne to Strassburg. What shall I say of the Rhine! Its ivy clad castle ruins of centuries long past; its "Bingen, fair Bingen," and a hundred other like pretty villages; its vine-terraced mountains; in a word, the embodiment of romance and the picturesque. Better to have said nothing, than to have said so little, you will say.

Antwerp has her Cathedral, Cologne her Dom and Strassburg her Münster. I climbed the towers of all three. The first two call for steady plodding; the last for the sailor's nerve, until finally you stand on the very pinnacle, and look out upon a picture that repays the weary effort and the test of grit. And the clock, that marvel of human genius! We stood with uncovered heads and watched the figures in their lifelike movements; the planets in their relative positions with respect to the sun, the wondrous mechanism that works out to a second more calculations in which time is concerned, than can be enumerated in the space covered by this letter, long as it is; and then remember that it is adjusted for 1,000 years, and you will not wonder that we journeyed 300 miles to see it.

Paris, the gay city of the continent. Two days there!

Why did we go there at all when we could stay so short a time? "Better have loved and lost than ne'er to have loved at all." The sands of inexorable time were fast running out when we must be again on the sea speeding homewards. August 28 our ship was to sail. We must see what we can of Paris; and we saw much. The Eiffel Tower with its summit in the clouds! What profound respect must one have for this triumph of engineering skill! Not that it is beautiful, but mighty and soul stirring as you mount higher and higher, by foot as high as you can, and then by elevator until you are as high as the pigeon seldom flies, 900 ft. above the ground, or three times as high as Trinity steeple, New York.

Memory carried me back to twenty-four years almost to a day. Sunday, September 2, 1870, the day the Republic was born, the day after the battle of Sedan, when a young fellow in an excited Parisian crowd. The gates of the Tuileries gardens opposite the Place de la Concorde, were broken in, and we rushed down the long avenue, the military on the Palace steps, instead of shooting, permitting us to pass through the Chamber of Deputies and out on the square beyond. An eventful day indeed.

Now again I stood in Paris on a Sunday morning at the same hour of the day, and saw within the once Imperial Gardens a candy woman selling cheap cakes and fruit for a sou up, and my mind reverted to the rocket-like splendor of Napoleon's empire; of the beauty of Eugénie, of the brave Prince Imperial, and then of their ignominious downfall and death, and those lines of Gray forced themselves upon me:

"The boast of heraldry, the pomp of power,
And all that beauty, all that wealth e'er gave,
Await alike the inevitable hour.
The paths of glory lead but to the grave."

"Ruminatin' agin!" It is harder to stop sometimes than to start. When your eyes meet these lines I will be again, God willing, "in the land of the free and the home of the brave." Sincerely yours,

WM. J. RICHARDSON.

Recent Improvements in Cable Traction.*

BY G. W. MCNULTY.

While the title of this paper is very general, it must be understood that the paper will be limited to a description of those improvements which have been embodied in the Broadway cable road of New York City. This limitation will perhaps appear reasonable when it is understood that the most recently completed road on the most important thoroughfare of the New World might naturally be expected to contain all the latest improvements. Indeed, in view of the writer's connection with the Broadway road from start to finish, he could hardly describe as an improvement something not used on that road without having to explain why it was not used—a task that might sometimes be awkward and occasionally invidious.

What, therefore, are considered to be the more important improvements adopted in the construction will be briefly described under the following heads:

1. Power Houses. 2. Power Plants. 3. Cables. 4. Vault Work. 5. Track Work. 6. Cars. 7. Car Barns.

It must be distinctly stated that originality is not claimed for these improvements. Many of them had already been used on other roads, but not so long that they could not properly be called "recent." Also of those used on the Broadway road, the writer, while he had to decide as to the adoption of all, does not claim to have originated all, or even most of them. He was fortunate in being able to surround himself with able assistants, and to their suggestions many of these improvements are due. It is, however, very difficult to give exactly due credit in all cases for improvement, often the outcome of prolonged discussion and experiment, and to avoid possible injustice to any, the above general acknowledgment will alone be made.

To those who may not think that some of the devices hereinafter described are improvements at all, it can only be said that perfect unanimity of opinion on such points is not to be expected, and if, in adopting and describing such devices the writer is only credited with having honestly exercised his best judgment, and incidentally adding something to the sum of our knowledge of that difficult subject, the cable road, he will be more than satisfied.

1. *Improvements in Power Houses.*—As the upper part of the Houston Street power house was to be rented for store and office business, it was important that no vibration from the machinery should be perceptible above the basement. Also, as the driving plant had to be installed and started before the building was completed above the first floor, and was everywhere pierced by columns supporting the upper floors, there was danger that with the imposition of the additional load of eight more stories, the compression of the soil might disturb the machinery foundation and throw the shaft bearings out of line. Fortunately, the remedy for both evils was the same, namely to isolate the column foundations, which were composed of "I" beam grillages resting on concrete. This was accomplished by surrounding each foundation by a steel cylinder driven to its full depth, six feet, into the sand. The machinery foundations rested entirely on the sand outside of the cylinder, and where necessary the column foundations were bridged over by "I" beams. The cylinder made a sort of slip joint between the sand inside and out, so that they could settle independently of each other. The result was very satisfactory. There has been no trouble from vibration, or disturbance of the alignment of the shaft bearing.

The ventilation of the power room of the Houston Street station was a somewhat difficult problem, which has not indeed been entirely solved, but it may be of interest to note the provision originally made for it. The power plant occupies the entire basement, which is about forty feet deep, and almost entirely below the street level. It is in plan about 125 × 200 ft., the side and both ends fronting on the street. The boiler room extends across the rear of the basement, and is separated from the machinery room by a brick partition, in which four openings were left for as many disk fans of an aggregate capacity of about 200,000 cu. ft. per minute, sufficient to change the air of the entire machinery room every three minutes. This would undoubtedly have kept the room comfortable in the hottest weather. The air was to be discharged into the boiler room, where it would have had the effect of assisting the draft, as well as reducing the temperature, since being drawn so rapidly through the machinery room, it could not become much heated in transit. To insure a uniform circulation of the cool air, it was to have been drawn in through openings just above the front sidewalk. Suitable screens, and if need be, the use of the front walk for a settling chamber, were relied on to obviate any trouble from dust. Air could also have been drawn down from the roof of the building through the shaft containing the cylinders of piping for the hydraulic elevators, but while a cool and a purer supply could thus have been obtained, it would, from the location of the shaft, have required ducts in the basement to insure proper distribution, and there would have been danger of piercing the cylinders, etc., in cold weather. The first plan of moving the air in mass from front to rear, by forcing it through an otherwise airtight partition, would, it is believed, have given good results, and, as far as known, is novel.

Provision for the health and comfort of the men was also made by ample bathrooms and convenient and well ventilated clothes lockers.

At the Houston Street station the coal was dumped into vaults under the rear sidewalk wall, which were high enough above the boiler room floor to permit the coal to run out into wheelbarrows from which it was shoveled into the furnaces, the only handling it received in ordinary circumstances. Hoppers under each furnace discharged the ashes into wheelbarrows whence they were dumped into the foot of a link belt elevator and raised to a bin from which they were discharged into carts in the rear driveway, all without handling. A reserve of several hundred tons of coal is kept in some lower vaults from which it can be wheeled to the elevator above mentioned, and raised above the driveway and discharged by a chute into barrels on the boiler room floor. An important part of the equipment of a power house is the system of hoists by which, not only the repairs and renewals of the plant, but also its installation is vastly facilitated. The time saved by such appliances is of special importance, where, as on the Broadway cable road, no stoppage of the machinery can be permitted.

At the 51st Street power house, where there were no columns, it was easy, by means of trolleys running on fixed and traveling beams to command every part of the room, and by the use separately or in combination of a five and a ten ton hoist to lift and transport any weight up to fifteen tons.

This arrangement has practically nearly the convenience of a large traveling crane at very much less cost and has the additional advantage that it can be used in two places at the same time, and cannot be disabled by a single breakdown.

At the Houston Street power house the multitude of columns, combined with the limited headroom, made any complete system of trolley hoists out of the question, but by placing a trolley girder over the line of the engine shaft, and one over each line of the cable driver shafts, and a pair of trolley girders over the jackshaft, it was possible to lift any portion of these shafts or their attachments, and carry it to the side of the room where it could be conveniently got at, or removed. By a combination of four ton hoists it is possible to lift sixteen tons at the jackshaft and eight tons at any of the other shafts. Separate trolley beams are provided for each engine to lift cylinder heads and pistons. In the 51st Street house a steam capstan and a pair of winch heads, running at different speeds, has been found very convenient in the rapid handling of heavy weights and in pulling and hauling around the floor. Unfortunately there was no good place for anything of the kind at Houston Street.

2.—*Improvements in Power Plants.* Following the course of the power from the coal through the cable to the car, we find on each boiler an automatic valve, so called, through which the steam passes on its way to the main. In its ordinary operation it is simply a check valve in case of a rupture of any part of a boiler, to prevent all the rest of the battery from blowing through the injured one. There is nothing new about this, but the valve is so managed that by moving a small lever it will also automatically close against the pressure of the steam, and by having the levers of all the valves on a battery of boilers connected together by a single chain which may be led to any convenient place, it is possible in case a steam main bursts or a general smashup occurs in the engine room to safely and certainly shut off all the boilers in a very few seconds by a single pull of the chain. Happily no accident has occurred to demonstrate the utility of this device, but such tests as we have been able to give it otherwise seem to leave no doubt of its effi-

* Read at the Twelfth Annual Meeting of the New York State Street Railway Association, held at Syracuse, N. Y., September 18, 1894.

ciency, and the knowledge that it is there ready for use will give increased confidence in the time of threatened danger.

Following the power through the engines, which present no novel features, we come to the transmitting gear connecting them to the cable drivers. Here rope drivers were adopted, not only to avoid noise and vibration incident to the use of gearing which, as before stated, would have been very objectionable in a building used for business purposes, but to give a degree of flexibility in the relative motions of the cable drivers that could not otherwise have been obtained.

This latter object was obtained by transmitting power to each shaft of the cable drivers by a separate set of cotton ropes whose elasticity permitted instantaneous slight changes in the relative speed of the drivers to accommodate sudden changes in the stress on the cable due to the variations in load, but also allowed a slight and continuous difference in that relative speed if required to compensate for the shrinkage or creep of the cable due to reduced tension as it leaves the drivers. A continuous variation, however slight, in the relative speed of drivers without slip of the cotton ropes does not at first sight seem possible without corresponding vibration in the ratio of the diameters, but a little study of the conditions which are obtained while transmitting power by an elastic medium will show that such variations of speed cannot be avoided if the resistance varies. In this case such variations accomplish measurably the purpose of loose differential rings in avoiding undue stress on the cables while passing over the drivers, and the unequal wear of the grooves resulting therefrom. An experience of over a year shows that the grooves wear very uniformly.

Another feature of the plant that has been carefully studied, has been the interchangeability, so to speak, of its different parts. By this is not meant the ability to move and replace, but to make a variety of different combinations, so that the plant can never be totally disabled by a single accident. For instance, in the Houston Street plant, there are four engines and four cable drivers, and any engine can be connected to any pair of drivers, making sixteen possible combinations. All important pipes are also duplicated, so that really our only sole dependence may be said to be the smokestack.

The signal system is believed to be a marked improvement over anything that has been done before, and while a large part of it is necessarily connected with the street work, it may on the whole be the best described here. Its operation is as follows:

When an employe wishes to communicate with the power house, he goes to one of the signal boxes, which are located a few hundred feet apart and just outside the train rail; he lifts a small, cast iron cover, opens the box inside and pulls a handle a certain number of times, corresponding to the signal he wishes to send in. In the engine room a large gong strikes the same number and a hand on a large dial points to the corresponding signal. When this has been done, the number of the box from which the signal has been sent in is struck on a small gong and at the same time both numbers are printed on a tape for future reference. Besides the usual signals for starting or stopping the cable, etc., and sending assistance, provision is made for "plugging in" a portable telephone at any signal box. A separate signal system is provided for each of the three cable divisions.

3. *Improvements in Cables.*—There is nothing novel about the cables, except their size—one and a half inches diameter—which is believed to be larger than any previously used on street railways. Those on the lower sections are about four miles long, and at a speed of six miles an hour and forty seconds headway, may sometimes be hauling as many as sixty cars at once. Doubtless, a one and a quarter inch rope would have been strong enough, as well as cheaper and lighter, but it would have stretched nearly 50 per cent. more under varying loads, giving a more irregular motion to the cars, and increasing the travel of the tension weights and the wear on the cable drivers. Its durability would for this reason have perhaps been decreased and in an even greater ratio, and as frequent change of cables is a serious inconvenience, as well as expense, the larger cable will probably prove cheaper as well as better.

The large cables weigh nearly forty tons each, a little over that indeed when mounted on the spools for shipment. They are delivered by a floating derrick to a special truck on which they are hauled to the power station by many pairs of horses. There a square cast iron shaft is put through the square hole in the spool and secured and centered by cast iron wedges drawn together by large bolts. The spool is then mounted in a wrought iron frame, the pillow block having sperical bearings so that no cramping of the shaft can occur. The old rope is then cut, and the new one having been led over permanant sheaves to the tension run is spliced on the other end of the old rope, brought up over the other permanent sheaves to a reel on which it is wound by a pair of engines geared to it, and having sufficient power to draw the old rope out and the new one in without assistance from the main engines. The shears, used to cut the old rope into convenient lengths for handling, can also be used for shearing and punching metal plates, often very convenient in repairing.

With these arrangements an old rope can be drawn out and a new one substituted and started up and the cars shifted over to it in a very short time and without the gripmen being aware that any change has been made. The old rope can be cut up at leisure, being wound off by reversing the engines that wound it on.

4. *Improvements in Vault Work.*—Under this head is included all work below the street surface, except that immediately connected with the track. Perhaps the most important improvement here was the side motion gypsy. In this device, the cable as it enters the conduit and just before it is engaged by the grip, goes over a vertical sheave which carries the cable at the proper height to enter the grip which, after it has passed the sheave, strikes a lever which forces the sheave horizontally into the conduit and lays the cable in the open jaws of the grip. When the grip leaves the lever the sheave is withdrawn by a spring. The arrangement is entirely automatic and has worked very well; it cannot, however, be used except where the cable enters the conduit.

Another gypsy, intended for use in all parts of the line, raised the cable from below the grip by a spiral wheel which, while revolving, had the requisite lateral motion given by cams on its shaft. The motive power was supplied by cable which entered a V groove in the spiral, and at the last of the revolution compressed a spring which, when released by the passage of the next grip, threw the spiral into part engagement with the cable. The device was ingenious, and for a time worked well, but as its operation depended entirely on the friction of the cable in the groove, it was soon found that when the rope became well lubricated and the groove a little worn its action was unreliable and its use was discontinued. This gypsy being actuated only by the live cable, could not under any circumstances throw it in the dead one, a point of much importance where two cables are run in the same conduit.

Another gypsy has since been devised which can also be placed on any part of the line, which will automatically select the right cable, and is much simpler in construction, as well as more reliable in operation. As it has not yet been protected by patent, its operation will not be further described.

The problem of "floating" a hundred feet or so up a 1 per cent. grade from the middle to the lower section of cables in front of the Houston Street power house received much attention. Although it was believed that it could be successfully done, it was feared that where so many vehicles are passing frequent delays must occur from obstructions of various kinds; so to avoid the trouble and expense of keeping men and horses on hand in case of any emergency, a so called "lazy chain" was installed. This consisted of a heavy endless chain of the link-belt type running in a trough under the slot and just below the grips, which were to be engaged by projecting hooks attached to the chain and held up by springs to permit them to recede when the grips moved faster than the chain, and when the cars slowed down they would catch and propel it. To enable the gripman to stop after the lazy chain had caught, the chain was driven through a friction clutch adjusted to slip if the gripman put on the brake, and, as an additional precaution, and to prevent the friction clutch from being destroyed by a long stoppage of the car, a reducing valve was put on the steam pipe by which the pressure was kept too low to permit the engine to slip the clutch for more than one or two revolutions. As the engine was double, it would start again as soon as the brake was taken off the car, so that as far as the gripman was concerned its manipulation was much the same as if he had hold of the cable or was on a down grade.

Fortunately, further experience showed that with proper care the track could be kept clean, so that the cars would always float over without trouble, especially as in reaching this point they were gripped to a high speed cable which gave the requisite velocity.

A modification of this device, with the lazy chain working in a horizontal position, was intended to be used to operate a curved cut-off or short circuit at Bowling Green or State Street in case of accident or congestion at South Ferry, but that also has so far proved unnecessary.

As it was very difficult to lubricate by hand the bearings of the deflecting wheels in the vaults while in motion, a grease reservoir was clamped to some convenient point on the V frame and connected to the bearings by lead pipes, through which the grease was forced at intervals by screwing down on a piston in the reservoir and directed by cocks to the upper or lower bearings as required.

5. *Improvements in Track Work.*—The first and greatest improvement was in the rails, which were especially designed for this road, To simplify the yokes they were made of the same depth, and for convenience of paving that depth was made seven inches. In the slot rail to secure a good support for the paving blocks, the web was made vertical, with very satisfactory results. The head of the tram rail was made with a groove just large enough to take the wheel flanges and enable them to crowd out the dirt, but too small to permit a wagon tire to catch in it. The flange was five inches wide, and contained enough metal to bring the vertical axis down to pretty near the center of depth, thus giving a very efficient girder section. The joint was made by a combination of a pair of four hole splice plates, with a McConway & Torley clamp, the former taking the transverse and the latter the shearing stress and together making a very effective joint. Owing to lugs on the yokes, and to the tie rods supporting the slot rail being half way between the yokes, the tram rail joints had to be one-quarter of a yoke space, or thirteen and a half inches, away from the yoke center, being thus not exactly suspended or supported. The result was satisfactory.

All slot rail joints were made on the yokes and no splice plates were used; only a larger and stronger washer being placed on the tie rod supporting the joint. This has answered fairly well. A drop forged, three hole splice plate joint, originally designed for the Broadway slot rail, is being used on the uptown extensions with promise of very good results.

The substructure presents some very novel features. Stout cast iron yokes were used wherever practicable, primarily of three standard types, namely, for straight track, surface crossings and curves, the latter weighing nearly twice as much as the others. Some modifications of these had to be made in complicated structures, but the number of special cast yokes was kept as small as possible, special wrought iron yokes being freely used in all difficult constructions. In fact, throughout the entire work all details were standardized wherever practicable. In the surface crossings, for instance, a typical structure was designed for a square crossing, and crossings of any other style or combination of sizes on double tracks were made by a slight change in the details, for which no special drawing was required. Crossing yokes were made flush on top and kept low enough to permit the use of heavy sole plates under the rails. A number of holes cored in the top flange of the yokes permitted the secure attachment of the sole plates in almost any

position. In this, as in other special constructions, the perpendicular web of the slot rail greatly facilitated all attachments thereto.

Cable crossings, which for sake of distinction were called intersections, were provided for at 23d Street and at Sixth Avenue, but fortunately their use has not been required. With the possible exception of fenders, perhaps no other subject received so much attention from the noble army of inventors as did the cable crossings. We planned, however, where a cable had to be dropped, to simply "float" over, which our experience at Houston Street shows to be always easily practicable at the points mentioned. With an automatic release, to be described later, and an automatic gypsy, as before noted, the whole problem, both of construction and operation, at cable intersections becomes very simple.

Crossovers from one track to another were always made with wrought iron yokes. They presented no other novel features.

Surface turnouts were made with tongue switches in place of run-offs, to secure better support for the wheels, and most of the latter tongues were secured by a locking pin that could be readily withdrawn from the surface, so that the tongue could be easily removed and replaced without disturbing the pavement.

In cable turnouts, of course, the slot switch was the most difficult problem, but it was very satisfactorily solved by making the point of the tongue stationary and throwing the grip shank into the proper slot by movable pieces working under the head of the slot rail, or in special boxes and arranged to support the slot tongue when at rest. Of course the slot and track switches were connected so as to work together, and no case has yet occurred where the grip has taken the wrong slot. They have also stood up very well under the heavy traffic of lower Broadway, which, it may be remarked, is often more destructive to track work than the cable cars themselves.

Before coming to the curves the carriers should be mentioned, since, though possessing no very novel features, they have worked very satisfactorily. To save journal friction and especially to reduce the slip, which occurs when the cable first touches the carrier after having been lifted off by the grip, and which by its multitudinous repetition becomes a serious source of wear, they were made as light as possible. They were cast with solid arms and heavy chills. As with the duplex system, each carrier had to be to one side of the center of the conduit; the size of the shaft bearings was made proportional to the weight they carried so as to secure uniformity of wear. Both bearings were contained in one bracket so as to insure proper position and alignment, and each bracket, secured from slipping by steady pins, rested on an angle iron frame at three points only so as to prevent chattering.

Curves are the *bête noir* of the cable road; their construction is its most serious problem. It is probable but for the curves there would be a dozen cable roads where there is now only one, but to have to go fast just where you ought to go slow, to be in constant danger of having your cable stranded if a careless or rattled gripman opens his grip ever so little, and to have to put a whole machine shop underground at every change of alignment are such serious and, so far, unsurmountable evils, that it argues much for the inherent merits of the cable road that they have not discredited it altogether. It must be confessed that there are no good curve constructions; some are less bad than others, that is all, and even the least objectionable are vastly complicated by the duplex system. That used on the Broadway road was as simple as any, and, as curve constructions go, has worked very well. Two sheaves, one for each cable, are carried in a frame secured between adjacent yokes so that it can be readily removed for repairs or renewals. Indeed some such arrangement was necessitated by the fact that we had to put the curve construction in the street before the curve mechanism was fairly designed, so that provision for its subsequent addition had to be made. This is a fair illustration of the conditions, probably too painfully familiar to most of you, under which such work is often if not usually, performed; the draughting room struggling hard to keep up with work already done, instead of having complete and harmonious plans prepared in advance, and the engineer expected to achieve just as satisfactory results as if sufficient time had been allowed him to see the end from the beginning and plan accordingly. In the present case circumstances more than individuals were responsible for the unfortunate conditions.

But this is a digression to what is neither recent nor an improvement in cable construction.

To return to our curve construction. In order to get the wheels on separate shafts instead of on the same pin, it was necessary to stagger them, as they could not be far apart vertically. In this way either sheave could be removed while the other was running. Lubrication was effected through pipes, the soft grease being forced from the reservoir by a weighted plunger. An angle iron guide, bolted to the yokes in short lengths, took the side pressure of the grip, while the edge of a flat bar, extending in sections between the sheaves for the whole length of the curve, guided each cable into its proper place. To get the cable started on the right side of this bar at the entrance of each curve, a so called "flipper" was employed. This was a novel feature, and deserves a moment's notice. It really was an extension of the flat bar or cable guide above mentioned, having a partial rotation on an axis parallel to the adjacent tangent. It was projected into the conduit between the cables, being kept out by a spring which permitted it to recede while the grip passed, but held it closely in contact therewith at a point between the cables so that the inner cable was kept above it and the outer one below, thus preventing the live cable from riding on the dead one, which would have done serious mischief. As a moving part kept in place by a spring and struck with some force by the passing grips many hundred times a day, it was adopted with some reluctance, but its action has proved very satisfactory.

6. *Improvements in Cars.*—While the grip is the fundamental feature of the car and, therefore, comes logically under this head, it is also the heart of the cable road as far as its design is concerned, the nucleus around which all the rest of the structure aggregates and the ultimate factor of the whole work. It may be said in planning any machine or structure—and a cable road is both—that part which is most closely controlled by the conditions of the problem to be solved should be first designed. The essential condition of the cable road problem is that there must be some means by which a street car can grasp or release at will a moving cable. The street car and the moving cable are simple problems taken separately. The difficulty lies in their combination; in a cable road it is the grip which effects that combination, and it follows that in planning a cable road the grip should be first selected or designed, and all other parts so arranged as to secure its highest efficiency. Unfortunately, in the Broadway road, through a peculiar combination of circumstances, which need not now be rehearsed, the grip was not fully designed until the road was nearly completed. This necessarily much complicated the design of the conduit and its attachments, as provision had to be made for some possible conditions of the grip which were afterwards found to be unnecessary, while the design of the grip was hampered by the development of unforeseen conditions for which the conduit as built did not adequately provide. Fortunately, by much patient study and some experimenting, it was found possible to devise a very satisfactory grip, whose more important features will be briefly described.

First. As it had to be able to take a rope on either side and go either end first, the grip was necessarily quadri-symmetrical in plan, with, of course, a pair of jaws on each side, both pairs moving together. Contrary to the more common practice, the lower jaws remain stationary. This was done partly to reduce the depth of the conduit, which on Broadway was a most important consideration, but more especially to reduce the slip of the cable on the carriers as it trails from the grip. This, as before noted, is in the aggregate a serious source of wear to both cable and carrier, and its amount in each case is obviously in direct proportion to the length of time that the two are out of contact, which in turn is approximately proportioned to the height that the cable is lifted by the grip. The jaws are lined by steel dies rolled from rail billets, which have given very good results. The shanks were of structural steel, and have also done well. At the end of each cable section, and also in case of prolonged stops, it is necessary that the gripman should be able to drop the cable altogether. Suitable provision was made for this, but it was early foreseen that it was not safe to place entire dependence on the gripman's care, whose attention was liable to be distracted at the critical moment, and whose neglect was certain to wreck the grip if it did not strand or break the cable. An automatic trip was therefore added, actuated by inclined projections in the conduit, which ensure the release of the cable at all desired points.

Some of the grips first supplied did not have this device, and its value was abundantly demonstrated by the accidents which occurred through lack of it. As several devices have been proposed whereby the grip can be made to pick up the cable at any point, a feature at first sight of much value, it may be worth while to say, first, that where cars are run on such short headway as on the Broadway road, should it be lost, it will be but a fraction of a minute before the following car will be ready to push the temporarily disabled one to the next gypsy where the cable can be regained. Next, to permit the jaw to get under the cable at all points, would require either a deeper conduit than was practicable in view of the underground obstructions on Broadway or, much more, cleaning of the same. Last, but not least, all carriers would have to be carefully protected from damage by the grip, a matter of considerable expense and one which would seriously interfere with keeping the conduit clean. Concentric wheels were used for operating both grip and brake as requiring less room for their operation and permitting greater range of motion and consequently power, and a more delicate manipulation of the grip when "stealing" or running slower than the cable, as is so very often necessary on lower Broadway. They are for these reasons easier for the gripmen, and hence preferred by them. While not quite so prompt as the lever, no trouble from that source has been experienced, and the starting and stopping of the car is less jerky.

The brakes offer no special features. Some air brakes have been tried with satisfactory results, but the advantage has not been sufficiently marked to warrant their general adoption.

The cars have been lighted with compressed gas on the Pintsch system, which has proved very satisfactory, and is believed to have been here used for the first time in street cars.

The heating question has received very careful attention, and several tests of different systems have been made. Some method of hot water storage has promised the best results, but the difficulty of charging on such short headway would be very great, and the experience of one winter would seem to prove that with a road carrying so few long trip passengers heated cars are not necessary.

7. *Improvements in Car Barns, etc.*—An extensive and elaborate structure for the storage of cars has been very carefully designed, but has not yet been erected. Its dimensions will be about 200 × 600 ft. by 100 ft. high. Its most noticeable feature will be a combined transfer turntable now partly installed and designed to be operated by electricity, but at present moved by hand gearing. To handle cars in and out of the barn, it is proposed to use two or three small motors driven by storage batteries, compressed air or superheated water. To bring out a car, the motor goes after it and brings it out to the transfer turntable near the front of the building. This not only shifts it to the proper track to run out, but, rotating 100 degs., puts the motor in position to push the car out onto the line and come back for the next one without switching. Of course, in running cars in, the operations are exactly reversed and the turntable then prevents the motor from being shut in by the car it has handled.

On the upper floors plain transfer tables traverse the center of the building, connecting with a car elevator at each side, while smaller motors or lazy ropes would handle the cars on the floor tracks.

Turntables would not be required here as, if lazy ropes were not

used, the motor belonging to the floor could always be placed near the transfer table opposite the track onto which the next car was to be run.

There is necessarily some complication of track work in front of the car barn, and all switches there are operated by one man in an elevated cab overlooking the whole street at that point, which has proved a very satisfactory arrangement. Suitable inspection pits and a well appointed machine shop equipped, not only for the repair, but also for the manufacture of grips when needed, complete the present installations at the car barn.

In conclusion, I may say that if the foregoing looks too much like a descriptive eulogy of the Broadway road, I was limited by the subject assigned to me to the record of improvements only, so that an impartial account of its shortcomings as well as its successes was not to be expected. It is very easy now to see where many things might have been made better, and even where some supposed improvements have not realized all the expectations that were formed for them. The next cable roads should be better than this, whoever builds them, and no one will be quicker than the writer to appreciate the magnitude of the difficulties which future improvements must surmount, or to give hearty credit to the man or men who may accomplish it.

One difficulty, however, ascertained in the construction of the Broadway road, can never exist to a like extent elsewhere. I allude to the underground obstructions, of subways, gas, water and steam pipes, pneumatic tubes, sewers and other matters too numerous to mention, which had accumulated in three centuries of the growth of a vast metropolis. Their removal alone would have been a formidable task, but as almost all of them had to be kept in use while the removal was going on, and the street traffic had to be continued as well, the writer is inclined to look back on this part of the work with a feeling akin to astonishment at its successful accomplishment in so short a time. To construct and put in running order through such a labyrinth, a complicated machine five miles in length to be jointly operated by an army of engineers and gripmen with reasonable precision and freedom from derangement, is an achievement of which any corporation may well be proud.

Taxation.*

By Allen Ripley Foote.

Taxes:—What Are They?

1. The many questions involved in the subject of taxation cannot be effectively discussed without a preparatory agreement as to the meaning of the word "tax." The courts frequently make law radically different in effect from what those who design the measure intended it to be, through construing the meaning of the words used. The law is not the act as engrossed, certified to, approved and filed with the Secretary of State; it is the Constitutional provision and the legislative enactment as construed by the courts. Words used in organic or legislative measures should be given an exact meaning, so that the spirit of the measure can neither be evaded by taxing authorities nor changed by judicial construction. This will make it certain that the law will have the effect designed by those who formulated it. The necessity for this precaution is thoroughly demonstrated by the experience of every community. The objects for which taxpayers' money can be expended under the elastic title, "*For the Support of the Government and Other Public Purposes*," are so many, and the opportunities for doing a good turn for party workers, personal friends and dear relations, through the distribution of public funds by vote winning measures are so great, it is not the part of wisdom to expect the kind of human nature that is subjected to such pressure and temptation, to be limited by any consideration less circumscribed than that of *legal honesty*. Whatever the law will permit them to do, in the matter of collecting and spending taxpayers' money, all taxing authorities will do.

2. Taxing authorities evade levying direct taxes in every possible way, because every dollar collected by direct taxation, as it is taken from the taxpayer carries with it his close scrutiny of, if not earnest protest against, the way in which the tax-spender uses his money. To avoid the inconvenience of showing that public funds are properly used, and to provide for liberal appropriations at the same time, taxing authorities have been forced to exhaust every discoverable means for squeezing income out of a subject after it has paid a direct property tax. The usual device is to resort to charges made for various reasons and called "fees," "licenses," "excise," "payments in gross amount or annual rentals, proportionate share of the receipts or a combination of such methods as compensations for franchise rights," "location permits," "inspection charges," or other designations. When appeals have been made to the courts for relief from burdens so laid, the relief has not always been granted, because the courts have illogically held that charges designated by other names than that of "tax" are not taxes and, therefore, must be paid, although a direct tax on the property employed in the industry has been paid. Guided by such decisions, all that it is necessary for any taxing authority to do, unless the word "tax" is designed by law, in order to avoid a constitutional provision or a legislative enactment designed to establish the principle of the equal taxation of all property, is to designate the charges made by some name other than "tax."

3. Justice determines the character of an act by its purpose and effect. The purpose of a charge by a taxing authority is to secure an income "for the support of the Government and other public purposes." The effect of the charge is to take by authority of law a portion of private property and devote it to "the support of the Government and other public purposes." This is taxation, and should be so defined by law in order to make all measures pertaining to taxation definite, so that they cannot be easily evaded by taxing authorities nor changed by judicial construction. This may be effected by a Constitutional provision which shall declare that:

All charges for the support of the Government of the State and of all political divisions thereof and for all public purposes are taxes."

Taxes:—How Should They be Assessed?

1. The object of government is to establish justice. This object cannot be realized unless all laws enacted for the government of society are just. The spirit of justice is equity, not equality. The Government requires for its support and other public purposes a financial service. Such a service must be laid on property. To be just, all measures for the assessment of taxes should claim payment at a uniform rate per cent. upon the value of all property within the jurisdiction of the taxing authority. A measure for the assessment of taxes, laying the charge on all men equally, on the ground that all men are or should be equals before the law, would be manifestly unjust. Such a measure would not be tolerated for a day in any civilized community. In the domain of personal duties all men are equal before the law. The next step of progress is to fix in the organic law with equal certainty the affirmation that in the domain of financial duties all property shall be equal before the law. Under this affirmation all property will be held for the support of the Government and all other public purposes, equally pledged dollar with dollar. This is equity.

2. A standard valuation must be established before a measure designed to tax all property equally can be carried into effect. The attainment of absolute justice is not possible. Value is, and must ever remain a comparative term. The only way to express value is in the terms of our monetary system, the dollar, its multiples and its divisions. An inequality in assessment necessarily produces an inequality in the charge, and would thus result in injustice being done.

3. With the standard for valuation fixed and the assessment made, the next act is to distribute the total amount required for the service of the Government, equally over the total amount of the assessed valuation of all property within its jurisdiction. In doing this an allowance must be made for the factor of error caused by delinquent taxpayers, so that the amount certain to be promptly received will be equal to the amount required. This adjustment is easily made, if honestly made, by making the tax levy at a uniform rate per cent. on the assessed value of all property.

4. It may now be affirmed:—(A) That all charges for the support of the Government, and for all other public purposes are taxes.

(B) That all property shall be assessed at its full value in current funds.

(C) That the tax levy shall be laid at a uniform rate per cent. on the assessed value of all property.

Taxes:—What is Property?

1. There is an important and far reaching necessity for a clear construction of the meaning of the word "property" whenever it appears in tax measures. So long as the standard of honesty in practical use is that of enacted, instead of natural law, crafty men will protect themselves from suffering the results of their dishonesty by seeking to make dishonest measures legal, and honest minded but not well informed men will govern their actions by such measures, never suspecting their dishonesty. The levying of indirect taxes through calling the charge by some name other than a tax, is one method whereby the payment of just taxation is evaded. Another method is to call property, for the purpose of taxation, that which is not property. If the fictitious property so assessed is 10 or 15 per cent. of the whole valuation, then those who pay the charges on fictitious property, pay more than their proportionate share. This is not just. In the light of this fact the necessity for strictly defining the meaning of the word "property" is clear.

2. The inherent quality of things of value, which constitutes them property, is the exclusive right of possession, of ownership. The natural right of ownership is the right of a laborer to possess unmolested the results of his labor. This protection is one factor in cost of government. If Government establishes justice, the protection offered by it to the possession and ownership of property will be certain, and its cost will be the lowest practicable.

3. The factors which combine to create property and give it value may be briefly recapitulated. A natural product upon which labor has been expended is a commodity possessing the first factor of value. When the commodity is desired by others and can be exchanged for another commodity having labor value, it acquires exchange value. The desire of others to possess the commodity, combined with their ability to give value in exchange for it, gives it a market value. When the government gives proof of ownership and protects the right of ownership so as to make it secure, the commodity obtains security value. The factors are therefore, natural product, labor, exchangeability, demand combined with ability to give value in exchange, and proof of ownership afforded and right of of ownership protected by the Government. These factors combined as a whole, create the entity known as property, and determine its value. The definition of property may be stated as an exchangeable product upon which labor has been expended and the ownership of which is protected by the Government.

4. It is clear that there may be as many classes of property as there are kinds of commodities or uses to which commodities may be devoted. If property is classified for the purposes of taxation, and the law includes all classes of property in its operation, and excludes from such classification everything not property, no injustice will be done. The usual method is to classify property as real and personal. Injustice is done through classing as personal property evidences of the

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ownership, and the protection of the right of ownership granted by the Government. Such instruments are promissory notes payable to order or on demand, issued by individuals, firms, corporations, associations, or governments, title deeds, certificates of stock, mortgages or deeds of trust, bills of lading, checks, drafts, and all other written or printed forms authorized by Government or recognized by custom as being representative of property, its ownership and value. The correct designation for this class of instruments is *securities*. This designation will serve the valuable purpose of making a necessary distinction between property and its representatives in popular thought, and will lead to their exclusion from taxation under laws declaring that all taxes must be assessed upon property equally.

5. Large properties can be best managed by admitting many individuals to part ownership. Small properties are best managed by individual owners. The most helpful facilities of the age and the strongest government that has made the nearest approach to establishing justice, are based upon combined individual ownership and individual citizenship. The services rendered by the greatest corporations are the most powerful aids to industry, helpful ministers to comfort and active promoters of the value of all property ever known in the history of humanity. Without the facilities for divided ownership the aggregation of capital necessary for the construction and operation of their plants would be impossible. All unjust restraint upon the ownership of such securities is a direct check upon the progress of industrial development, and for this reason is a direct blow at the welfare of the masses who labor and are poor. In their interest the demand should be made that the securities in which they may invest their savings shall not be subjected to taxation after the property represented by the securities has been taxed.

6. I am aware that the demand for the taxation of securities comes from those for whom protection is asked from its injustice. This is not strange. Those who are in the full enjoyment of abundance should consider with tenderest compassion the vagaries of brain of those who feel poverty gnawing at their heart. Let the well-to-do reflect that, in the struggle for better conditions, character is not yet considered a greater good than property by the vast majority of men, and that the standard of legal honesty is not high nor infallable.

7. If any securities are classed and taxed with personal property, justice demands that all securities shall be so classed and taxed. To select some and omit others is as repugnant to the requirements of justice, as to create favored classes of individuals. In fact, this will be the result. All property has an individual ownership. All income derived from an unjust tax must of necessity relieve to that amount the payment of a just tax by others. This is the intention. If no such gain could be made, there would be no demand for taxing so-called personal property. Those who intelligently advocate such a tax know that a tax is a charge upon property, no matter how laid, and that to tax property, and then to tax its representative, which in itself has no value, is double taxation.

8. To obliterate the vice of double taxation effected through first taxing property and then taxing the representatives of its ownership and value, but one object lesson is needed. Let every person who is the owner of a representative of value by common consent, refuse to pay the tax unless ALL representatives of ownership and value are included in the tax assessment on equal terms. There is no economic difference between the character of a deed to a farm recorded in county records, and a certificate of stock recorded in the stock register of any corporation. There is no just reason, and should be no legal reason why the deeds owned by the Astors should not be taxed, if the stock and bonds are taxed, from the net income on which interest on the savings deposits of the poor are paid. Taxation cannot "be equal and uniform upon the same class of subjects" if a part of the representatives of ownership and value are included, and a part are excluded from the class of personal property. Such discrimination is based upon a legal and an economic fallacy. It must be abandoned by taxing all representatives of ownership and value, or none. It cannot be continued if the word property is used and construed in strict accord with its true economic meaning.

Property is an exchangeable product upon which labor has been expended and the ownership of which is protected by Government.

Securities are the representatives of the ownership and of the value of property.

Taxes:—Who are Interested in the Demand that They Shall be Just?

1. I once had the good fortune to hear a preacher say the reason people made the same mistake twice was because they did not learn their lesson sufficiently well the first time. In an address delivered before this Association September 21, 1886, the Hon. G. Hilton Scribner said: "During the late war the National Government, under great financial stress, instituted an inquisitorial burden, called the "Income Tax." This was such an unpopular proceeding that it was abandoned at the earliest possible moment, and the country breathed more freely and felt a sense of relief when the whole system was abolished."

An income tax is now imposed by the National Government under stress of political expediency. It cannot be said that this has been done because the people did not sufficiently learn the inquisitorial character of an income tax the first time it was imposed, for the reason that its reimposition has not been demanded by the people. It was demanded by politicians who have thought they could win votes from the many who are poor by adopting a measure popularly supposed to be an assessment upon the rich to relieve the poor from taxation. This is the conceded reason for all unjust taxation.

2. In his address Mr. Scribner further said: "If the street railroad corporations were taxed in the same manner that the citizen is, they would pay simply a tax upon their real estate, assessed at from 60 to 80 per cent. of its value. Instead of this method, these corporations pay:

First.—A tax upon their real estate.

Second.—A tax upon the roadway.

Third.—A tax upon personal property at the aggregate market value of the entire issue of stock.

Fourth.—A tax upon gross earnings.

Fifth.—A tax upon net earnings or dividends.

Sixth.—A specific tax upon each car.

Seventh.—A lump sum tax for maintaining three railroad commissioners."

3. If this statement is correct, your own books of account will show the price you have paid, are paying, and will continue to pay, for the failure to use the words "tax" and "property," with their strict economic meaning in tax legislation. You can trace the cost of unjust taxation to your shareholders, but you cannot trace its cost to the state or community as a whole. Your class of corporations is but one of many. Your interest, enormous as it is, does not equal that of the people who work for wages in this great state. You did not ask for this series of tax levies under the guise of many names. The people of your state have not asked for this glaring injustice. It is the work of tax eaters, who fatten on the spoils of political power. They have enacted this legislation without asking your permission or that of the people. They depend for its perpetuation upon your apathy, and upon being able to develop into vigorous life all the latent hatred that is assumed to rankle in the hearts of the poor against the rich, if an attempt is made to undo it. In this fact is enclosed the greatest danger that now threatens the stability of the state. The socialists and the anarchists, whom we need most to fear, have not come to us from abroad. They are the creation of our own political system, that intrusts ignorance and vice with political power.

4. I will again give voice to Mr. Scribner's words. He says: "For all this, the corporations are themselves, in good part, at fault, when they are unjustly attacked by legislative, executive or judical officers. The managers of such corporations instead of meeting in some very private manner and holding a whispered consultation, as to the easiest way of getting the hand out of the lion's mouth, should have the courage to assert the rights of the companies they represent, and to contend for them to the last. More than this, every holder of corporate property should not only propose to take part in the election of every officer whose action may affect his interests; but he should make no concealment about his intentions to do so. It is better, especially under a republican form of government, to demand inalienable rights than it is to beg for them. No class of citizens should acquiesce in, or tamely submit to any such injustice as that now being practised and imposed upon the holders of corporate interests, by the present system of unequal taxation. There is nothing in state socialism, not in communism, carried to its extreme results, more contrary to, and subversive of, all the fundamental principles upon which personal and proprietary rights are founded, than the present legislation of the state of New York in its cruel, unjust and extortionate discrimination against corporations in the matter of the distribution of public burdens. Of course, it cannot last, for legal extortion is necessarily short lived. It cannot last, for those classes that contrive iniquity for other classes are, sooner or later, the victims of their own devices. It cannot last, for as corporations have no means of making money, except as they collect from those who have dealings with them, these burdens which are placed upon corporations, if they are persistenly continued, must, in the end, be paid by an ever increasing proportion of the very classes themselves who were intended, not only to be exempt from them, but to be benefited thereby. It cannot last, for it is such a plain, obvious and gross injustice to such a large number of citizens, and to such important interests within the state, that if the Government shall fail to destroy the wrong, the wrong will not fail, in the end, to destroy it."

In concluding Mr. Scribner said: "Is there likely to be any better time than the present in which to expose the right and wrong of this whole matter, and in which to commence in earnest this corrective movement? Absolute equality in taxation should be *demanded*, and representation in every department of the Government, the only method for its *enforcement*."

This appeal was made to you by one of your own members in 1886. What has been your response? Apathy! The very condition upon which, so far as you are concerned, politicians relied to give them protection from righteous indignation and just punishment when they enacted these measures, the very condition upon which they now rely to maintain their perpetuation.

5. With a subject like this it is impossible within the limits of a single paper to do more than to sketch the outlines of a few of its salient points, but before closing this paper it must be given a practical turn by indicating a feasible line of procedure to secure a just system of taxation. In this behalf the first thing to be done is to formulate the *demand*. The act of doing this will demonstrate its all-inclusive character. It cannot be confined to your class of corporations alone. It touches the interests of every corporation. It is not for industrial corporations only, it is for banks, trust companies and insurance companies as well. It is not for corporations, as such, at all. It is for investors in their securities and the users of their services as individuals. It is not for capitalists as such, at all. It is for those who toil and are are poor. Upon them the burden of taxation, however laid, by all indirect or unjust methods finally rests. It is for them and their welfare that I plead.

6. That the demand may be made clear and receive the criticism from all points of view necessary to establish its justness, I submit for your consideration, as an appendix to this paper, a suggested law to cover the entire broad question of state and local taxation. As discussion will show its defects and suggest changes to make it clearer, more perfect, more completely just, changes will be made in its text until it has passed the stage of being so changed. With this object in view, it should be brought before every association of citizens for dis

cussion, from the "Ministers' meeting" to the "Chamber of Commerce," from the "Garment Makers' Union" to the "Clearing House Association," when perfected, it should be made the shibboleth of no party, but in the next pending state election it should be presented to every candidate for the Assembly and Senate, with the direct demand that he shall endorse it with his written agreement to vote for the measure if elected. In such way only can it be made certain that the will of the people is to be enacted into law exactly as the people have agreed it shall be done.

7. One point must be kept clearly in mind in considering this proposed measure. If it is not constitutional in any of its bearings, those who demand its enactment have the right and the power to make it constitutional. Its relation to existing laws governing taxation should not be considered except for the purpose of showing why those laws should be set aside and a new law adopted, that will more nearly align itself with the natural laws of justice. This is the object and the purpose of the demand.

8. To secure the enforcement of this demand, "representation in every department of the government" is the ultimate education of individuals in the initiative source of power. This educational work must begin right here with yourselves. From you it must broaden to every stockholder, employe and patron of the corporations you represent; to every stockholder, employe and patron of every corporation in the state; and from them every person who asks justice only.

APPENDIX.

TO PROVIDE A JUST SYSTEM OF TAXATION. PROPOSED BY ALLEN RIPLEY FOOTE, WASHINGTON, D. C.

Author of the Discussion of the Economic Principles Involved in "The Law of Incorporated Companies Operating Under Municipal Franchises."

[NOTE.—Suggestions are invited from any person, firm, corporation or association, and from the taxing authorities of any municipality, county or state, designed to make this proposed law more certain in construction, more simple in its application, more completely just in its effects.]

TAXATION.

1. All charges for the support of the Government and for all other public purposes are taxes.

2. All property shall be assessed for taxation at its full value in current funds. All exchangeable products upon which labor has been expended, and the ownership of which is protected by law, are property.

3. The tax levy shall be laid at a uniform rate per cent. on the assessed value of all property for the same tax levied within the jurisdiction of the state and of each division thereof.

4. All property assessed for taxation shall be entered in the books of the tax assessor for the tax district in which it is located, in the name of the owner, user, or person having the property in charge.

5. Bills for taxes shall be made in the name of the owner, user, or person having the property in charge, as entered in the assessors' books, and the payment of the same shall be a legal payment for the full amount of the tax bill of any debt or obligation of any kind due from such person to the true owner of the property upon which the levy was made.

6. Tax bills shall be lien upon the property on which the levy was made, and may be sold for non-payment, as provided by law.

7. Property shall not be taxed in any way except as herein provided. Tax assessments shall be made but once in each year, and the levy for all state, county and municipal taxes shall be entered in the same bill. Charges shall not be made by state, county, municipal or other public authorities for the support of the Government or any other public purpose, except a property tax, for the right or privilege of engaging in any industry, business or vocation.

8. Securities representing the ownership and the value of property shall not be taxed.

9. The legislature may exempt the whole of any class of property from taxation, but it shall not make any partial exemption by authorizing a decrease in valuation, or of the rate per cent. of a tax levy for one or more classes of property less than the unexempted whole, or for a part of a class, nor shall it exempt a part of the property of any class.

10. Special assessments and tax levies may be made in consideration for special benefits accruing from public improvements upon all property securing an increment of value by reason of such improvements.

11. Fines may be assessed and collected for violations of law; charges may be assessed and collected for costs of courts in all legal procedures; for costs of records on all recorded instruments or documents; for all public inspections, supervision and audits; and license fees may be assessed and collected for the control of all places of public amusement; the regulation or suppression of all immoral practices; the protection of health; and the supervision of public nuisances.

12. The legislature shall not delegate the right to exercise the power of taxation for any purpose, to any political division of the state or other public authority, without providing by law that the books of accounts of such division shall be kept as directed by the State Comptroller, who shall audit all such accounts annually.

THERE has been chartered the Willow Grove & Hatboro Street Railway Company, of Hatboro, Pa.; capital $18,000. The president is John H. Fow, of Philadelphia; and O. E. C. Robinson, of Hatboro; J. F. Cottman, of Jenkintown; Charles F. Ehrenpfort, of Willow Grove, are some of the directors.

"The Perfection of the Electric Railway Motor."*

BY LINCOLN NISSLEY.

Mr. President and Gentlemen of the Convention.—The subject of this paper, which at first thought suggests a broad and inviting range, is, on examination, found to be closely defined. Instead of a fertile field, the past years stretch out more like a vast desert; the wayside thickly strewn with bleaching, or rather rusting, skeletons of commutators, gears, brush holders, controllers and empty pocket-books; while beneath the debris lie buried fond hopes and rosy expectations of some contrivance, which, at its birth, was to wax great, and going forth subdue the land, and as an everlasting monument to its inventor, go thundering down the ages, around curves of small degree, up steep grades on the other side and never slip a gear or miss a fare.

A study of the history of the electric railway motor shows us that from the beginning up to a few years ago there has been a great tendency toward complicated, fanciful and impracticable designs, including outlandish forms of field magnets, and unnecessary number of field cores and coils. In most cases, also, the mechanical construction has been very bad, the shaft being too small, the bearings being weakly supported and the general workmanship poor and not up to standard.

It has long been my opinion that the proper way to design a good railway motor is to consider very carefully and systematically each part, first by itself and then with reference to the other parts, and thus collect and build up the elements which are best.

Let us now take up the various parts of the electric motor and consider each as a simple problem in designing.

The size of the frame should be such that it can readily be placed upon any standard truck.

The machine should be completely shut in so as to make it thoroughly iron clad.

A good, substantial iron clad frame does more than anything else to give great stability and strength to the whole machine, and is highly desirable in a railway motor. The bearings should be directly and rigidly mounted in this frame, a simple fact that has often been disregarded, and all parts should be interchangeable. The armature and car axle should be in perfect alignment; and consequently perfect meshing of the gears is obtained, which experience has proved to be of vast importance. The gearings should be mounted closely to the frame so as to eliminate buckling and tendency to loosen parts. The field magnet should be bipolar. The field should also be of the single magnetic circuit rather than the consequent pole type, because the former is more economical in wire and current required, lessening the cost of renewals and repairs.

A single circuit requires only 70 per cent. of the weight of wire, and 70 per cent. of the energy of magnetization that is required by a double magnetic circuit. The field cores should, of course, be perfectly insulated. This can be accomplished with certainty by winding them on a solid spool of material which is firm and waterproof and highly insulating. The armature should be of the ring type, so that the winding does not slip out of place or pile out at the ends when running at high speed, a fact which will be appreciated by those who are operating cross country and suburban lines.

The armature should have teeth or projections upon it, in order to secure and protect the wires from mechanical injury, to reduce the reluctance of the magnetic circuit and the weight of wire and energy of current required to magnetize it. The perfect insulation of the armature core is of the utmost importance. The best material and the most complete covering should be used, and the greatest possible care should be exercised to avoid short circuits, grounds or broken wires.

The efficiency should, of course, be as high as possible, and is made a maximum by reducing all elements of loss as far as possible. These losses are current to magnetize field, loss due to armature resistance, friction, resistance of air and eddy currents. It has always seemed to me that if a machine can be run for several hours under field load without any part becoming overheated, the efficiency of that machine must be high. This fact is more absolute than any efficiency test can possibly be.

In looking over the past eight years of practice in the designing and perfection of the electric railway motor, we have much to commend and considerable to condemn. The boldness of the achievements, the problems that have been solved, the rapidity of development seem almost beyond comprehension. That the electric railway motor in less than eight years should reach the high state of perfection, economy and efficiency that it has, as compared with the long years of development of the steam engine, is remarkable.

In the perfect railway motor we have something entirely different from what we have in the steam engine. We have no reciprocating parts, but continuous rotary motion. The strains are all tangential, and this aids greatly in running and maintenance.

The railway motor of yesterday is not what the railway motor of to-day or a few years hence will be. Yesterday we were struggling with difficulties connected with the commutator and brushes which have been the great bug-bear of all types of motors. Commutators and brushes require more care outside of gearing connecting motors to axle than anything else we have to deal with. They have always been the weakest spot in the electric railway motor. The question arises, Can these difficulties be overcome? I think they can and have been to a great extent already overcome by several of our larger manufacturers.

In connection with the motor, we are laboring under very serious difficulties in regard to proper control and regulation. In the control

* Read at the Third Annual Meeting of the Pennsylvania Street Railway Association, held at Reading, Pa., September 5, 1894.

of the railway motor we cannot do exactly as we do in the locomotive, adjust our point of cut-off so as to secure the best results with a given load.

We have to govern our motors by varying the resistance in the circuit, which means loss necessarily, because the resistance has to be overcome to some extent by the current passing through it, or by reducing the intensity of the field magnet, which also means loss. If this is true then it seems to me that it is unfortunate, but is it necessary? I do not think so.

The ideal railway motor for the propulsion of our cars would be a motor running at a continuous and uniform speed and with a variable gearing giving the motor the advantage of power when the car was first started. You all know that when our motorman wants to change the speed of his motor, he moves a switch or controller handle around, which adjusts the current flowing through the motor. Now, as a matter of fact, the motor should adjust the current itself, and not the man, and the speed of the motor should remain absolutely constant, while for regulation between the motor and the gear on the driving wheels, you should depend on varying the mechanical advantages entirely.

It should be borne in mind that it is less than three years since the first single reduction motor was commercially introduced. The work was done under the most unfavorable circumstances. Compared with similar motors of to-day they were indeed crude and very costly. They answered the purpose, however, and it is generally admitted that they have been a financial success as compared with the use of former construction.

The single reduction motors have since been in continual operation, and those of recent manufacture, embodying the latest improvements are a great advance in the onward march towards perfection. That there are still annoying circumstances in connection with the mechanism no one who is charged with their practical operation will for a moment deny, but inasmuch as they are universally proving a financial success, it may be taken for granted that electrical and mechanical improvements will be gradually introduced until they become as nearly perfect as anything of the kind can be. The question is not, whether a motor is perfected, but whether it is enough of a success to warrant the improvements which will lead to perfection.

The modern "Atlantic liners" are simply an improvement upon the pioneers in the ocean service; there has been no sudden revolution in steam engineering. The screw propeller did not jump into immediate favor, but it was an important change which slowly forced its way to the front. So with the electric railway motor. Its advantages are not yet thoroughly appreciated, but they will be. Its future is assured. With this outlook will come better construction, better engineering, better mechanics, and the solving of the larger problems, which will place the perfected railway motor on a cheaper, better and more successful basis.

In the words of one of America's greatest philosophers, Emerson, "Our duty is plainly not to throw ourselves across the track, not to block improvement, not sit still until we are stone, but to watch the uprise of successive mornings, and to conspire with the new works of new days."

Economy of Power House Operation.*

BY J. B. CRAVEN.

Mr. President and Gentlemen:—"Economy of Power House Operation" has been so often and so thoroughly discussed that I do not know that I can say much that is new on the subject, and yet being one that must ever come up before the management of a street railway system, I feel encouraged to beg the attention of this meeting for a few minutes, that we may see how, and where with intelligent management and proper attention the best results may be obtained on the most economical basis. Starting from the boiler room, we come at once to the place where in most cases the greatest waste will be found. It has been said that the waste due to improper firing is often of greater consequence than any other loss which is produced in the operating of of a steam plant. There are two causes for this: First, poor construction of the boiler. Secondly, poor firing and lack of care of the boilers. Most of us think that any man can fire a boiler, and whilst looking with awe and wonder at the engine and generator, forget that all the power comes from the coal pile and pay little attention as to the economy in transmitting that power from the coal to the engine. No greater mistake is made than to place the care of boilers in incompetent hands, for they require the highest degree of care, conscientiousness and constant attention.

The fireman must be ever on the watch to see that the water is kept at the proper level, to keep an even steam pressure, and to show by his steam, coal and water records that he is getting just as good cards as the engineer can show by the manipulation of the steam he uses in his engine. He must see that the fires are spread evenly over the grates and are of an even thickness that the proper amount of air is admitted into the furnace to obtain good combustion.

If you could realize how easily from 1 to 20 per cent. of coal can be shoveled into the furnace and up the chimney without generating any more power, you would see how essential it is to have something more than mere machines shoveling coal into a furnace. Another point of importance is to see that boilers are kept clean and free from scale, which is simply the result of improper attention.

If for a moment you will stop and think that in the construction of the boiler, the maker has reduced the thickness of the tubes as much as possible consistent with safety, and then look at a tube with from one-eighth to one-half an inch of scale on it, you will at once see how great the loss must be transmitting the heat through this scale; not only that, but it leaves the iron exposed to the effects of the heat without the proper circulation of water back of it, which causes rapid deterioration, and in some cases is liable to cause an explosion. I have used quite a number of boiler compounds for the prevention of scale, but have found the best to be plain coal oil. We have used it in Buffalo for the past two years with success, putting about one pint a day into each boiler and letting it enter with the feedwater by means of a sight feed lubricator. However, no one remedy will fill all cases, and each must be the subject of some experiment.

Another source of loss comes from insufficiently covered boilers and pipes; see that all exposed parts, that possibly can be, are covered with some good non-conducting material, and prevent as much as possible radiation and condensation. The steam pipes should be kept tight and all leaks followed up at once and stopped, and in this way have as little loss as possible between the boilers and engines. See that the piping is well drained, so that water will not carry over to the cylinder of the engine. This is accomplished by separators placed as near to the engine as possible, and the water thus separated is returned to the boilers. In a good many cases this water is allowed to go to waste; if this is found to be the case it should be remedied, as this water is separated at a very high temperature, and requires very little heat to turn it again into steam. Before entering the engine room, I would like to say something on the subject of feedwater heaters. If your engines are running non-condensing, the question is very easily settled; as, however, the majority of steam plants are run condensing other factors are brought in. In the power house of the Buffalo Railway Company, one-seventh of the engine capacity is run high pressure. In this way, taking the feedwater from the hot well, at an initial temperature of 110 degs. and passing it through two heaters in the exhaust line of the high pressure system, we get a final temperature of 194 degs. before the water enters the boilers. It is claimed by some that this method of taking the water from the hot well is not right, on account of the oil to be found in this water. But so small a portion of the hot well water is used, that the amount of oil in it is small, and by this method we do away with secondary heaters in the exhaust line, between the engine and condenser, and not only save in the first cost, but I think obtain slightly better results. However, one thing is important, whatever means are used to heat the feedwater, it should be done, for not only will there be a great saving in fuel, but the straining of the boilers, due to putting cold water in, will be done away with.

Passing from the boiler room, we come to the engines and generators, and the types seen here will be many and varied, from the high speed, belt driven machine to the slow speed, direct connected machine of large units; as you all know, the tendency of late has inclined to the use of the latter type. In my mind there is no doubt of the efficiency of the direct connected unit over the belted one. It is evident to all that where space is valuable it has the advantage of taking up less room. They can be thrown in and out of service with as much rapidity as the belt driven machine; there is a saving of from 1½ to 3 per cent. due to the slipping of belts, very little in itself, but when figured up at the end of a year in a plant of any size will amount to considerable.

Added to this there is the saving in labor and the decreased expense due to wear and tear, as this item is less in slow speed than high speed machinery. For the above reasons I have drawn the conclusion that direct connected units are more economical than high speed ones. Regarding the size of units used, it depends entirely on the output of the plant. I would advocate as large as possible, yet not so large that the breaking down of one would cripple the output. However, in plants that have not these latest types of machines, great saving may be made in the operating of the engines. In many cases after the constructing engineer has left, engines are ofttimes supposed to look after themselves, those in charge simply supplying them with steam and oil. What I said in reference to the man in charge of the boiler room applies with equal force here. Put a thoroughly competent man in charge and you will find it a paying investment. Intelligence and experience are the best safeguards and the real insurance against accidents. Fifty dollars a month more to a capable engineer will probably be repaid a hundred times by the care taken and the high state of efficiency at which the machinery is kept. In such a state an engine is a reliable piece of mechanism. If neglected it is liable to fail at any time, causing delays and worries, and not only adding to the expense in the cost of repairs, but a loss in the receipts outside.

A capable engineer will see that his engines are indicated at least once a month, to see that the valves are properly set and so keep the steam consumption down to a minimum. All pounding, knocking, and leaks should be followed up and remedied at once, and the engines kept in such a state as at all times to be ready to perform the severest service exacted from them. Always keep the load as near the normal capacity of the engines as possible, as engines at that point are most economical; besides you will have fewer machines in service and thus save in the oil supply. Here I will say a little on the subject of oil, as I think quite a saving may be made at this point; in fact I have had one engineer use $640 worth more of oil in six months than another engineer used in the same time, and the engine capacity was increased during the time the last man was in charge. The lowest priced oil is not always the cheapest; some oils will go much farther than others, and the question of what to use should be settled only by careful examination. After being used once it can be filtered and used again on the lighter parts of the machinery. If rags are used for wiping instead of waste, they can be washed and used again, and the grease and oil extracted will be found useful in some part of the system. By washing the rags 80 per cent. can be saved over what the cost would be if only used once and thrown away. Coming to the generator, we find a

*Read at the twelfth annual meeting of the New York State Association September 18, 1894.

machine that is usually well made and efficient. Keep them dry and thoroughly clean and have the commutator kept as smooth as possible. The principal trouble will be found in the sparking of the brushes and the heating of the armature and the field coils. The causes for these troubles are too many to enter into here; but on the appearance of trouble the machine should be stopped as soon as possible, for the old maxim "A stitch in time saves nine," can be applied here. Look out for the minor electrical apparatus in a station, every thing such as switches, connections, and all instruments should be kept clean and in working order, especially in the case of lightning arresters, as they may be the means of saving an armature.

In conclusion I would call your attention to the necessity of having ample copper in the outside lines, and the rails well bonded, and where the system is large enough put in return wires. What is the use of expensive and economical machinery in the power house if you allow 20 per cent of the power to be expended heating up poor connections in the return circuit?

The Electric Brake in Practice.*

By Elmer A. Sperry.

Examination of accounts of the electric street railway companies of our large cities reveals the fact that the item of damage, already very great, is one of growing importance. Investigation of the circumstances and detailed statements of numerous items taken at random from the damage account, point at once and in no uncertain way to the inefficiency of the present hand brake. In many instances, could the car or train have been stopped within a comparatively short distance, the accident and resultant damages would have been entirely averted. The first investigation led to others with the same result, and in consequence the writer is prepared to show that nearly 85 per cent. of the accidents directly occurring, are due to the inefficient operation of brakes. The growing frequency of accidents and the constantly increasing demands of the public for damages, are indications that have not been made to impress the mind of the engineer, or I am sure adequate means would have been forthcoming for the correction of so grave a fault inherent in all the present systems of power-operated street cars. Some of our municipal authorites are taking action with reference to the increasing frequency and severity of accidents, and although no thorough scientific investigation of the matter has been published, yet it is a startling fact that with the present hand brake, no electric or other equipment to-day stands provided with anything in the line of an emergency brake. In so grave and urgent a case, what can be done in the line of remedy? The question naturally arises, will any system of braking worked upon or in connection with the ordinary wheel of a vehicle be sufficient for the stop required? What is the maximum efficiency obtainable by the brake working through the wheels? Is it sufficient to arrest the car before accident in case of emergency? Can it be made in any event a sufficient accident-preventer? The popular notion that most accidents are due to brake failure is true, but in a way that is little understood, the failure being one of degree. It may not be known that under proper and standard conditions any car or train may be brought from a speed of ten miles an hour to absolute rest inside of ten feet. It is not generally appreciated that the wheel brake has ample capacity to accomplish this. The former investigations of the writer with reference to adhesion under conditions of acceleration and retardation, climbing and descending hills, afford ample proof that the rail adhesion through the wheels gives the wheel brake more than capacity sufficient to accomplish this result. For instance, assuming any weight and load, say 17,000 lbs., the stored up energy, 64,426 foot pounds can with ease be dissipated within twenty feet for the ordinary equipment, and less than half of this distance, or

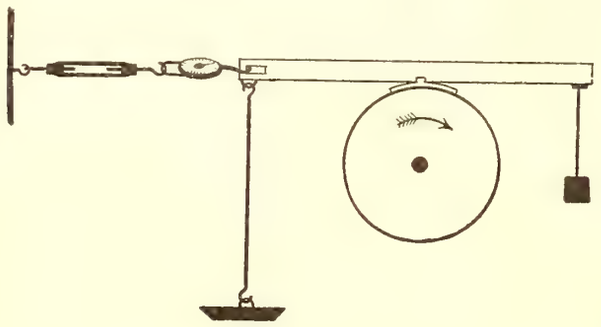


FIG. 1.

a little over nine feet under conditions of coupled drivers, or if the wheels are compelled to revolve in unison. This latter consideration will be seen to have quite an unexpected as well as pertinent relation to the problem. It will be seen that the center of gravity of the mass, is far above the wheel contact with the rail. The retarding effect takes place on the base line in a plane below that of the center of gravity, really the farthest projection downward of the mass as a whole. A sudden stop operating on this base line tends to pitch the upper portion forward, bringing nearly all of the weight, and with it the retarding capacity, upon the front pair of wheels. The brakes on the rear pair in the ordinary equipment will have but little effect; if, however, by any practicable method they are coupled to the forward drivers, the brakes on this rear pair still remain active and of full effect. This is true even if the back pair should be lifted clear of the track. With increased weight upon the forward drivers comes ample increased adhesion, thus preserving the full tractive effort of the total weight intact for purposes of stop, which is impossible in the ordinary equipment. These effects are all aggravated in case of a short wheel base. The present tendency toward a longer wheel base is a step decidedly in the right direction and should be encouraged. The effect of shifting the load in reference to the axles will be especially noticed in descending hills, where the momentum of the rapidly retarded mass tends to shift the load centers still further forward, in some cases almost wholly onto the front drivers. It will be seen to have a greater effect than in *ascending* grades, where in stopping, the inertia tends to correct the position of the shifted load, whereas going down, in stopping, the momentum as stated tends to still further aggravate the condition.

Bearing these facts in mind, let us turn for an instant to the ordinary hand brake. The ratio in the brake levers will be found in the modern trucks to be anywhere from 6 to 11½, averaging about 8½ to 1. The lever arm of the staff will be found to be anywhere from 6 ins. to 13 ins. Assuming 11 ins. as the average, the radius from the center of the break chain to the center of the brake staff will be 1¾ ins., giving thus 6.28 to 1, or a total leverage of 53.4 to 1, from the operating handle to the brake beam. Two elements now have to be assumed. First, the friction coefficient of the brake shoes acting upon chilled wheels. Second, the power upon the brake staff. The writer has endeavored to cover both of these unknown quantities by actual experiment, giving the results in the tables. Table I was taken by a dynamometer being fastened directly to the brake staff handle in line of the pull of the motorman, a cast iron brake wheel sixteen inches diameter from center to center of a one and a quarter inch rim bearing the handle.

Table I.

Weight of motorman.	Gradual pull with one hand.	Jerk with both hands on hand wheel.	Emergency jerk with both hands on hand wheel.
140	112	135	275
200	135	275	385
287	145	235	312
175	125	212	285
153	125	245	310
185	150	200	300
170	150	275	350
155	135	210	325
135	110	175	325
135	125	250	350
160	125	250	405
176	100	200	400
185	176	250	375
	Av. 131.7	224	338.23

The tests show that the full power that can be maintained upon the brake lever for a sufficient length of time for the purposes in hand does not exceed an average of 180 lbs.

Table II.

Speed rev. per minute 33 in. wheel.	Brake pressure.	Traction.	Coefficient.
Varying, 150	900 lbs.	87.4 lb.	9.7 pr. cent.
125	900	91.7	10.2
100	900	99.8	11.1
78	900	118.	13.2
56	900	133.	14.8
38	900	150.4	16.6
20	900	154.	17.1
4	900	174.6	19.4
Constant, 105	300	29.4	9.8
	500	50.5	10.1
	750	91.	12.
100	1150	125.	11.2
	1500	178.	12.
	2200	305.	14.4
94	3780	488	13.2

Table II was obtained as shown in Fig. 1. A brake shoe that had been run in service about three or four days was taken with the axle carrying its co-operating wheel, lifted out of the truck and placed between the centers of a lathe, the load upon the brakeshoe accurately measured, and the shoe held from movement around the wheel by a dynamometer. Every precaution was taken to avoid handling the periphery of the wheel or the face of the brakeshoe, and even the dust was left upon it so as to conform as nearly as possible to the normal conditions of practice.

Tracing our 180 lbs. application to the brake beam with allowance

*Abstract of a paper read before the American Institute of Electrical Engineers, September 19, 1884.

for loss of friction, we have 3,840 lbs. applied to each of the two shoes which upon the chilled surfaces are found under ordinary circumstances by Table II to give a coefficient of about 12 per cent. This would give a retarding effect of 460 lbs., which is less than one-third that

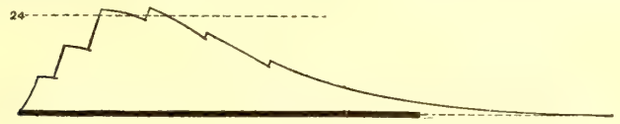


FIG. 2.

easily obtainable were the power needful for its application at hand. The coefficient under these conditions must have been about 37 per cent. to realize anything like the total value of the retarding effect of the wheel. This under condition of chilled and glazed surface is entirely out of the question, showing at once the necessity of power in the application of brakes, if anything like their full value and use is to be obtained. This is also amply borne out in practice, as those who have tested this point well know that under ordinary conditions it is next to impossible to slip the wheels of a motor car by the hand brake.

For years the writer has believed that electricity was vastly preferable to any other force for the application and control of brakes. Working first on the solution of the continuous brake problem for railway trains, he built his first electric brake apparatus in 1882 and has studied and experimented on the problem in its various phases almost continuously since that date, with more or less encouragement in the line of substantial progress. As to its application to electric cars, the apparatus was successfully applied on some double truck cars in Illinois, one of these cars weighing as much as twelve tons. The first equipment similar to that shown in Fig. 5, was con-



FIG. 3.

structed some five years since. This apparatus has been constantly undergoing alterations and has been experimented with, until for the past eighteen months a constantly increasing number of electric cars, equipped with it, have been in regular service, some of these running with change of motormen on each of thirteen daily trips, the same motorman having the car once in about three days, making it impossible for the men to become familiar with the operation of the brake. During this time one car has made upwards of 70,000 miles, hauling a trailer about 48,000 miles, during some special weeks of test, making from 178 to 220 miles daily.

The electric brake under discussion has been operated over a year on equipment upon different roads, from electricity generated independently of the trolley connection, the braking current not being derived from the central station, but produced by the power of the moving car, which power it is desired to get rid of, or destroy. The brake thus operates equally well with the trolley off, and, as will be understood from the following description, the trolley current has nothing at all to do with the car while the brake is being operated, except possibly to maintain the lighting circuit. The electric brake at the same time is entirely independent of the hand brakes, which may or may not be present upon the equipment. The braking action being altogether independent of the brake shoes, it is not found necessary to employ them in connection with the electric brake, although in the earlier forms they were used, and in the case of trail cars, especially in heavy service and on grades, some engineers prefer to use them at the present time.

The current employed by the writer for operating the brakes is developed by automatically turning the motor or motors into generators. As these are driven forward by the moving car, they develop current which is controlled as to intensity by the starting rheostat of the car. The braking current is thus produced at the expense of the mechanical energy stored up in the moving car, which, being consumed causes a retardation and final stopping of the mass as a whole. The current so generated may be furthermore led through a brake magnet as above seen, to apply the brake shoes; it may arrest the motion of the car direct by magnetic adhesion, or develop heavy retarding currents in the moving metallic mass by magneto-induction. When an active local circuit is used, the latter method is usually employed for reasons which will be made more apparent.

The connections, and in fact the whole arrangement of the electric brake upon the car, is extremely simple. This is shown by the fact that only one small extra wire needs to be run to the controller, in addition to the ordinary wiring of the standard equipment without the electric brake. The certainty of operation is evinced by the fact, that at present writing over 150 of the equipments have been placed, which are making upwards of 10,000 miles daily in regular service. Early in the experimentation a phenomenon was observed in reference to the persistence of the current even after the motor had stopped. This is due to the slow action of the decreasing magnetization, taken together with the reaction or self-induction effect of the fields and any brake coil or coils that may be in the circuit. The movement of the magnetic lines, which persist after, and in fact long after the motion of the motor has ceased, generates potential. In many instances it is possible to draw an arc from the rupture of the brake circuit one second after the motion has ceased, showing the presence of current in the local circuit. Fig. 2 has been developed from the average stop to show the curve of current in reference to the motion, the black line indicating the period of motion during the application of the brake, and the curve indicating the current intensity and its duration. The current flowing after motion ceases, though small, is found exceedingly useful in holding the car from starting itself, even on quite a heavy grade, as only a small quantity of energy added to the already great friction of quiescence will prevent the car from starting. This persistency of current is also found useful to kill or destroy the magnetism of the brake magnet, in case it is desired to suddenly move the car forward again.

The current required to be developed to stop a car when no other braking apparatus is used is found to be only a fraction of that required to accelerate the car in the same interval. This may be easily illustrated by the lines in diagram Fig. 3, A being the electrical energy applied in a given acceleration; B the resulting mechanical energy stored in the car after deducting all the wastes in the motor, and between the motor and the momentum; C the average mechanical energy in the car at the time of applying the brake; D being the electrical energy required to be developed for retardation after the efficiency losses have all been provided for out of the quantity C. Thus it will be seen that the so-called efficiency losses, act in a two-fold sense between A and B and between C and D, to reduce the amount of current required to be generated for braking purposes.

Automatic resistances were even at one time used in the endeavor to relieve the motorman of *all* responsibility in connection with the control in applying the brake, but superlative simplicity was found to be much more desirable than the superlatively automatic, and the

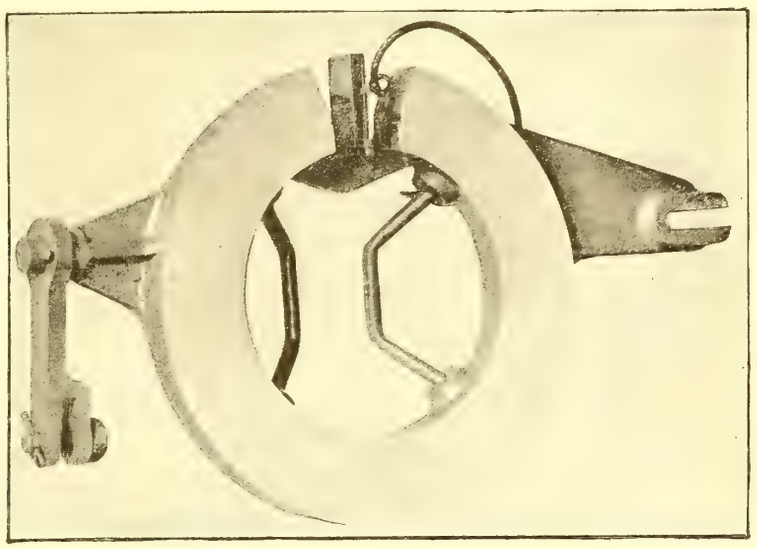


FIG. 4.

automatic devices were seen to be entirely unnecessary, the apparatus as at present constructed being of great simplicity.

The diagram of the braking current in Fig. 2, shows the automatic decrease in the intensity of the brake application so desirable with the decreasing speed referred to above. As the speed decreases, the generator runs more slowly and consequently produces less and less current.

With this style of brake, the life of the wheels is increased from two to three-fold, thus affording a saving in the item next in cost to the electric maintenance itself, to say nothing of the entire saving in brake shoes. This is emphasized in the fact that the brake shoes are being constantly besmeared with sand and grit thrown from the wheels, and when in this condition, they are brought against the wheels with the tremendous pressures noted above. A better method could hardly be devised for reducing both wheel and shoe. We little realize the great number of brake applications necessary in a day's run. Careful record has been kept of this point, giving in three days an average of 1,377 brake applications per day for a run of about 164 miles.

Another interesting feature in this connection is that a flat wheel from skidding is an impossibility. It will readily be seen that should the wheels stop, the generator connected with the axles ceases to produce current, and none therefore exists to farther apply the brake, and though they may be sliding forward on the rail, yet the wheels continue to rotate more or less, and constantly present new surfaces for the sliding contact.

The braking action is two-fold and is especially efficient. The rotating armature of the motor, instead of tugging ahead by its momentum, is itself pulling back and more or less powerfully braking the car through the gears by the retarding effort of the magnetism of its field while generating the braking current. The power required therefore to perform this work is taken from the energy of the moving car which it is desired to destroy; not only is the car thus retarded, but the electric brakes arrest the motion of the wheels direct with a force that is remarkably powerful and under perfect control of the motorman.

Two forms of braking magnets are used, one for winding up a brake chain usually employed in connection with the trailer, and another for directly arresting the motion of the axles, one magnet

only being used in connection with each axle, as shown in Figs. 4 and 5. These magnets are truck mounted, not an ounce of their weight being directly on the axle, and are so supported that their gravity acts to automatically retract from the brake face. The brake face is automatically lubricated to a slight degree, receives a high polish and does not cut or rapidly wear. The brake is noiseless in its operation. It will be seen from the cuts that inasmuch as it does not revolve, no commutating or contact device is necessary. Its crescent form accomplishes important technical functions and also eliminates the necessity of pulling off a wheel for its attachment, removal or inspection. The brake face is *solid unbroken metal* with no grooves or interstices for catching grit or sand, which in part explains the absence of wear above referred to. The brake magnet is practically indestructible, a few turns of stout wire constituting its one coil entirely enclosed and sealed in metal. No harm or moisture can reach it. The lubricator for the brake surface is dry, not sticky or adhesive, and does not gather sand or dirt and retain it upon the braking face. No mechanical pressures whatever are employed to arrest the car, and hence no strain or shoulder wear comes upon the journals.

As to the arrangement for application and control of the brake by the motorman, about a year ago the following appeared from the pen of the writer:

"Considering the inexperience of the operator and the responsibility which at times well nigh overwhelms him, I think that, as engineers, we should be willing to set a very high mark to be attained

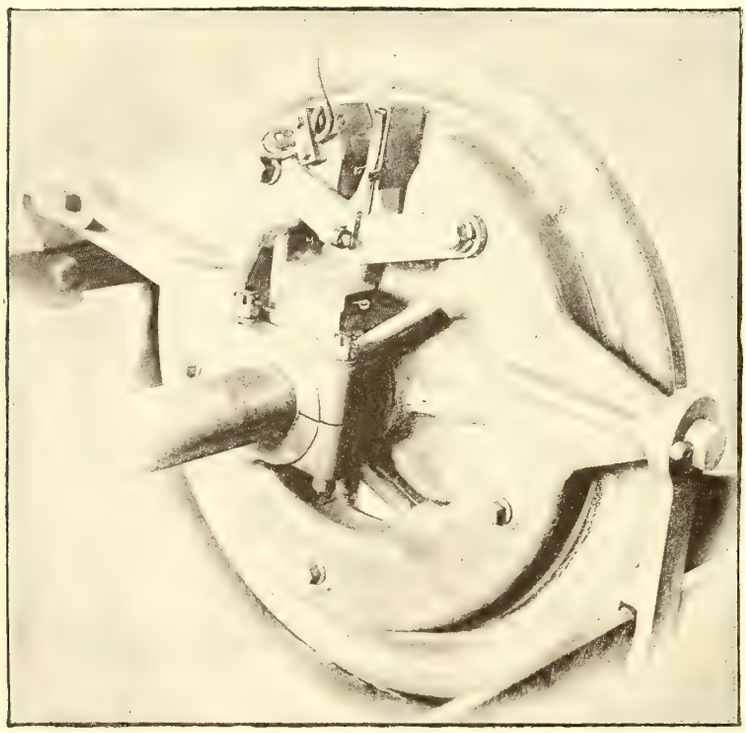


FIG. 5.

in the ideal brake for electric street railway service, namely, the use of but *a single controlling handle for everything;* starting, accelerating, retarding and braking the trailer, or trailers and all. Let the motorman have nothing to think of except one handle, and two thirds of the accidents now occurring will be prevented. Let this handle require no more exertion in its operation than the present controlling handle. Let the motorman fulfil his functions with as little physical exertion as possible; he will then have a greater reserve for mental application when necessary. A motorman required to exert an enormous amount of brute force, constantly grinding at the brake, has but little life left to apply in case of emergency. I agreed with a prominent writer on this subject, where he says that a multiplicity of handles is fatal in time of emergency."

At the time the above was written, equipments controlled as therein set forth, namely, by the use of a *single controlling handle for everything*, had been in operation for upwards of a year. The methods employed for accomplishing this have been varied, but in the form most in use at the present time the resistance contacts are employed in a two-fold manner; the controller handle is made to operate back and forth over the same contacts for controlling both the application of the current to the motor and braking the car. A self-correcting and interlocking device is also provided, so if the motorman does not throw the handle clear over, the transformation is completed automatically before the movement of the lever can reach the operating contacts.

It will thus be seen that the brake is automatic and does its work without any special act or even the knowledge of the motorman. He simply "works a single handle" back and forth, and electricity "does the rest." Suppose the motorman wishes to stop his car, he turns off the current by simply swinging the lever over to the right. This operation is made to automatically convert the motor into a special dynamo for generating currents at very low speeds, and also simultaneously to cut off all connection with the trolley current. The brakes are then applied by simply swinging the handle back over the path it has just traversed; the farther it is swung to the left, the stronger the brakes are applied. The act of releasing or letting off the brakes, again automatically re-establishes connection with the trolley and re-converts the dynamo into a motor. The same rheostats and contacts are applied to control the motor while running the car, and also to control the slight amount of current generated by the transformed dynamo, which is sufficient to brake the train.

The motorman cannot turn on the current before the brakes have been released, nor can he apply the brakes before the current has been turned off. This is a result of construction, and constitutes a feature of merit in the new electric brake, effecting an economy in current and a saving in wear and tear. Freeing the conductor of all care in this connection, and leaving the braking of the train—including trailer or trailers and all—solely in the hands of the motorman by placing at his command a power with which he may with the utmost ease accomplish his task, constitutes an important advance in the art of control of electric railway equipment.

It has been found that the electric brake is practically incapable of abuse by any motorman, due to the fact above named, that no amount of over-application can cause flattening of the wheels, or any harm whatever to any part of the equipment through their locking and skidding.

The principal moving parts are simple and durable, being only two in number. The various portions of the controller have been subjected to the severest tests possible, one test made in 1893, consisting in 518,700, consecutive brake applications without appreciable wear, the parts being in regular service at the present time.

Operating the brake in this manner, it will at once be seen that the system is one of the utmost certainty of operation, surer even than the hand brake, from the fact that every time the car runs, the motor, which is depended on for the braking action, receives a test, and its fitness and capacity for the next brake application is constantly being demonstrated. On the other hand the motorman never knows whether his hand brake is sure to operate when called upon for the next application.

The advantages found to result from the practical use of the electric brake as compared with former brake systems; its qualities as an accident preventer, as well as its general commerical value may be recapitulated as follows:

1. The certainty of its operation.
2. The enormous power at instant command and under perfect control.
3. The absence of all power absorption at moneyed cost from the central station.
5. Its extreme simplicity.
6. Observed saving in wheels, two to three-fold.
7. Entire saving in brake shoes.
8. Lubrication of brake face; very little wear of either wheel or magnet.
9. Absolute silence of operation and release.
10. The low E. M. F. at which it operates.
11. The ease of its application and control.
12. Conserving strength and prolonging the usefulness of the motormen.
13. The smoothness of its operation.
14. The fact that its use cannot cause flat wheels.

Feeder Patent Decision.

A decision far reaching in its effect, was given September 12, by Judge Acheson in the United States Circuit Court of Appeals in Philadelphia, against the Edison Electric Light Company. The decision was on appeal of Westinghouse, Church, Kerr & Company, from the decision of the Circuit Court in New Jersey, in an infringement suit brought by the Edison Company to restrain the appellants from using one of their patent distribution systems of feed wires.

The patent contested was letters patent No. 264,642 granted to Thomas A. Edison for an electric distribution and translation system by reason of the construction and operations of an electric light plant at the city of Trenton, N. J., by the defendant Westinghouse, Church, Kerr & Company.

All through, the testimony of the defence was to show the great similarity between gas and water distribution and that of the electric distribution according to the specifications mentioned in this patent.

The judge after reviewing the facts of the case, says, "The plan of electric distribution covered by the claims in question is not 'the creative work of that inventive faculty which it was the purpose of the constitution and patent laws to encourage and reward.' To sustain these claims would be to sanction a monopoly in that which belongs to the public. In announcing this conclusion we cannot do better than quote some observations of the Supreme Court which apply with great force to this case, as we read the proofs."

THE New Castle, Minersville & Tremont Street Railway Company, of New Castle, Pa., was incorporated September 19, with a capital stock of $100,000, to construct and operate an electric railway in New Castle, Schuylkill County, Pa. W. F. Sadler, of Carlisle, Pa., is president of the company, and other stockholders are L. S. Sadler and Willard F. Thompson, of Carlisle, and Elias Davis, of Broad Mountain, Pa.

Wheels.

Just as we are going to press the following letters have been received upon the subject of cored wheels and their action on curves:

PASSAIC, N. J., September, 22, 1894.

EDITORS STREET RAILWAY JOURNAL:

I am becoming very much interested in the subject of the wear and behavior of the wheels under street cars. With the introduction of heavier cars, the life of those wheels which I have an opportunity to examine, is being very much shortened. This rapid wear is making trouble. Mr. Fitch in his article, published in your July issue, makes a number of exceedingly good points, but in speaking of the uses of the cone, he seems to me to omit one point. Wheels when fast on one axle and held square in the truck will travel, or tend to travel in a straight line, regardless of slight differences in size. In fact, experiment has shown that wheels may be thus fitted and of such differences of size as to run round a curve of a given radius without slipping; but if the axles are put into the truck square with each other and are fast on the axle, the tendency of the truck is not to follow the curve, but to go straight ahead. This has always seemed to me to be one of the strongest arguments against coning of wheels. If a pair of wheels has no tendency to go round a curve, because of their difference in size, then certainly the making of the individual wheel in such a way as to practically give two diameters can be of no advantage, since slipping must be encountered in any event. I suppose that it is pretty well understood that coning has some advantages on a straight track. It tends to keep the truck centered between the rails. J. F. T.

NEW YORK, September 24, 1894.

EDITORS STREET RAILWAY JOURNAL:

Mr. Fitch in the July number of the STREET RAILWAY JOURNAL presents a number of advantages which coned wheels have over those with cylindrical treads. He gives what has been, and what I suppose is to this day the generally accepted idea among car builders and railroad men. When I was a young man it was received as law and gospel. It is a real good theory, but it has no foundation whatever in fact. I do not believe that the centrifugal force in any ordinary street car work has anything to do with the behavior of the wheels on the track. Theoretically the trailing truck of a long car should have just as much centrifugal force as the forward end. The rear half of a long motor car ought not, theoretically, to have any less centrifugal force than the front half, yet the front half of the car jams its wheel hard against the outside rail, while the rear half will have its wheel slack to the rail, and perhaps grinding against the inner rail. That fact certainly ought to smash the cone theory.

All cars built with a due regard to the laws of nature and the rules and regulations laid down in the books, tend to go straight ahead. When a car reaches a curve the rail proceeds to push the wheel sideways and the first wheel gets a very large percentage of the push. The second wheel practically takes none at all of it, consequently cars go around curves cornerwise. In the old days when it was customary to let the outer wheels run around curves on their flanges it was almost universal to find that they cut a pair of grooves in the outer flat rail. In this case, theory may be all right for the forward pair of wheels, but how about the second pair? It is certainly all wrong for them. It used to be a common belief among railway men that coned wheels stayed in the middle of the track better on tangents than those which were cylinders, and in 1873 it was a question whether one of the popular systems of loose wheels and axles was not led into trouble because, using cylindrical wheels, they had difficulty with the swinging of the trains from side to side on straight tracks. But supposing the cone theory worked all right in practice as well as on paper, would it be of any practical use? I think the answer a very doubtful one, because after a comparatively little wear they become cylindrical, and with a little more wear they are coned in the opposite direction.

As Mr. Fitch showed, wheels on curves will slip and slide regardless of coning or being fast or loose on the axles. In fact a wheelbarrow wheel wont go round a curve with as little friction as it has on a straight line.

I can't agree with Mr. Fitch in the statement he makes in his sixth paragraph, at the bottom of the first column. I think the side motion seen in a car upon the track under the circumstances which he describes, is not so much due to the lagging of one wheel behind the other, as to irregularities in the surfacing of the track. He says that: "When one wheel is minutely smaller in diameter than the other, and lags behind, its direction of travel is changed from a straight line to an outward direction or path, until its own largest circumference next to the flange of the wheel is in contact with the ball of the rail." This may be an explanation, but it does not correspond with all the facts in the case. It does not to me seem to correspond with the fact that unequal diameters on the same axle held squarely across the track tend to travel in a straight line. It should think it more likely that there was a sliding of the wheels at right angles to the rails. This seems to me rational, but the slipping and lagging of one wheel behind the other does not. Most good trucks hold their axles rather too rigidly lengthwise of the track to make this seem probable.

FRANK ADAMS.

Fender Report in Baltimore.

Some time ago a car fender commission was formed in Baltimore, Md., consisting of the Mayor, City Register and City Commissioner, for the purpose of considering the subject of life guards for trolley cars. Mendes Cohen, past president Am. So. C. E., was employed to investigate and make a report on all fenders which came to his notice. In all, seventy different types were offered, but out of this number, which included nearly, if not all, of the best known fenders, none met with his unqualified approval.

The various fenders are grouped into classes, based on form or mode of operation. Class 1 are termed "combination fenders," meaning those which include in one design a projecting front fender, together with a wheel guard, being thus complete in themselves. The following are named under this head as patentees of fenders likely to prove effective in service: William C. O'Brien, J. W. Darley, Jr., William R. Will and W. R. Fowler, all of Baltimore, and the R. A. Crawford Manufacturing Company, Pittsburgh, Pa.

Class 2 are "front scoop or pick-up fenders," designed to save persons caught, either standing or fallen in the way of an approaching car, but which make no provision for the contingency of failure to pick up the victims. These are divided into two groups. In the first are included such fenders as failing to pick up the victim will not by their form cause injury in passing over him. As belonging to this group Mr. Cohen mentions two, of which Samuel C. Kindig and William J. Ogden, both of Baltimore, are inventors. Neither of these, however, came fully up to the requirements, but both inventions contain good and valuable features. Of course, as already explained, these fenders will each require an effective wheel guard to operate in connection with it.

Fenders of Class 3 assume to trip the person struck and cause his fall upon the platform, but which, like the fenders of Class 2, make no provision for those who are not successfully picked up or saved from falling. Of this class there are but three devices which merit attention, viz.: Louis Pfingst, Boston, the fender used by the Buffalo Street Railway Company, and that of Ferdinand Groshans, Baltimore.

This Buffalo car fender differs from the first only in the fact that it does not slide under the car. It is so arranged as to be readily attachable and, when the direction of the car is reversed, the fender is lifted off by the conductor and motorman and transferred to the other end of the car. Dr. Groshan's fender is not thoroughly worked out in its mechanical details and would not be entitled to notice, except for the elastic edge, which is good and may be fairly relied on to trip a person without seriously bruising or injuring him.

Class 4, or "wheel guard fenders," with or without scoops, are intended to protect from being crushed by the wheels any victim whom the front fender has failed to save. In this class several are mentioned. They are the fenders of which the Detrick & Harvey Machine Co., Baltimore; S. Wright, New York (in use in Philadelphia); George Blakistone, Baltimore (on entire equipment of the Central Railway Company of Baltimore); H. S. Robinson, Fallston, Md., and F. Groshans, Baltimore, are the patentees.

What is needed is a very simple piece of work, the more simple the better. Mr. Cohen's report concludes as follows:

"It is required that the front surface of the car, striking a standing human being, shall be so arranged as to afford a reasonable prospect of saving the person from being dashed to the ground; and, further, so arranged that it shall do the least possible damage by its own impact; and, further, if it fails to do the duty expected of it, and the person does fall to the ground, or is already lying there, that it shall be so devised as to pass over him without causing further injury; and that there shall also be on each car a suitably arranged wheel guard, preferably of angular or "pilot" form, which shall be automatically brought in close contact with the street and rails, in order to prevent the crushing of the victim, whom the front device has failed to save."

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

Atlanta is the city which many of our readers will visit this month at the annual meeting of the American Street Railway Association. For all who expect to attend the Convention, we can predict a most delightful trip, and we urge upon every company the desirability of being represented. The Convention promises to be the largest and most successful in the annals of the Association. The programme decided upon is a most attractive one, the papers being upon subjects having an important bearing upon street railway practice, while the social features of the meeting promise to be particularly pleasant and attractive.

Instances of Exorbitant Insurance Premiums are continually being brought to our attention, and bear added testimony to the soundness of our position in urging the advantages of mutual street railway insurance. We learn from insurance people that rates higher than even now are contemplated, on account of unprofitable business. On the other hand, we are informed that the losses of a certain mutual company, making a specialty of electric railway and lighting risks, have been a small fraction of their premiums received, and that a dividend or rebate of 50 per cent. on the business of the past year is about to be declared. These two statements do not seem consistent, and altogether, it is but fair to state that experience with mutual insurance in this field, is not sufficient to enable percentages of loss to be calculated with any degree of certainty, yet we are sure that the cardinal principles on which all successful mutual companies are founded are wise, and must inevitably lead to lower rates or better profits.

Leakage from Overhead Lines, unless special care is taken to provide good insulation, often amounts to a large percentage of the total output, and reduces the efficiency of the system materially. To provide against loss from this cause, the overhead line should be frequently and thoroughly inspected, and care taken to determine any faults or breaks in the insulation. Usually natural causes are the only agents of destruction which need be feared, but some remarkable performances of the amperemeter in a station near New York last month led to an investigation which disclosed other courses for the current. It was found after the engines had been called upon to deliver considerably more current than usual, that the manager of a neighboring road had been using the extra current to operate his cars, his own generating apparatus having broken down. The connection was made at a a point where the feeders of two lines passed close to each other. Hereafter linemen should be instructed to look out closely, not only for weakness in the insulation, but also for surreptitious connections with the overhead circuit made by other power users.

"Street Car Wheels and Axles," is the title of a paper to be read at the coming meeting of the American Street Railway Association in Atlanta, Ga., by D. S. Cooke, electrical engineer of the Trenton Passenger Railway Company. This should receive, as it deserves, the careful attention of the Association, and should have the fullest discussion. Since we are entering upon a new era in street railway traffic, and are introducing new methods of propulsion which have increased the scope of the street road beyond any precedent, we have encountered entirely new and perhaps unexpected conditions. With the change from animal power to electricity and the cable, the railroad manager is confronted with a change in the condition of his rolling stock. Among the exceedingly important of these conditions is the increasing wear of the wheel. Harder service, heavier weights, and greater brake power all combine to shorten the life of the wheel. Unfortunately, the conditions of street service differ so materially from those of any other railway work that the experience of the steam railway men is of comparatively little value; hence, it becomes necessary to study the problem in the light of the new and rapidly growing experience.

City Engineers and Local Street Railway Managers are often at loggerheads as to the best methods of track construction (including the type of rail and material for paving), when it is proposed to reconstruct or extend a system for mechanical traction. Several instances of this kind have occurred recently, and the reason has usually been that engineers in the employ of municipalities were not as well posted regarding existing street railway practice as those directly engaged in the business. The city engineer is supposed to be always on guard for the best interests of the city, but in his zeal he may insist upon the use of a new rail or of a type of rail that is employed in another city where the conditions differ widely from those in his own locality. The essential features of a rail to be considered are strength, so as to avoid the necessity of tearing up the streets for repairs, degree of obstruction to vehicular traffic, in some cases to provide a track for vehicles, and ease of draft. From a street railway standpoint a T or center bearing girder rail is most desirable, because of their ease of draft and strength with economy of material. In cities

where these types are not allowed, a compromise must be effected. A grooved girder rail may be employed in an exceptionally clean city with fair results, but will not fit the conditions of a city where the streets are habitually dirty. Other rail heads of almost every conceivable type have been tried with more or less satisfactory results, so that in the present state of the art it is almost folly for a person not fully informed on the results of past trials to undertake the design of a new rail and insist upon its adoption. Let such city engineers as may have to pass on any part of street railway construction keep thoroughly posted upon all improvements made in the industry, and it will then be found that their ideas and those of the managers will agree in all essential particulars.

Five State Street Railway Associations, those of New York, Pennsylvania, Massachusetts, Ohio and Michigan, held their annual meetings last month, and each, according to the report of its executive committee, was in active and prosperous condition. The increase in state associations throughout the country is evidence of the fact that they form an important aid to the industry in which their members are engaged. There are many important subjects, as we have repeatedly stated in these columns, which the American Street Railway Association, owing to its national character cannot take up, and with which the individual companies of the state acting alone are not able to cope. Yet the prosperity of all depends upon the prompt and effective action by some body or association in the common interest, either to prevent unjust legislative oppression, or to assist in the perfection of the operating department of railways by a general exchange of information or in other ways to be of benefit. The amount of capital invested in the street railway industry, through the general introduction of mechanical methods of propulsion, has increased so rapidly during the last few years that the need of united action is much greater than ever before. We feel confident that if the advantages to be secured by joining state associations were more generally realized, a much larger proportion of the operating companies of a state than at present would be enrolled in their lists of membership. For the small company, as for the large, the need for mutual help is equally important, and while the excuse is often made that the railway in the small city can add but little strength to an association, it should be remembered that, especially in securing legislative action and reform, a railway company in a small city or town can often use a greater influence in proportion to its size with a representative from its district, than one in a large city. As for those companies which are so shortsighted as to wish to profit by others' work without co-operating in the ends sought, a time may come when they will need assistance in their turn, but that assistance may not then be readily offered or available.

The Business Situation is Improving. Whatever may be the causes, there is no doubt about the fact. Eastern markets, particularly in New York, have been filled for nearly a month past with buyers from nearly all parts of the country. The pressure upon the custom houses of applications for the release of goods from bond has been so great that for several weeks their clerical forces have had to work late at night in the endeavor to satisfy the energy of the merchants who are seeing substantial profits in the growing volume of business. Boxes, bales and barrels are once more encumbering the sidewalks and trundling merrily through the streets on their way to the railroads. The dry goods industry has first felt the effects of this increasing confidence in the future. It is said that at one time over 4,000 purchasers of dry goods were in New York City alone, and under the stimulus of their demand, prices have been steadily advancing, and the large surplus stocks at the great manufacturing cities of New England have been rapidly drawn down to a point where increased production has necessarily commenced again, on a larger scale. A "straw," which has given great encouragement to those disposed to be optimists, was a recent sale at auction of an immense stock of silk, about 600,000 yds. in all, which went off at prices averaging less than 10 per cent. below the general market. Other departments of business are slowly but surely picking up, and stocks of goods, wholesale and retail, which for nearly a year past have been kept at the very smallest possible point in anticipation of lower tariff rates, are now being replenished everywhere. The prospects for a good fall trade and excellent spring business in the general industries of the country are exceedingly bright.

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Financial markets—the most sensitive of all—have been encouraged by the business revival and although there is believed to be "a large short interest" in the stock market, composed of those who are inclined to think the general conditions not wholly favorable, the general feeling is one of cheerfulness and belief in the immediate future of American securities. Railroad stocks have gradually advanced with improved reports of freight earnings, and nearly all stock quotations other than railroad, have shared in the current hopefulness. Government finances, too, are improving, The gold reserve is steadily increasing, the enormous volume of custom receipts during the past few weeks has provided for all immediate necessities and it is confidently believed that the new tariff bill will permanently run the Government and leave a reasonable surplus. The money depots of the world, London, New York, Paris, Berlin, are full to overflowing with cash which the banks, as agents of the capitalists, will be only too glad to loan upon satisfactory security, and no security is, as a rule, more satisfactory than properly endorsed drafts secured by bills of lading. The best commercial paper is eagerly sought for at low rates of interest and it may be considered certain that when our manufacturers and merchants the world over are certain enough of their markets to again take up the work of production and distribution, the money supply will be, for some time at least, equal to the demand.

* * * * *

The street railway industry has borne its burdens in the great financial depression of 1893-94. Eighteen months ago the skies were bright, earnings were increasing and street railways were enjoying unexampled prosperity. Then came the crash. Earnings fell off at once, though proportionately less by far than was the case with the railroads of the country, and indeed less than with most industrial firms and corporations. Street railways have always the great advantage of a cash business, and where they are not overcapitalized they can easily stem any ordinary financial depression. Throughout the present one the necessary net earnings have generally been obtained by

severe retrenchments. It is probable that many of the properties have had experience in economizing, which is, to some extent, a practical offset to temporary financial troubles. The demand for new apparatus and supplies of all kinds has rapidly fallen away. New construction, except in a few large cities, has almost completely stopped. The great manufacturing companies, confronted with a rapidly contracting market, have effected great economies in their own organization, and have been putting down prices to a point hitherto unheard of. It is probably true that a street railway can be built and equipped to-day at a price less by fully 50 per cent. than was the case two years ago.

* * * * *

The time is ripe for action. It is not probable that prices for apparatus and for the major supplies necessary in street railroading will ever—or at least for years to come—be materially lower than at present. It is hard to believe that manufacturers can be making any reasonable margin of profit at the present figures. Electrical apparatus stands at prices less than one-third those of three or four years ago. Steel rails, even the patented sections, can be purchased at prices which compare favorably with those of the English market in spite of the far higher wages in this country, for our coal and iron production is so enormous and our processes of manufacture have been cheapened to such a degree that the time when we can compete with England in the world's iron and steel markets seems to be almost in sight. Ingot copper is at extremely low figures, and it is being drawn into wire at prices which represent a fraction of the profits of better times. Structural iron and building materials are cheap, and everywhere the cash purchaser can come into the most favorable market obtained in the experience of many years. These conditions, however, will not long obtain. "Those who know" are already purchasing, and from all sides street railway manufacturers and dealers report greatly increased inquiry. This strengthening demand will inevitably bring about higher prices, and those who are in the field first will reap the benefit of the lower.

* * * * *

The market for street railway bonds is beginning to show some life, and a few issues have recently passed out of brokers' hands to the investor at a reasonable profit. Generally speaking, however, Eastern bankers and brokers have not cleared their coffers of the more or less "choice" bond issues of all kinds, with which they have been loaded down during the financial depression, and are not disposed to assume responsibility for street railway bonds outside of those of the large systems and principal cities of the country, whose safety is beyond reasonable doubt. This, however, is not due so much to the lack of money or of credit, as to a more or less general feeling in banking circles that many street railways have been overcapitalized. In cases where there is no ground for such suspicions, street railroads are, even now, readily securing a hearing and can in many cases either borrow money on a deposit of bonds as collateral, or, if presenting exceptionally choice issues, can sell them outright at favorable rates.

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For the reasons above stated, we are strongly advising our friends to complete their financial arrangements so long held in abeyance, and to go into the market at once prepared to take advantage of business conditions and opportunities, which may not be found again for many years.

Our Forthcoming Souvenir Edition.

As in a number of years past, we shall issue during the present month in honor of the Atlanta Convention and of our tenth anniversary, a Souvenir Edition of the Street Railway Journal, which we believe will be one of the handsomest and most comprehensive publications in the history of trade journalism. The contents will be devoted largely to the interests of street railways in the South, and will contain numerous illustrations of scenes in and about Atlanta, as well as street railway views from every principal Southern city. Other features of the publication will be portraits of a very large number of the officers of Southern street railway companies, portraits of the past presidents of the American Street Railway Association, executive committee and local committee of arrangements, with those of a number of Atlanta's prominent citizens. The table of contents will also embrace an article descriptive of the growth of the Street Railway Journal, and of the street railway industry during the last decade, together with numerous other interesting subjects.

Our headquarters during the Convention will be in Parlors B and 6 of the Aragon Hotel, and we shall also have a handsome booth in Exposition Building, near the entrance to the Convention Hall. In this connection we extend a cordial invitation to all the delegates, supply men and visitors to call and register with us, assuring all of a hearty welcome.

Electric Railway Ambulance.

As a result of a conference between Health Commissioner Dr. George Homan, of St. Louis, and President Scullin of the Union Depot Street Railway Company of that city, the latter company has decided to put in operation an electric street railway ambulance. The plans for this unique car have been drawn up by Dr. Homan, and the car is now being built by the St. Louis Car Company. It will be fitted up so as to be complete in every detail, and its line of service will be from 12th and Pine Streets over the line of the Union Depot Railway Company to the City Hospital, and the western terminus at Kings Highway and Arsenal Street, where patients will be transferred by ordinary ambulances to the Female Hospital a quarter of a mile distant, and also to other institutions in that vicinity.

Pending the completion of this car an ordinary car has been fitted up temporarily for the service. It runs on a regular schedule, making seven trips daily, handling each day from fifty to sixty patents, who are in charge of a competent physician.

On Saturday, September 15, 1894, the stockholders of the Orleans Railroad Company, of New Orleans, met to consider a proposition for a change of motive power. The plans and specifications had been prepared by H. J. Malochée, E. E., of that city, and a report was submitted by him regarding the estimated total cost. This report was approved as read, and the necessary two-thirds of the total number of shares were voted in favor of the proposed change.

Work on this line will begin very shortly when the contract will be let, the whole to be done under the supervision of the consulting engineer of the company. This road, which runs through a thickly populated section of the suburbs, reaches Canal Street by the narrow streets of the French quarter, but when leaving these, the cars run on several very wide and broad avenues, which are lined with beautiful residences. This line also reaches the famous French Market of the Crescent City, as well as the Fair Grounds where the winter races are held.

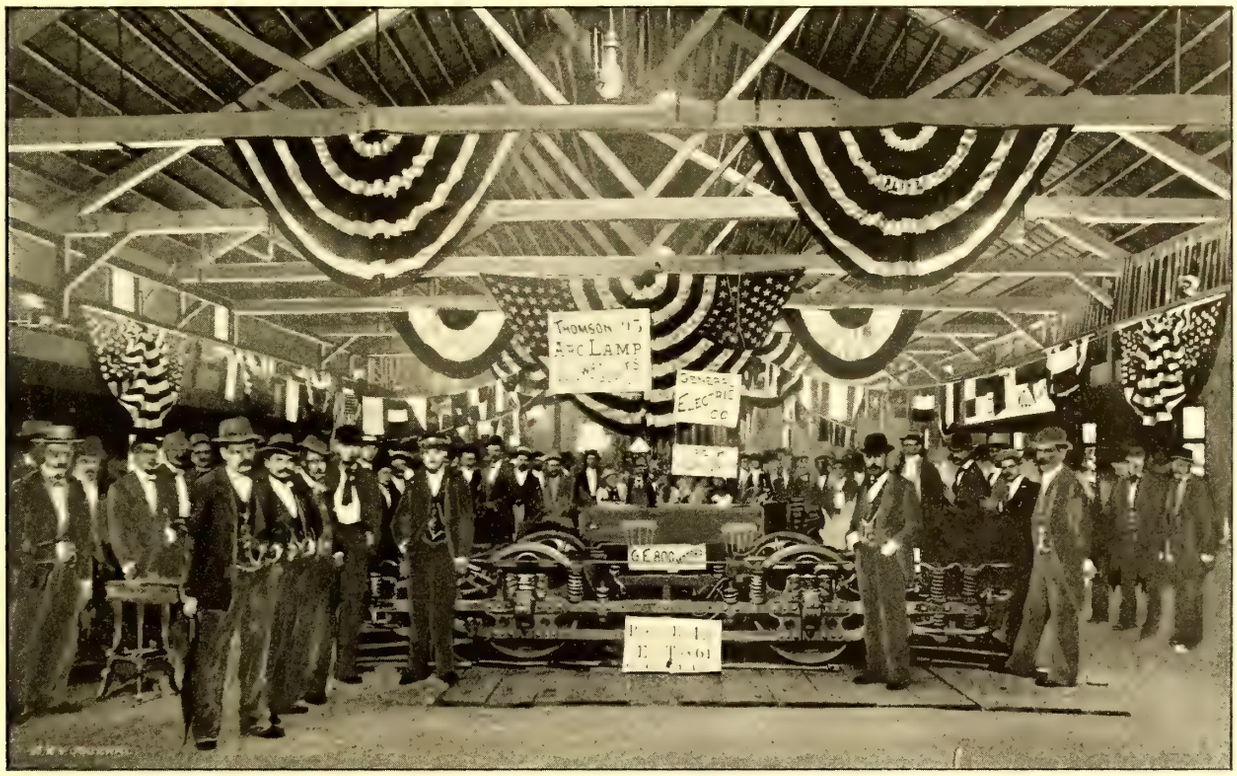
THIRD ANNUAL MEETING OF THE PENNSYLVANIA STREET RAILWAY ASSOCIATION.

The third annual meeting of the Pennsylvania Street Railway Association was held at Reading, Pa., Wednesday, September 5 and 6. There was a large attendance, and the meeting was a most successful one in every particular. An especially attractive feature of the meeting was the fact that an exhibit of street railway supplies was held in connection with it. Heretofore, supplies have been shown only in connection with meetings of the American Street Railway Association, but the exhibits were most complete both in number and variety, and reflected great credit on those represented, as well as upon J. A. Rigg, president of the Reading Traction Company, to whose efforts, we understand, the plan of making the exhibit was finally brought to a successful completion.

nual address. Richmond L. Jones, of Reading, welcomed the visitors to the city. He dwelt at length on the application of steam and electricity to transportation, and closed with a beautiful eulogy on the death of the late president of the Association, R. H. Rhoads.

A paper was then read by Lincoln Nissley, general manager of the Citizens' Passenger Railway, of Harrisburg, on "The Perfection of Street Railway Motors." This is published in another column.

In the business meeting which followed Mr. Nissley's paper, the subject was discussed as to the admission of supply men as members of the Association. It was finally decided to admit representatives of supply houses to the Association as honorary members, upon payment of an admission fee and annual dues, the honorary members to have the same privileges as other members, except that of voting and holding office.



VIEW OF CONVENTION HALL, READING, PA., SHOWING EXHIBIT OF THE GENERAL ELECTRIC CO. AND PECKHAM MOTOR TRUCK & WHEEL CO.

The part of host was ably filled by Mr. Rigg, and the hospitable welcome and entertainment extended to all during their stay at Reading will long be remembered by all participants.

The official place of meeting was at the Neversink Hotel on the summit of Neversink Mountain, several miles from the center of the city. It is reached by the Neversink Mountain Electric Railway, which has been described in former issues, and which winds around the mountain, disclosing beautiful views of the neighboring hills, the city of Reading and the picturesque Schuylkill Valley, until the summit is reached at a height of some thousand feet above the city below.

The exhibits were held in Metropolitan Hall at the corner of 5th and Chestnut Streets. While some considerable distance from the Neversink Hotel, this hall was quite near the Mansion House, which was the headquarters of the Association during the last day of the meeting. A detailed account of the different exhibits is given in another column.

The meeting was called together at 11 A. M., September 5, in the parlors of the Neversink Hotel by Vice-President Wright, of Allentown, who delivered the an-

At the afternoon session an interesting paper on "Power Stations" was read by L. H. McIntire, general manager of the People's Traction Company, of Philadelphia.

In the discussion that followed Mr. McIntire was asked in what sized roads it would, in his opinion, be advisable to use direct connected and belted generators. In reply, Mr. McIntire said that this question depended largely upon local conditions, especially the question of cost of real estate, since the belted plant took more room than the direct connected. As a general rule, however, where the units used were larger than 300 or 500 K. W., the direct connected method was preferable, and that even where the units were smaller, direct connected plants might be used to advantage. In plants where the unit was 1,000 K. W., or over, the direct connected plant, in his opinion, was the only practicable.

In the business meeting that followed the question was brought up of the best method of apprising the non-member companies in the state of the advantages of the

Association and enlarging it by the addition of new members. Remarks were made by Messrs. Given, Lanius, Bragg, Darlington, Lawless and others, and it was finally decided to refer this question to the executive committee for action.

The election of officers resulted in the following choice: President, John A. Rigg, Reading; first vice-president, Robert E. Wright, Allentown; second vice-president, G. L. Greenwood, Pittsburgh; secretary, S. P. Light, Lebanon; treasurer, W. H. Lanius, York. Executive committee, C. L. Magee, Pittsburgh; J. J. Patterson, Lancaster, and B. F. Myers, Harrisburg, with the president and secretary members ex-officio.

The place of meeting for next year was left to be determined by the executive committee.

In the evening a trip was made in special electric cars to the power station of the Metropolitan Electric Company, which supplies current to the cars of the Reading Traction Company as well as to an extensive lighting system. The party was shown through the station by J. L. Boyer, chief engineer of the Metropolitan Electric Company and also of the Reading Traction Company. The station is located on 7th Street, and the railway plant consists of a vertical, 600 H. P. Lake Erie engine, direct connected to a General Electric M. P. generator of 730 amperes and operating at a speed of 150 revolutions. The station also includes a Hamilton-Corliss 1,000 H. P. engine, which supplies power for the city and commercial lighting, and six Ide engines, manufactured by the Harrisburg Foundry & Machine Company in the light and motor department of the company. The arc lighting machines are of the Wood, American and Thomson-Houston patterns, and the incandescent lighting is done on the Edison three wire system. The company has also recently installed an M. A. Green 500 H. P. engine, which drives a General Electric 300 K. W. generator. Schieren belts are used.

The company has at present fourteen ninety horse power tubular boilers, and is installing a new National water tube boiler of 1,000 H. P. An interesting feature of the station is the method of cleaning generators by compressed air, described elsewhere.

From the station the party visited Mineral Springs Park, where they witnessed the act of DeLeon, the "Demon of the Deadly Current," on the electric wire, and listened to the concert by the Ringgold band.

Thursday morning the members visited the exhibits at Metropolitan Hall, and in the afternoon, in three special cars, the first of which contained a fine band of music, a trip was made over the Mount Penn gravity road. The ascent of the mountain was made by means of a steam locomotive of peculiar design to surmount the steep grades and pass around the sharp curves of the line. The delegates were regaled with a sumptuous repast at the hotel at the summit, after which the descent of the mountain was made. Further entertainment was provided at the Mansion House in the evening for those who remained for the late train.

THE EXHIBITS.

The exhibits were shown at Metropolitan Hall, corner of 5th and Chestnut Streets. The floor space, though large, was well occupied. The decorations of the hall were elaborate, consisting of bunting and draped flags, while illumination was provided by arc and incandescent lamps, the current for the former being supplied from the street railway circuit in front of the building. There were frequent exclamations of surprise and admiration at the enterprise of the manufacturers represented in presenting such an excellent exhibit, and commendation of the plan of exhibiting at state conventions. The hall was visited by a large number of the residents of Reading as well as delegates.



EXHIBIT OF THE HUBLEY MANUFACTURING CO. AT THE READING CONVENTION.

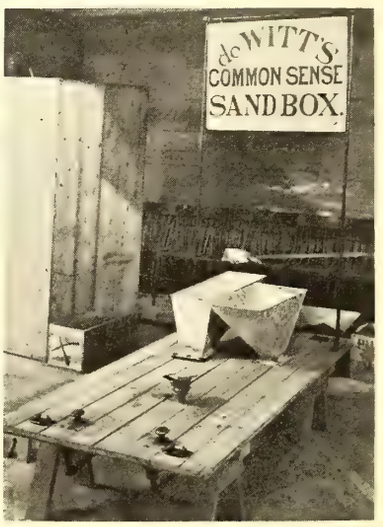


EXHIBIT OF E. F. DE WITT & CO.

We present below a detailed list of the exhibitors and of the articles shown:

THE EXHIBITORS.

F. J. Hanold & Company, of Reading, Pa., showed a large number of kinds of coal which the firm handles.

The Scarritt Furniture Company, of St. Louis was represented by H. D. Nourse who showed photographs of Scarritt car seats.

The E. S. Greeley & Company, of New York, was represented by Frank A. Magee, who showed several headlights manufactured by this company, and which were soon sold.

The Reading Wood Pulley Company, of Reading Pa., showed at the end of the hall a number of different sizes of wood faced pulleys. The company was represented by W. L. Laramy.

Charles A. Schieren & Company, of New York, were, of course, represented and in their space was a large belt designed for the Reading Traction Company. A section of electric perforated belt was also shown.

The Street Railway Advertising Company, of New York and Philadelphia, showed advertising racks and a number of very tasteful advertisements, and W. B. Le Van, Jr., of New York, and S. H. Taylor, manager of the Philadelphia office of the company, were present.

The Cutter Electrical & Manufacturing Company, of Philadelphia, distributed circulars of the well known C & S automatic magnetic cut-out. This cut-out has been described in the Street Railway Journal and has been found to be a most reliable device.

Locke Brothers, of Salem, Mass., were represented by E. Mather, of Harrisburgh, who also represents Warren Webster & Company in that city. One of the well known Locke damper regulators, which have given excellent results in street railway plants, was shown.

The Eureka Sand Box Company, of Lebanon, Pa., presented for inspection one of its sandboxes which can be worked by foot or hand power. The box was shown in operation on one of the cars of the Reading Traction Company. The company was represented by J. K. Raudenbush.

THE FAIRBANKS COMPANY, of Philadelphia, exhibited a full line of valves, cocks and other standard steam specialties manufactured by it. The company makes a specialty of the Jennings high pressure gate valve and the improved Williams rotary gauge cock, which attracted much attention. W. C. Jennings was the company's representative.

THE AMERICAN CAR COMPANY, of St. Louis, occupied a table in the center of the hall and showed a large number of photographs of the exterior and interior of different cars manufactured by them. E. J. Lawless, the well known Eastern representative of the company, was present and explained the advantages of the company's new truck and cars.

THE HALE & KILBURN MANUFACTURING COMPANY, of Philadelphia, occupied a space on the right hand side of the building, about half way from the entrance, and showed four car seats illustrating four varieties, the longitudinal and reversible, in rattan, plush and carpet. The company was represented by Charles E. Barrett of the New York office.

THE OKONITE COMPANY, of New York, was represented by W. F. Forby, who found many users of Okonite wires among the delegates present. The company distributed as a souvenir of the Convention a leather pocketbook stamped with the trademark of the Okonite Company, and containing a trick catch which afforded no little amusement and interest.

THE DELAWARE HARD FIBRE COMPANY, of Wilmington, Del., exhibited samples of its fibre in different forms. Special interest was taken in the fibre bridge manufactured for controllers, a specialty being made of this by the Delaware Hard Fibre Company. The company's representative was C. H. Hammond, who also had a supply of catalogues for distribution.

WM. E. HOOPER & SONS, of Baltimore, exhibited a large number of samples of their well known cotton ropes. These were arranged in a handsome frame where they could be easily examined, and owing to the general interest felt in rope transmission for cable and electric roads received much attention from the delegates present. A number of samples of duck cloths were also shown.

MACAN & COMPANY, of Philadelphia, local agents for the Magnesia Sectional Covering Company, of Ambler, Pa., exhibited samples of the latter company's well known magnesia covering for steam pipes. Mr. Macan was present and was kept busy in answering the many inquiries in regard to the appliances manufactured by the Magnesia Sectional Covering Company, which are giving good satisfaction in a large number of steam plants.

attracted much attention. Mr. Field showed a section of roofing which illustrated the Berlin patent anti-condensation roof lining. This system is in use on a large number of railways, and its merits were appreciated by all present. The company has also done considerable work in the city of Reading, so that the delegates had an opportunity of studying the construction of the work in actual service.

E. F. DEWITT & Company, of Lansingburgh, N. Y., showed two standard sand boxes of the firm's Common Sense type. Mr. DeWitt was present and took great pleasure in showing the operation of the box to all delegates. He proved conclusively that the box can be relied upon to deliver sand wet or dry on the track whenever necessary. With this box, sifted sand is not a necessity since the box will operate even if there should happen to be stones in the sand. The box can be operated by a hand lever or by the foot as may be desired.



EXHIBITS OF WARREN WEBSTER & CO. AND E. MATHER AT THE READING CONVENTION.

WARREN WEBSTER & COMPANY, of Camden, N. J., showed samples of their feedwater heaters, purifiers, exhaust and live steam separators and oil separators. These attracted a great deal of attention on account of their compactness, and the company's representative, A. T. Gahagan, was kept busy in explaining the merits of the devices. The company also showed views of the factory of Warren Webster & Company, as well as handsome photographs of different apparatus manufactured by the firm. Warren Webster & Company claim to have manufactured more horse power of the apparatus of which they make a specialty, than any other concern.

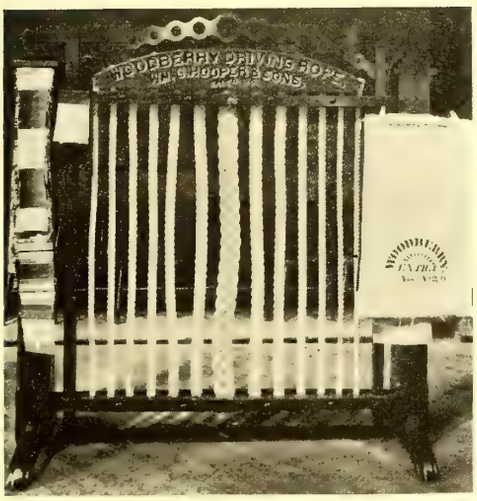


EXHIBIT OF WILLIAM C. HOOPER & SONS.

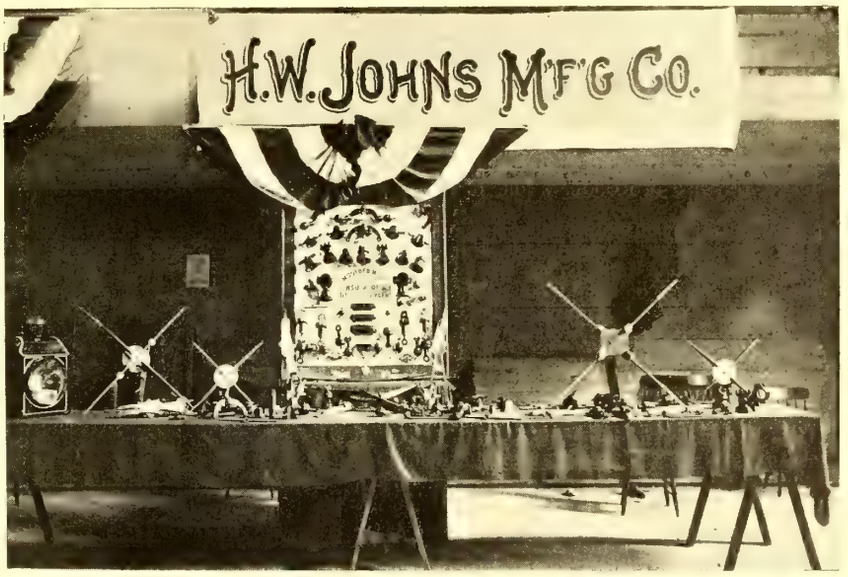


EXHIBIT OF H. W. JOHNS MANUFACTURING CO. AT THE READING CONVENTION.

THE WESTERN ELECTRIC COMPANY, of New York, was represented by Jay Wiley of the railway department, and made a good showing of trolley line and overhead parts. These were arranged on a long table where they could be easily inspected by the delegates, and many favorable comments were passed on the design and finish of the articles shown. Directly back of the table was a full sized pole with the flexible bracket of the company, also rail bonds which proved of special interest to visitors.

CHARLES G. SMITH, of New York, the famous lamp manufacturer, made a splendid exhibit of his varied line of lamps, which was the subject of most favorable and complimentary comment on the part of all present. On three sides of the space devoted to "Smith of New York" were arranged combination lamps, electric clusters, clusters with glass reflectors, headlights, lamp parts, automatic torches, etc. The exhibit also included samples of bell cord which the company supplies. Newton Clark was the company's representative.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., was represented by John M. Field, and its system of station construction

JOHN H. GRAHAM & COMPANY, of New York, was represented by C. A. Hoagland, who exhibited samples of the H. & C. sleet cutting trolley wheel manufactured by the Storm Manufacturing Company, of Newark, N. J., and for which John H. Graham & Company are sole agents. This wheel, which as been illustrated in the STREET RAILWAY JOURNAL, automatically removes the incrustation of ice from the wires in winter, leaving them clear for the transmission of the electric current. All wheels are made of aluminum bronze bushed with graphite, and owing to the approaching winter season, Mr. Hoagland had many inquiries in regard to the wheel, as well as about New Departure bells.

The Brooklyn Car & Veneer Works, of Brooklyn, N. Y., occupied a space at the lower left hand corner of the hall, and made an exhibit which was a most extensive and creditable one. The company supplies railway car woodwork, mouldings, veneer seats, ceilings, etc., and in the exhibit were sample veneers for ceilings, upper deck advertising racks, advertising frames, side and end frames, railroad car seats, etc. The company also showed single and double seats made of veneer, and side seats for depots, the backs of which were made of perforated veneer. W. B. LeVan, Jr., represented the company. The company distributed a very tasteful business card printed on a sample of veneer.

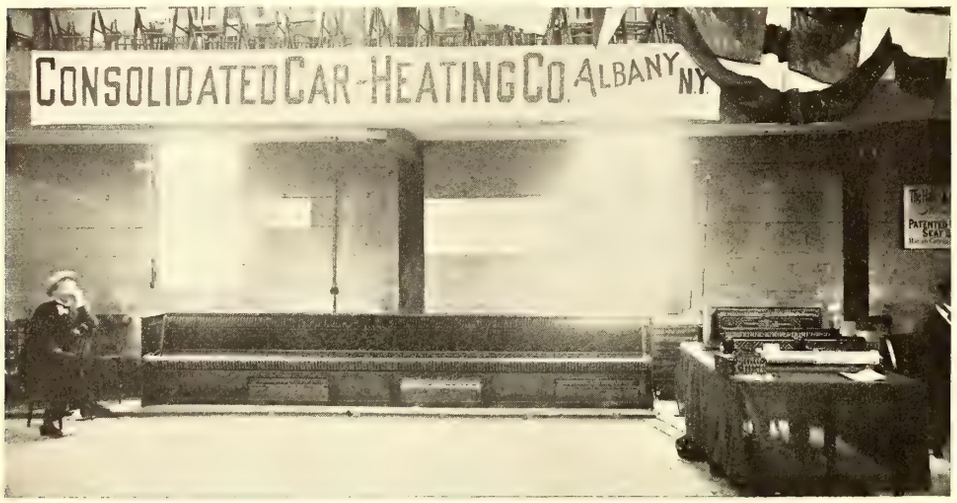


EXHIBIT OF THE CONSOLIDATED CAR HEATING CO. AT THE READING CONVENTION.

The Peckham Motor Truck & Wheel Company, of Kingston, N. Y., was represented by the company's Eastern manager, A. W. Field, and showed a 6 E Peckham truck ready for operation and equipped with General Electric motors, as mentioned later in the description of the General Electric exhibit. This truck has a six inch wheel base and a fourteen foot spring base, being, it is said, the longest spring base truck manufactured. The truck was equipped at each end with the Peckham standard fender, which has been described in the Street Railway Journal, and which sets within two inches of the ground. The operation of the truck was greatly admired by the street railway men who were present.

The Mark Railway Equipment Company, of Chicago, Ill., had at Reading a line of box joints shown in position on standard rails of various types and sizes. The joint bridges manufactured by this company are of malleable iron, and are not only desirable for electric roads, but are claimed to be the only joints suitable for cable tracks which have yet been brought out. The company has recently closed a large order for the Chicago City and Pittsburgh Traction Companies' cable lines. Samples of the joints were also shown for joining flat and girder rails, etc. The Mark Railway Equipment Company has a large call for these special joints, which are of course made to order. A sample of a box and chair for three point rails was also shown. J. K. Rogers, Jr., represented the company.

N. T. Kunkle & Son, of Reading, Pa., occupied a space in the center of the building, and made a very tasteful display of the different lubricating oils supplied by them. These oils were contained in fancy bottles which were arranged in the form of a pyramid. One tall bottle contained three kinds of oil of different specific gravities, which were shown very clearly, as the denser oil was at the bottom and the lighter at the top, with the medium heavy oil between the other two. The company also showed samples of its special motor, gear case and journal greases, also samples of oil in different stages of manufacture. A large block of paraffine for paraffine lights was also shown. The company was represented by Mr. Kunkle, who distributed a number of vials containing a sample of one of his products.

The Bridgeport Car Equipment Company, of Bridgeport, Conn., exhibited one of its standard fenders and sandboxes which attracted no little attention. These fenders have been adopted by the Bridgeport Traction Company for all of its cars, and are also in use on the Cincinnati Inclined Plane Railway, Troy City Railway, Fitchburg & Leominster Railway, Lowell & Suburban Railway and other prominent lines. The sand boxes of the company are also in use on the cars of the Pittsburgh Traction Company, as well as elsewhere where they are taking the place of other well known sand boxes, and are giving excellent service. The Bridgeport Car Equipment Company also supplies snow plows and other appliances for street railway companies, and promises to be a large manufacturer of street railway appliances. The company was represented by William Grunow, Jr.

The Safety Clutch Brake Company, of Philadelphia, showed both its upper and lower clutch brakes, and the railway representatives who saw the devices all spoke highly in its favor. Its accuracy and certainty of action were especially commented upon, and the general verdict was that it was a brake which would stop a car as quickly as might be required. The power is applied at the rail. The clutches are covered and protected from dust, and the durability of the brake is equal to the life of the car. Mr. Santee, who represented the company, has recently returned from a Western trip and reports that a most favorable reception has been accorded there, especially in Chicago, to the brake. The Pullman Company has adopted it, as have also a number of prominent railway companies of the city. The brake is also giving excellent results on the line of the People's Traction Company, of Philadelphia, as well as on other roads in the East.

A. Whitney & Sons, of Philadelphia, whose car wheels have achieved a wide reputation for durability, made an exhibit which attracted no little interest. A chief feature of the exhibit was a new type of car wheel which is described elsewhere in this issue. This wheel is cast with a general internal section similar to the ordinary wheel, but with a tread separated from the internal section by cellular cavities. In this way the chill on the tread of the wheel can be made more uniform and of a greater depth, as well as of greater density of metal, as smaller bodies of cast iron are denser than greater. The wheels can be cast with any type of chill, and the company can maintain the same weight in its manufacture as of an ordinary wheel. The merits of the wheel were pointed out to delegates by L. R. Faught, inventor, and F. A. Lex, of the company's Philadelphia office. Axles and other standard products of the works of A. Whitney & Sons were also shown.

Benjamin F. Shaw, of Wilmington, Del., was represented by H. R. Fothergill, of the Philadelphia office. A large line of the Shaw fine high pressure pipe fittings for power house equipment was shown, also copper bends for expansion purposes, which were much admired, as was also Mr. Shaw's trolley bracket for electric railways. Some tools exhibited by Mr. Shaw showed the quality of the work done by him, which is well known to our readers. The delegates had an opportunity to examine Mr. Shaw's products, since the power house of the Reading Traction Company was equipped by him, as was also that of the Scranton Traction Company, the Steinway Railway Company, of Steinway, New York, and other well known stations. An-



EXHIBITS OF BRIDGEPORT EQUIPMENT CO., MARK RAILWAY EQUIPMENT CO. AND A. WHITNEY & SONS.

other appliance which attracted a great deal of interest was the Spencer damper regulator which is most popular in power stations, and is giving good results. Mr. Fothergill explained that Mr. Shaw is ready to furnish plans and specifications to all persons ready to equip their stations.

THE J. G. BRILL COMPANY, of Philadelphia, was represented by Samuel L. Curwen, and as the company's cars are in operation on the lines of the Reading Traction Company, it was thought not necessary for the company to make any special exhibit. To enable delegates, however, to inspect carefully one of the Reading cars, the Reading Traction Company placed just outside the entrance one of its standard cars which had been in operation for about eighteen months, but which had been recently repainted and varnished. The car was thirteen feet over all and was mounted on a Brill No. 21 truck equipped with G. E. 800 motors. The interior finish was in mahogany with bronze trimmings and birdseye maple ceilings. The seats were covered with Wilton carpet. The windows, of which there were seven on each side, were of handsome plate glass. The exterior color was Tuscan red on the main panel, with gold lettering, "Reading Traction Company," edged with black and with silver trimmings. The lower concave panel was painted buff with red trimmings, the dashes being the same color as the main panel.

THE H. W. JOHNS MANUFACTURING COMPANY, of New York, had one of the most complete and handsome exhibits at Reading. It was in charge of James W. Perry. The space occupied was that on the right hand side of the hall directly next to the entrance, so that the attention of everyone entering the hall was immediately attracted to it. In the center of the exhibit was a large panel containing a complete line of the H. W. Johns Manufacturing Company's trolley insulators, hangers, pull-offs, strain insulators, ears, switches, brass and insulated crossovers, circuit breakers, etc. Particular attention was attracted by the company's Giant strain insulators, which are guaranteed to withstand a strain of over 6,000 lbs., and which are giving good results on a number of the principal street railways in the country. In front of the panel was a long table covered with all varieties of street railway supply parts manufactured by the H. W. Johns Manufacturing Company, including a Lincoln insulated crossover, Philadelphia circuit breaker and Perry mechanical clip. The latter has been adopted by a number of prominent roads throughout the country where soldered ears are considered objectionable. The exhibit was tastefully decorated with flags.

THE PRICE RAILWAY APPLIANCE COMPANY, of Philadelphia, was represented by James M. Price and presented an exhibit which attracted a great deal of interest. The exhibit consisted of samples of the well known Price joints and brace chairs for deep girder rails, including the "Little Giant" joint and K joint. With the joints were also shown samples of the Price bond. This consists of a plate of copper bent into shape, resembling a V in section, placed upon the flanges of the two rails on each side, and enclosed within the jaws of the joint plates by driving up. As will be seen, the copper is compressed between two stout surfaces of iron and steel with large and admirable contact with each. It is also not exposed to danger of decomposition from action of the salts of the earth. The simplicity and efficiency of the device made the exhibit of Mr. Price a most attractive one. Results were also shown of a series of tests made in the same current in the Drexel Institute with various bonds in common use, showing that the Price bond with an average current of 200 amperes had a lower average resistance, and consequently horse power loss, per mile, than that of any other of the bonds, and less than one-quarter that of one other well known bond.

THE GENERAL ELECTRIC COMPANY, of New York and Schenectady, occupied the most prominent location in the hall, the exhibit being in the middle of the building directly in front of the entrance. The exhibit consisted of two General Electric 800 motors mounted on a Peckham truck, which was blocked up so that the motors could be shown in operation. A type "K" series parallel controller was used and current was taken from a wire connecting with the circuit of the Reading Traction Company. This part of the exhibit attracted a great deal of attention and was the center of a large crowd whenever the motors were run. The railway department of the company also had a most practical exhibit on every street in Reading, from the fact that the cars in the city are equipped with General Electric motors. In the hall, close to the electric truck were also a number of tables on which were shown a line of overhead equipment supplies which attracted much attention. As the hall was lighted with Thomson "93" arc lamps, railway men had an opportunity of studying the merits of this system of lighting. These lamps are arranged to operate on railway circuits, and were connected ten in series. They burned very steadily without flickering, proving the claim made for them that by their means the distribution of arc lighting can be successfully accomplished by electric railway companies. The company was represented by H. J. Crowley, manager of the Philadelphia office, D. L. Huntington, electrician, and R. E. Moore, of the supply department.

THE HUBLEY MANUFACTURING COMPANY, OF LANCASTER, PA., occupied quite an extensive space at the lower right hand corner of the hall. Its exhibit included a full supply of the company's well known overhead line equipment parts. These were arranged on a large panel covered with blue cloth and placed in the center of the exhibit. The company's trolley harp and wheel attracted a great deal of attention. This device combines strength and lightness, while all sharp points on the harp are avoided, so that it will not catch in the trolley wire. The trolley wheel has a rolled edge so as to avoid cutting the trolley wire. The company also showed improved overhead frogs, samples of insulated paper and cloth and a new composition for motor bearings of which it is making a speciality. At the side of the entrance to the company's exhibit which was inclosed by a brass railing, was a sample of its car brake handle, the main feature of which is that it is practically unbreakable. A sample was shown of a handle which had been completely twisted out of shape in order to prove this quality. Other appliances shown were a Cope "come-along" for pulling the trolley wire taut; also a combination lamp bracket adopted by the Pennsylvania Traction Company for signals on the rear end of the car. These can be used at night for lamps, and in the daytime for flags. The company also showed a number of arc lamp parts which are carried in stock. At the side of the exhibit was a large roll of Roebling wire for which the Hubley Manufacturing Company is agent. The company was represented by W. H. Beatty, formerly of the Novelty Company, and Frank H. Stacey, secretary of the company.

THE CONSOLIDATED CAR HEATING COMPANY, of Albany, N. Y., occupied a large space on the right of the hall, and the exhibit was one of the most interesting as well as one of the most extensive in the hall. Along the side of the wall was a complete car seat for an eighteen foot car equipped with the company's heaters. Six heaters are usually used on each car, three being on a side, and the heaters are located under the seat, the hot air coming through the riser. The operation of the heaters is regulated by a switch giving five intensities of heat, and the heaters shown were operated from the power circuit of the Reading Traction Company. On a table, close to the sample seat already mentioned, were a number of single heaters with cases removed to give opportunity to examine the construction. Among them was a heater which has been in use for two seasons, yet a careful examination of the coil showed that no oxidization had occurred on the spiral conductor. H. N. Ransom, of Albany, the company's representative, stated that the record of the company that no coil of a heater supplied by it has ever burned out still remains unbroken. Delegates who wished to learn of the results secured on roads by the heaters had an opportunity for examining a large collection of testimonials showing that the Consolidated Car Heating Company's system had been most successful in its results and had proved to be a great favorite. Mr. Ransom mentioned among other recent orders the following: For the Poughkeepsie & Wappinger Falls Electric Railway, entire equipment; also for the entire equipment of the Derby (Conn.) Street Railway; Newburgh (N. Y.) Street Railway; New Haven & Centerville Street Railway, and an increase order from the New Haven Street Railway, covering all of the cars on that road not previously equipped by the company.

ATTENDANTS.

Among those present were the following:

Allen, E. H., Allen Electrical Supply Co., Philadelphia, Pa.
Allen, A. H., Westinghouse Elec. & Mfg. Co., Philadelphia, Pa.
Armstrong, W. A., Lancaster, Pa.
Arrowsmith, A. V., Reading Traction Co., Reading, Pa.
Ash, E. W., Schuylkill Traction Co., Ashland, Pa.
Aulenbach, M. C., Reading Traction Co., Reading, Pa.

Barrett, Chas. E., Hale & Kilburn Mfg. Co., Philadelphia, Pa.
Beatty, W. H., Hubley Manufacturing Co., Lancaster, Pa.
Billinger, Geo. S., York Street Railway Co., York, Pa.
Blake, H. W., STREET RAILWAY JOURNAL, New York.
Boyer, J. L., Metropolitan Elec. Co., Reading, Pa.
Bragg, C. W., Westinghouse Elec. & Mfg. Co., Philadelphia, Pa.
Breese, C. P., Walker Manufacturing Co., Philadelphia, Pa.
Breneman, B. F., Pennsylvania Traction Co., Lancaster, Pa.
Brightbill, S. L., Lebanon & Annville St. Ry. Co., Lebanon, Pa.

Carson, Robt. H., People's Traction Co., Philadelphia, Pa.
Clark, Newton, C. G. Smith, New York.
Clitz, Paul Randall, Johnson Co., Philadelphia, Pa.
Crowley, H. J., General Electric Co., Philadelphia, Pa.
Curwen, Sam. M., J. G. Brill Co., Philadelphia, Pa.

Darlington, F. W., Pennsylvania Traction Co., Philadelphia, Pa.
DeWitt, E. F., E. F. DeWitt & Co., Lansingburgh, N. Y.
Dickerson, J. W., *Street Railway Gazette*, New York.

Ellis, Harvey, Ellis Manufacturing Co., Philadelphia, Pa.

Fales, T. M., York Street Railway Co., York, Pa.
Faugh, L. R., A. Whitney & Sons, Philadelphia, Pa.
Ferree, S. P., Street Railway Advertising Co., New York.
Field, Arthur W., Peckham Motor Truck & Wheel Co., Boston, Mass.
Field, John M., Berlin Iron Bridge Co., East Berlin, Conn.
Fisher, G. H., Chas. A. Schieren & Co., New York.
Forby, W. F., Okonite Co., New York.
Fothergill, H. R., Benj. F. Shaw, Wilmington, Del.

Given, Wm. B., Columbia & Donegal Railway Co., Columbia, Pa.
Gahagan, A. T., Warren Webster & Co., Camden, N. J.

Haldeman, Thomas W., Pottsville, Pa.
Hammond, C. H., Delaware Hard Fibre Co., Wilmington, Del.
Hanold, F. W., Reading, Pa.
Harrington, W. E., Philadelphia, Pa.
Hayes, Wm. H., West Chester Street Ry. Co., West Chester, Pa.
Hirons, Wm. F., Lamokin Car Works, Philadelphia, Pa.
Hoagland, C. A., John H. Graham & Co., New York.
Hooper, James E., Wm. E. Hooper & Sons, Baltimore.
Huntington, D. L., General Electric Co., Philadelphia, Pa.

Janney, W. H., Electric Traction Co., Philadelphia, Pa.
Jennings, W. C., The Fairbanks Co., Philadelphia, Pa.
Jerome, R. S., Central Electric Heating Co., New York.
Jones, Richmond L., Reading, Pa.

Kenfield, F. L., *Street Railway Review*, Chicago.
Kunkle, H. T., H. T. Kunkle & Co., Reading, Pa.

Lanius, W. H., York Street Railway Co., York, Pa.
Laramy, W. L., Reading Wood Pulley Co., Reading, Pa.
Lawless, E. J., American Car Co., New York.
LeVan, W. B., Brooklyn Car & Veneer Works, Brooklyn, N. Y.
Lex, F. A., A. Whitney & Sons, Philadelphia, Pa.
Light, S. P., Lebanon & Annville Street Railway Co., Lebanon, Pa.

Magee, F. A., E. S. Greeley & Co., New York.
Mansfield, Frank, Walker Manufacturing Co., New York.
Mather, Edmund, Reading, Pa.
McIntire, L. H., People's Traction Co., Philadelphia, Pa.
Moore, R. E., General Electric Co., Philadelphia, Pa.

Nagle, James W., *The Car*, Philadelphia, Pa.
Nissley, Lincoln, Citizens' Passenger Ry. Co., Harrisburg, Pa.
Nicholson, S. L., James Boyd & Co., Philadelphia, Pa.
Nourse, H. D., Scarritt Furniture Co., St. Louis, Mo.

Ostrom, John F., Middletown & Highspire Railway Company, of Steelton, and Pennsylvania Steel Co., Steelton, Pa.
Owen, Benj. F., Reading & Temple Railway Co., Reading, Pa.

Padley, James C., Wissahickon Elec. Lt. & Pass. Ry. Co., Phila.
Patterson, John J., Pennsylvania Traction Co., Lancaster, Pa.
Perry, James W., H. W. Johns Co., New York.
Pratt, G. E., Jackson & Sharp, Wilmington, Del.
Pratt, Mason D., Pennsylvania Steel Co., Steelton, Pa.
Price, James M., Price Railway Appliance Co., Philadelphia, Pa.

Ransom, H. N., Consolidated Car Heating Co., Albany, N. Y.
Raudenbush, J. K., Eureka Sand Box Co., Lebanon, Pa.
Rigg, John A., Reading Traction Co., Reading, Pa.
Rigg, S. E., Reading Traction Co., Reading, Pa.
Rupp, D. A., York Street Railway Co., York, Pa.

Smith, Chas. H., Lebanon & Annville St. Ry. Co., Lebanon, Pa.
Smyser, Geo. P., York Street Railway Co., York, Pa.

Taylor, S. H., Brooklyn Car & Veneer Works, Brooklyn, N. Y.

Vosburgh, A. C., New Process Rawhide Co., Syracuse, N. Y.

Webb, H. E., Solar Carbon & Manufacturing Co., Pittsburgh, Pa.
Wiley, Jay, Western Electric Co., New York.
Wright, Robt. E., Allentown & Beth. Rapid Tran. Co., Allentown, Pa.

Yardley, John H., Philadelphia Car Wheel Co., Philadelphia, Pa.

Motor Repairs.

Tagging Wires—Sparking Controllers—Oil Rings—Commutator Short Circuits.

By James F. Hobart.

The proper tagging of every wire put into a car, should be insisted upon by master mechanics. Especially where the wires come up through the platform, and enter the controller, is a careful system of tagging necessary, for every time the controller is taken down, every wire must be disconnected and pulled down below the platform floor. If carelessly put on, a good many of the tags will get knocked off, or becoming loosened, will slide down the wires, often working back into the hose out of sight; then, when the controller is connected up again, and a couple, or more, of the tags are missing, a "cut and try" method must be followed to make sure that the controller is properly connected up; that is, the tagless wires must be connected by guess, and the cars tested with current to see if the connections are right, if not they must be taken down again, connected differently, and another trial made.

There is another method of picking out the wires, and it is by getting a magneto, testing each wire until the proper connection for each has been worked out, and then replacing the missing tags. This is the right way to do it, but it is seldom so carried out in any car house. In the first place, magentos are scarce, there is one somewhere, but it would take an hour to get it, and the car is wanted in fifteen minutes, so the fifteen minutes are spent in guessing, connecting up, testing with current, and then reconnecting until the proper connections have been found. Then the car is hustled out of the barn and the wires go tagless until the controller is again overhauled, when the whole business is repeated. Again, I have known the tags which have worked into the hose, to cut through the insulation and form a short circuit, cutting out perhaps one of the fields, in an armature, or even more, and having such an effect upon the car that it had to be pushed into the barn dead, by the next car to come along.

In case a Westinghouse car should come into the car house with the complaint that "the controller sparks," as a rule no repairs will be necessary. All that is needed is to remove the shield over controller, cut off current at switch underneath the hood of the car, and scrape the contact strips thoroughly with a screwdriver, or some other suitable tool. It will be found that the sparking was caused by partially or wholly short circuiting the controller connections by a collection of dust, fibre from the wire insulation and other matter which may have found its way into the controller box.

After scraping the contacts clean, let all the connections and the inside of the controller stand be swept clean of all dust, a small whisk broom being a good tool for the purpose. While cleaning out the dust and dirt keep a sharp lookout upon the shoes on ends of the contact bars. A good many of the shoes become badly melted, and probably the copper (or bronze) dust formed from the shoes, does much towards causing the short circuiting of the contact strips, which is the principal cause of the heavy sparking above mentioned. Removing every particle of dust from the controller and its case almost always effects a complete cure.

Armature trouble is the worst enemy of the repair man, and more than one armature is burned out by the oil containing fine particles of metal, which works down

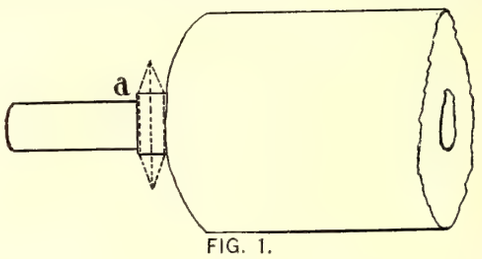


FIG. 1.

from the bearing on back end of motor shaft. For some time, a "grease ring" has been put between the commutator and the bearing upon that end of the motor shaft, and it has been found profitable to put a grease ring upon the shaft at the other end of the armature. The shoulder which projects about three quarters of an inch beyond the winding, *a* (Fig 1) may be trued up in a lathe, a thread cut therein, and a grease ring screwed on tight enough to prevent any oil from working between it and the shaft.

A grease ring need not be more than five-eighths of an inch thick (just enough to find a good bearing on the shaft) and project about two inches from the shaft. The

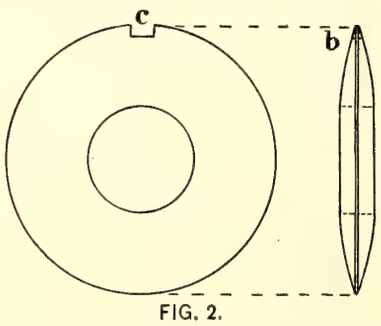


FIG. 2.

outer edge of the ring may be turned down to the thickness of one-sixteenth to one-twelfth of an inch, as shown at *b*, Fig. 2. The ring thus made would be about six and one-half inches in diameter, five-eighths of an inch thick, with very thin edges. The problem now is to screw that thin edged ring fast to the shaft. This is best done by making a "spanner" to fit the ring (Fig 3.), then to file a notch in edge of ring to fit the spanner hook, *d* (Fig. 3.), The notch (Fig. 2) may be one-fourth inch deep and three-eighths wide. After screwing on the ring, the notch should be filled with soft solder, or a bit of metal may be fitted in the notch and soldered fast.

With the ring in position any grease, which might work along the shaft from the bearing, is thrown off

by centrifugal force before it gets into the armature winding. Once there, the oil penetrates the insulation, and upon the armature becoming short circuited, or receiving a very heavy current from some other cause, the oil becomes carbonized and then, in connection with the

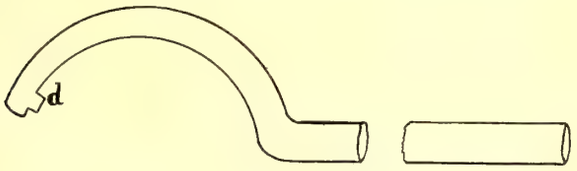


FIG. 3.

finely divided metal brought by the oil from the bearing, a pretty good path is provided from one armature wire to another and a case of burning out is some day brought to the repair shop. All this trouble, or a good deal of it, is prevented by the grease ring.

One of the principal causes of armature failure is in the cavity just back of the commutator, *a* (Fig. 4), where the wires curve downward from armature, and upwards to the commutator, leaving a cavity which completely encircles the armature shaft. In this cavity, close to the commutator, trouble originates. Perhaps a little oil gets into the cavity, or some moisture. The former causes short circuits between the commutator segments by be-

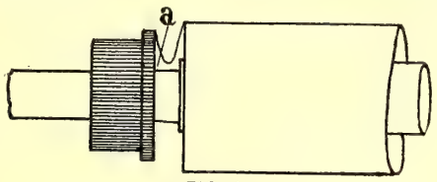


FIG. 4.

coming carbonized as noted above. The moisture does the damage in its own way, and seems to help fix particles of carbonaceous matter to the mica insulation until it is bridged completely across. Then trouble begins; the short circuit thus formed develops intense heat, the wire insulation is vaporized, and a continuous deposit is formed nearly or quite around the commutator, short circuiting the entire concern.

The only remedy for this trouble is to remove the commutation, clean it up, test out all short circuits, and resolder the armature wires. For taking down commu-

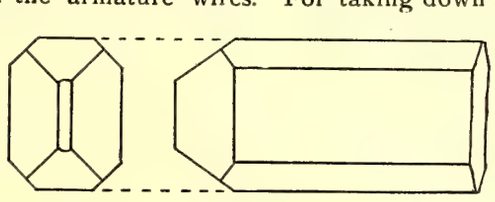


FIG. 5.

tator connections, a copper (soldering iron) is needed with a bit tapered down, about as shown by Fig. 5, to one-twelfth of an inch thick and five-eighths of an inch wide. This size of copper will just go into the wire slot in commutator, and is wide enough to heat the whole length of the slot at once. The secret of taking down armature

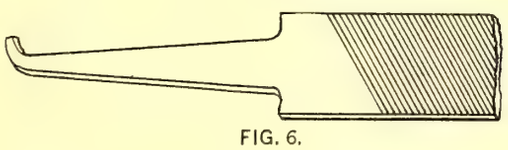


FIG. 6.

winding connections lies in having the copper well turned, and then keeping it well covered with solder while melting out the wires. If a "dry" copper, even when well heated, be put on to a wire, the solder will not be melted nearly as quickly as when there is plenty of solder on the copper. The solder makes a better contact between commutator and soldering copper—that's all it does.

The other tools required for taking down armature connections are a pair of lineman's pliers and a hook for prying out the wires after they have been loosened by unsoldering. Usually, the end of a file, bent up as shown in Fig. 6, is all the tool used for that purpose, and answers very well.

A commutator should be put on with a taper fit, a feather being cut in to prevent turning around, and a thin nut screwed up against the commutator to keep it tight upon the taper. Several three-eighths holes are drilled in the face of the nut, which is very thin, much like a grease ring, to take the pins of a spanner wherewith the nut may be turned up or taken off. A spanner for this purpose is supposed to be at hand in every repair shop, but the men take little time to look for such a tool. Instead, the nearest punch is picked up, and with it placed in one of the spanner holes, the nut is started by hammering on the punch. The nut is badly injured by such treatment and its life badly curtailed. Master mechanics should see that commutator nuts are not abused in this manner.

There are two holes diametrically opposite each other in every commutator into which studs may be screwed, and by means of a bar placed over the studs, and across the end of the shaft the commutator is pulled off by tightening the nuts on the studs. It requires ten or fifteen minutes to adjust, apply and use this commutator pulling rig, whereas, if each nut on the studs were replaced by a small gear, threaded to fit the studs, and a third gear placed between the two stud gears, then, by means of a crank applied to one of the gears the commutator could be pulled off in short order.

The commutator must be cleaned of all dirt. Sandpapering is the usual way of doing the work, the commutator being laid flat on a bench and sandpaper rubbed on until all the dirt and discoloration has been removed. Much better and quicker work can be done in this way, by providing a sort of vertical lathe to rotate the commutator with, instead of rubbing the commutator by hand. Something like a potter's wheel would be good for this business, and would save a good deal of time.

Trolley Parties in Philadelphia.

The leasing of electric cars for trolley parties, as mentioned in our last issue, has become very popular in Philadelphia, and as many as thirty-two cars have been chartered in one night for this purpose on the line of the People's Traction Company. The cars are leased at $10 for the evening and are often very tastefully decorated by the lessees. The cars are run the entire round trip down 4th Street to Snyder Avenue and up 8th Street and Germantown Avenue to Mount Airy and return to the starting point, a run which requires two hours and thirty-two minutes. The excursionists often take with them a band of music.

Originally tin horns were carried in great numbers, but as the residents along the line objected to the noise, the use of sleigh bells has been substituted.

Tar Burners in Melbourne.

The Melbourne Tramways & Omnibus Company, of Melbourne, Australia, has made some interesting experiments in the use of tar for fuel.

The tar, after being received from the gas company, is kept in 400 gal. tanks. It is kept in a liquid condition by means of exhaust steam pipes, which are coiled in the tanks, and is pumped to the feed tanks, which are above the boilers, as required. From these feed tanks, it is led, first, through a large strainer, then through a two inch pipe to the furnaces.

The tar is mixed in the burner with steam, and both tar and steam pipes are provided with flexible joints at the furnace doorplate, so that they can be easily swung back, as the furnace door is opened.

The results have been very successful from an economic standpoint.

The Wissahickon Electric Passenger Railway.

A well arranged electric station, at which current for operating both an electric railway and extensive arc lighting system is generated, is located at Wissahickon, a suburb of Philadelphia on the Norristown branch of the Philadelphia & Reading Railway. The railway has not been in operation a very great length of time, the first car having been run September 30, 1893, but a considerable traffic has already been created, and with six cars in operation last summer, from 3,000 to 4,000 passengers were carried daily. Arrangements for a number of additional turnouts and cars have been made, and a six minute headway will now be maintained during the busy portions of the day. The road is a single track line, of a length of from three and a half to four miles, and extends from the station at Wissahickon to Roxborough and Manayunk. It is a succession of severe grades, several of them being as high as 11 per cent., and there is one short grade of 13 per cent.

There are at present eight cars in regular service, two of which were built by the St. Louis Car Company, four by the John Stephenson Company, Ltd., and two by the J. G. Brill Company. The first two are mounted on St. Louis trucks and the other six on Brill trucks. The cars have an eighteen foot body and are furnished inside in mahogany with birdseye maple ceiling. Brass trimmings are used. Each car has six large plate glass windows on each side. The exterior color is an Indian red for the main panels and dashes, with the lettering on the former in gold, with black lining and silver trimmings. The lettering on the dash is in silver. The lower panel is painted a light buff.

The car house is located at the main terminus of the line close to the passenger station at Wissahickon, and not far from the power station. It is of brick and has a capacity for ten cars.

The track is substantial in character being laid throughout with a ninety pound, nine inch Johnson girder rail. The ties are placed two feet between centers and measure 7 × 9 ins. × 7 ft. 6 ins. in length. They are mounted on two inches of ballast. The track is paved for a considerable distance with Belgian block or brick. The joints are double bonded and connected with two supplementary wires, and cross connected at every third rail. A No. 0 extra B. B. Swedish galvanized iron wire is used for bonding.

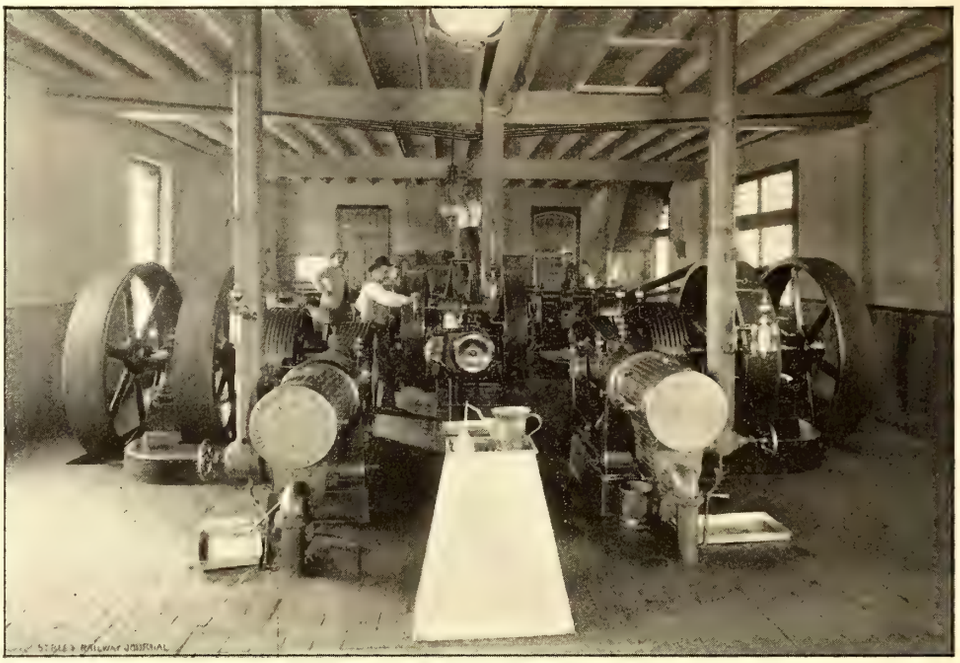


FIG. 1.—LIGHTING PLANT—WISSAHICKON ELECTRIC PASSENGER RAILWAY CO.

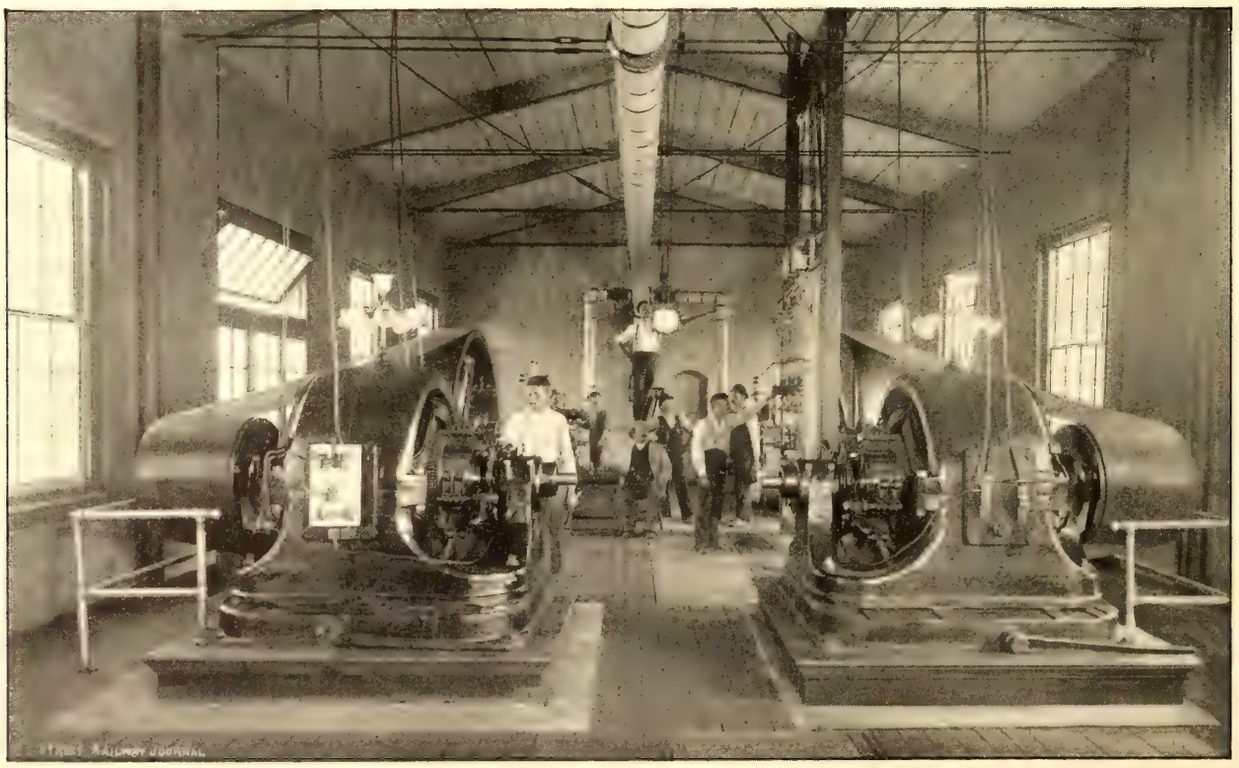


FIG. 2.—RAILWAY PLANT—STATION OF WISSAHICKON ELECTRIC PASSENGER RAILWAY CO.

Iron tubular poles supplied by the Walworth Manufacturing Company and the National Tube Works, of

McKeesport, Pa., are used. Roebling trolley wire and No. 0000, feeders supplied by Holmes, Booth & Hayden, are used, together with H. W. Johns overhead material, and Whitney car wheels.

Two interior views of the station are given in Figs. 1 and 2. It is located at Wissahickon, close to the Schuylkill River and on the side of a steep hill. Coal is received from a siding of the Philadelphia & Reading Railroad, and is dumped directly into a storage vault, from which it is admitted to the boiler room as required. The boiler room equipment consists of four 100 H. P., upright tubular boilers supplied by the Stearns Manufacturing Company, of Erie, Pa., and one eighty horse power, upright tubular boiler manufactured by Henry Warden, of Germantown Junction, Philadelphia. Pea coal is used, costing delivered about $2.55 per long ton.

The engine room contains both railway generators and arc light dynamos, the railway equipment being shown in Fig. 2, and lighting equipment in Fig. 1. The length of the engine room is 140 × 40 ft., and that of the boiler room 90 × 26 ft.



FIG. 3.—EXTERIOR OF STATION—WISSAHICKON ELECTRIC PASSENGER RAILWAY CO.

The railway plant consists of two Watts-Campbell single expansion engines, with cylinder dimensions, 14 × 36 ins. These are belted to two Westinghouse 112 K. W., M. P. generators, running at 625 revolutions per minute. The railway switchboard is placed between the two generators, and is of white marble panels mounted on an oak frame. It is supplied with Westinghouse circuit breakers, ammeters and lightning arresters, and Weston voltmeters. A Wells & Coutan steam gauge indicates the steam pressure.

The arc lighting equipment is located on the same floor as the railway equipment and consists of two single expansion engines, with cylinder dimensions, 12 × 15 ins., manufactured by the Taylor Manufacturing Company, of Chambersburg, Pa., and one of the Woodbury type, with cylinder dimensions, 11¼ × 14 ins., purchased from the Stearns Manufacturing Company. Each engine drives American arc light machines which have been fitted with Ball armatures. The switchboard is located at the end of the station and is supplied with General Electric lightning arresters. One steam main, seven inches in diameter, and covered with H. W. Johns' asbestos packing, extends the entire length of the room and supplies the steam to the engine equipment. Schieren belts are employed.

A considerable extent of territory is supplied with arc lights from the station, including Manayunk, Roxborough, Wissahickon, Falls, and all of East Fairmount Park as far as Green Street, Philadelphia. A total of 365 lights are operated from the station, and one circuit is fourteen miles in extent.

The railway plant is owned and operated by the Wissahickon Electric Passenger Railway Company, with the following officers: President, P. P. Liebert; vice-president, Isaac Wilde; secretary and treasurer, John Flanagan; superintendent, James C. Padley.

The lighting plant is owned by the Wissahickon Electric Light Company, with the same superintendent, secretary and treasurer, and with William Johnson, president, and James Christie, vice-president.

Extensions in New York.

By a resolution of the New York Board of Aldermen, passed on September 18, the Metropolitan Traction Company was authorized to construct a most important connecting link in its system of roads, which is destined to afford transit by electricity and cable from the upper end of Harlem down both sides of Central Park to the lower end of New York City. The link in question will connect the present Columbus Avenue line and the projected crosstown line at 116th Street, which is fed by the road now under construction in Lenox Avenue. If the expectations of the company are fulfilled, six months will see electric cars on the underground trolley system running on both the latter thoroughfares and connecting on the west and east, respectively, with the cable roads in Columbus and Lexington Avenues.

The Conti Compressed Air System in Paris.

As many of our readers are aware, the distribution of power by means of compressed air upon what is known as the Popp system is in very extensive use in Paris. At present there are two central stations representing altogether 13,000 H. P., as well as several stations for operating pneumatic clocks, refrigerating stations and other plants.

It is now stated that the General Omnibus Company, of Paris, will construct three new compressed air tramway lines in Paris, to be operated on the Conti compressed air system which has been experimented with elsewhere in Europe, and which differs from the Mekarski system. In the Conti system the reservoirs on the cars are not designed to carry the entire supply needed, but arrangements made so that the reservoirs can be re-stored at intervals along the route. Pipes are laid under the track to iron boxes sunk in the roadway, in which are located connections so that the reservoirs on the car can be stored. The time required for storing and making connections has been reduced, it is stated, to a few seconds.

THE Helena Rapid Transit Railroad and Helena Electric Railway of Helena, Mont., have been consolidated.



TWELFTH ANNUAL MEETING OF THE NEW YORK STATE STREET RAILWAY ASSOCIATION.

The Twelfth Annual Meeting of the Street Railway Association of the State of New York was held at The Yates, Syracuse, N. Y., Tuesday, September 18, 1894. President D. B. Hasbrouck presided.

The following delegates of railroad companies were present:

Albany, John W. McNamara, Treasurer Albany Railway.
Auburn, A. H. Underwood, Treasurer Auburn City Railway Co.
Binghamton, J. Tracy Rogers, President, and J. P. E. Clark, Treasurer Binghamton Street Railroad Co.
Brooklyn, W. J. Richardson, Director Atlantic Avenue Railroad Co.
Buffalo, J. B. Craven, Electrician Buffalo Railway Co.
Charlotte, C. A. Derr, Superintendent Rochester Electric Railway Co.
Elmira, W. W. Cole, General Manager West Side Street Railroad Co.
Long Island City, P. J. Gleason, President Long Island City & Newtown Railroad Co.
New York City, D. B. Hasbrouck, Vice-President Metropolitan Railroad Co.
Rochester, J. H. Stedman, Transfer Manager Rochester Railway Co.
Rome, John S. Wardwell, President Rome City Street Railway Co.
Syracuse, W. R. Kimball, President, John A. Moffitt, General Manager, W. P. Gannon, Secretary and Paul T. Brady, Director, Syracuse Street Railway Co.

There were also present:

Belden, A, J., Railroad Contractor, New York City.
Blake, Henry W., STREET RAILWAY JOURNAL, New York.
Brady, Paul T., Agent Westinghouse Electric & Manufacturing Co., Syracuse.
Cicott, Frank X., Railway Department, Pettingell-Andrews Co., Boston.
Coles, Stephen L., *Electrical Review*, New York City.
Crossman, T. E., Official Stenographer, Brooklyn.
Crowell, Howard H., General Electric Co., Syracuse.
Evans, H. C., Johnson Company, New York City.
Foote, Allen R., Washington, D. C.
Forby, William F., Okonite Co., New York City.
Foster, H. H., Dreher Manufacturing Co., New York City.
Fuller, Charles M., Davis Car Shade Co., Portland, Me.
Granger, John A., New York Car Wheel Works, New York City.
Harrington, W. E., Cutter Electrical Manufacturing Co., Philadelphia.
Hooker, Thomas, Syracuse Storage Battery Co., Syracuse.
Issertel, Henry G., H. W. Johns Co., New York City.
Lawless, E. J., American Car Co., St. Louis.
Le Van, W. B., Jr., Brooklyn Car Wood & Veneer Works, Brooklyn.
Magee, Frank A., The E. S. Greeley & Co., New York.
Mercur, R. J., New York Car Wheel Works, Buffalo.
Peckham, Edgar, President Peckham Motor Truck & Wheel Co., Kingston.
Porter, H. C., Syracuse Storage Battery Co., Syracuse.
Ransom, H. N., Consolidated Car Heating Co., Albany.
Russell, F. D., Rochester Car Wheel Works, Rochester.
Seely, John A., Railroad Contractor, New York City.
Taylor, John, Taylor Electric Truck Co., Troy.
Sharp, Edward P., Webster & Beach, Boston.
Stump, C. E., *Street Railway Gazette*, New York.
Vosburgh, A. C., New Process Raw Hide Co., Syracuse.
Wiley, F. W., Standard Underground Cable Co., Boston.
Wyman, Edward B., Central Electric Heating Co., New York City.
Young, Jefferson, Stilwell-Bierce Co., Syracuse.

At the conclusion of the roll call President Hasbrouck read the following address:

THE PRESIDENT'S ADDRESS.

Gentlemen of the Association:—As we "ring up" another point on the annual "indicator" of our Association, congratulations are in order.

Though we have, in common with our fellow citizens, felt the pressure of the times during the past year, we have *not* had a blizzard to obstruct the roads for a week, nor have we had a "tie-up," to vex us and deprive us of revenue for a like period. We may follow the example of that good Dutchman, who, when he had broken his leg, thanked the Lord that it was not his neck. The continued growth of our cities and towns has increased the demand for street railways, and it is our business to supply the demand.

The work of consolidation in many localities has gone on, by which many small companies have been merged in greater organizations, thus securing greater efficiency and economy in operation and a more satisfactory service to the public. That thousands of horses have been relieved by the tireless trolley, that thousands are given a rest by the substitution of the cable, is a matter of congratulation to every humanitarian. And "more to follow" What the next decade may bring forth none of us will venture to predict. We will endeavor to keep up with the times if the "powers that be" will permit us.

The "weary load" of taxation, under which we labor, has been so clearly set forth in the paper prepared by the Hon. G. Hilton Scribner

and read before this Association, at one of its annual meetings, that nothing can be said to add to its force. Measures have been taken to bring to the notice of the Constitutional Convention, now in session, the subject in which we are all so deeply interested. We think we are entitled to even handed justice. All taxes should be equal and uniform in their ratio to the value of the property taxed. Our present constitution is absolutely silent on this important matter, and the Legislature might, if it chose, put the entire public burden on any class of either property or persons. We confidently rely on the intelligence of the Convention to give the subject a careful consideration.

The selection of this city as the place of meeting brings to the speaker a bit of reminiscence. He was born hereabouts. At the date of his birth the site of Syracuse, and a long distance east of it, was a swamp, covered with blackened stumps. Hardly called by its present name, it was better known as "The Five Corners."

The completion of the Erie Canal, in the speaker's boyhood, gave an impetus to various business enterprises, and the "Salt City" has grown to its present proportions. In the early days of the canal it was regarded by travelers as the perfection of speed and comfort to take a packet boat here at evening, and find yourself safely landed at Utica the next morning.

We boys were on good terms with the Onondaga Indians. It is related that one of their chiefs, when the "Six Nations" were a powerful confederacy, once illustrated his point by taking a bundle of sticks, and, after endeavoring in vain to break them combinedly, found no difficulty in doing so when separated. In the language of Bunsby, "The bearings of this observation lays in the application on it," viz., the street railway companies of the State should act in concert in all matters in which they have a common interest; and there is no way in which they can better protect themselves than by acting together as members of this Association. The motto adopted by the Dutch founders of our city of Brooklyn, "Een Draght Mackt Maght," which may be freely translated, "One pull makes a strong pull," ought to teach us a profitable lesson. Measures have been taken which, it is hoped, will induce every company within the bounds of the State to unite with us for the common good.

Allusion will doubtless be made in the report of the Executive Committee, to one who has rarely, if ever, been absent from our annual gathering, but who, since our last meeting, has departed this life. Having known him from the beginning of his railroad life, and even longer, I am constrained to say that by the death of William Richardson, we are deprived of a genial associate, as well as a wise and prudent counselor. Next to his immediate family, the speaker has felt a personal grief in the loss of an old and faithful friend.

An employe of the company, of which Mr. Richardson was for a long time president, once said of him: "He was a fair man. We could always get a hearing when we appealed to him." He took a paternal interest in those under him, to an extent not usual in great corporations, and which, if generally cultivated, would help to lessen the friction between employers and employed, and ultimately make the fact apparent, that their interests are identical.

Finally, in giving place to the gentleman who shall be selected to preside over your deliberations, let me repeat my congratulations on the measure of success which has attended us under so many adverse influences, and to express the wish that you may long continue to serve the public acceptably, and achieve, at least, a "living profit" to yourselves.

The Report of the Executive Committee was then presented, as follows:

REPORT OF THE EXECUTIVE COMMITTEE.

SYRACUSE, September 18, 1894.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.

Gentlemen:—Your Executive Committee respectfully submits the following report:

MEMBERSHIP.

The membership now consists of thirty companies, the highest number yet reached. The Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company has withdrawn, but the Syracuse Street Railroad Company, our host on this occasion, and the Hornellsville Electric Railway Company have more than taken the place of the first named company, its officers having always manifested but slight interest in the welfare of the Association.

This fact leads us to remark that the officers or members who have been most interested in the success of the Association have been those most intimately connected with its work, especially in legislative matters, which indeed is the essential reason of its existence.

SPECIAL REPORTS.

Inasmuch as the operation of the New York Broadway cable system had been necessarily delayed, it was impossible for the report on "Recent Improvements in Cable Traction" to be prepared in time for presentation at the meeting a year since.

We shall, therefore, have the pleasure at this meeting of listening to this report, and thereby learning something relative to the construction and operation of what must be, in many respects, the most interesting cable system in the world.

The subject selected by the author of the report on "Economy in Electric Power Stations," is one in which a large number of member companies using electric power are deeply interested. Economy is a word that is ever ringing in our ears, and he who produces the largest financial results at the least possible cost is the man for whom the sharp eye of the world is ever on the lookout.

Electric power has boomed into almost universal use in so short a time, that it is not at all strange that in a number of departments of the service there are places where greater or less waste is to be discovered and remedied by the economical mind. One of these departments will be carefully treated at this meeting from the standpoint of economy.

KINDRED ASSOCIATIONS.

We are glad to welcome to the Brotherhood of State Associations, the Michigan Street Railway Association, just organized. We hereby extend the hand of fraternal fellowship. The Street Railway Association, of the State of New York, having grown to be a sturdy youth, assures the newcomer of his hearty goodwill for a vigorous life.

SPECIAL COUNSEL.

One of the main features of the work accomplished by the Association, is that of giving careful attention to street railway interests, during and following the annual sessions of the legislature.

In order that the best possible care be taken thereof, the Association has secured the services for the past three years of special counsel, in the person of Charles J. Bissell, Esq., of Rochester, N. Y.

We hereby express our appreciation of his faithful, devoted attention to the interests of our business before the legislature and the Governor.

His work is faithfully and conscientiously performed, and by the exercise of rare tact, has been able to protect our business from the enforcement of unreasonable demands, that have from time to time been attempted to be made through the medium of the legislature.

This successful result has been in large measure accomplished through the assistance rendered counsel by the extensive membership of the Association, the officer of a relatively small company often having greater personal influence with his representative than the man in the great city. "In union is strength," and the truth of the adage has found very satisfactory demonstration in the history of our society.

For this special reason, therefore, is your committee desirous of having every street railway company in the state, no matter how small the company may be, a member of the Association.

OBITUARY.

William Richardson departed this life December 31, 1893, in the seventy-fifth year of his age. He had been actively engaged in the street railway business for the last thirty years, first with the Dry Dock, East Broadway & Battery Railroad Company, of New York, and afterwards with the Atlantic Avenue Railroad Company, of Brooklyn, both companies members of this Association. At the time of his death he was the acting president of the former company.

He rose to a high place in the esteem of all who knew him. He was always present at the meetings of this Association, and took a lively interest in its welfare. From ten years of age he earned his own living in the world, and by indomitable energy and high resolves secured the high position he occupied amongst his fellows at the time of his death. We shall miss his rare counsel in our deliberations, and we sorrow that we shall not look upon his kindly face again.

Henry W. Slocum died April 14, 1894, in the sixty-seventh year of his age. He had risen to great eminence during the Civil War, and was a major general in the Northern Army, with a brilliant record. Shortly after the close of the war he became interested in the Brooklyn Crosstown Railroad Company, and was elected president of the company in 1866, which position he held until the sale of the road to the Brooklyn City Railroad Company.

In 1889 he became president of the Coney Island & Brooklyn Railroad Company, holding the office until a few months before his death, when he was succeeded by his son, Henry W. Slocum, Jr.

General Slocum was a man among men; clear headed, far sighted, and withal a genial companion and friend. Those who had the pleasure of his acquaintanceship mourn a sincere friend.

Edward F. Drayton departed this life May 27, 1894. He was the secretary and treasurer of the Coney Island & Brooklyn Railroad Company, having been connected with the company since 1860. Of a retiring disposition, he lived a quiet life, faithfully serving the company of which he had been for so many years a highly esteemed officer. His death caused sincere sorrow to his many friends.

We shall greatly miss the faithful and true friends who have gone out from our companionship. Respectfully submitted

BY THE EXECUTIVE COMMITTEE.

The Report of the Treasurer was presented, and showed the financial transactions of the year to be:

Receipts	$5,860.09
Expenses	5,381.20
Balance	$ 478.89

The report of J. B. Craven on "Economy in Electric Power Stations" was then read. This paper is printed in full on p. 627 of this issue.

The president announced the subject to be open for discussion by any of the gentlemen present.

MR. COLE: I would like to ask Mr. Craven if he would advise direct connected engines on small roads, of fifteen to twenty-five cars, where the load is variable?

MR. CRAVEN: I think I should, yes.

MR. COLE: Would you advise that, over using the idler, and giving your belt good surface contact on the pulley?

MR. CRAVEN: Yes, I should.

MR. SEELY: I am not a member of the Association, but I would like to ask a few questions; you speak of injecting oil into the boiler; do you refer to crude or refined oil?

MR. CRAVEN: Refined oil.

MR. SEELY: Have you had any experience in the use of crude oil?

MR. CRAVEN: I have not. If you put in the refined oil, it reduces the scale from a hard substance into a slime, which is easily blown out, and when we open the boilers, as we do once a month, we find probably one-sixteenth of an inch of hard scale that is very easily broken off. We can clean the tubes in most cases and have them as clean as when first put in.

MR. SEELY: Do you inject the oil as you operate the machinery?

MR. CRAVEN: Yes, sir.

MR. SEELY: Not a hot well?

MR. CRAVEN: No; we inject a pint of oil in the course of ten hours' run.

MR. SEELY: I have heard it spoken of very highly; but never heard anyone who employed it express an opinion. It is entirely satisfactory?

MR. CRAVEN: It has given better satisfaction than anything we have used for that purpose.

MR. ISSERTEL: The report refers to roads of a certain size using a return wire. For how large a road, that is, for how many miles would you recommend such a construction?

MR. CRAVEN: Well, that would depend upon the number of cars, more than on the length of the road; but a road six miles long, with ten cars, I should say, would require a return wire, as well as the bonding of the rail.

MR. ISSERTEL: How large a wire do you use?

MR. CRAVEN: That has to be figured out. I should say a No. 0 for the bond itself; but when you commence to put in return wire, it has to be calculated according to the distance and number of cars.

MR. SEELY: Do you believe, in using return wire, that they should be put in conduits, or the rail bonded back in sections—do you think there is any saving in placing the return wire in contact with the earth, or should it be tapped in every 1,000 ft, and then returned in conduits? I think that is the ideal construction, but it is extremely expensive.

MR. CRAVEN: In Buffalo we run an underground feeder system, and we are bringing our return wires through these conduits. In cases where there is no underground system, lay the wire in the ground.

The paper of Mr. George W. McNulty, on "Recent Improvements in Cable Traction," was then read. This paper is published in full on page 621 of this issue.

On motion the papers of Messrs. Craven and McNulty were ordered to be received and printed in the minutes.

A voluntary paper by Allen R. Foote, of Washington, D. C., on "Taxation," was read by him. An abstract of this paper is given on page 624.

The paper was received and ordered to be printed.

The nomination of officers and selection of next place of meeting being the next business in order, Messrs. McNamara, Rogers and Gannon were appointed the Nominating Committee. The committee made the following report:

President, G. Tracy Rogers, Binghamton; first vice-president, John H. Moffitt, Syracuse; second vice-president, William W. Cole, Elmira; secretary and treasurer, William J. Richardson, Brooklyn.

Executive Committee: D. C. Hasbrouck, New York City; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn. Place of meeting, Albany, N. Y. The report of the committee was approved. The meeting then adjourned.

In the afternoon the visitors were driven around the city and shown the various points of interest. An inspection was made of the new track being laid by the Syracuse Street Railway Company.

In the evening a complimentary banquet was extended at the Yates House to all in attendance, and was a pleasant affair, breaking up just in time to enable those leaving the city to catch their trains.

While there was no regular exhibit made, models were shown by the following companies: H. W. Johns Co., Consolidated Car Heating Co., Taylor Electric Truck Co., Cutter Electrical Manufacturing Co, Davis Automatic Car Shade Co., Peckham Motor Truck & Wheel Co., New Process Raw Hide Co.

Seventh Annual Meeting of the Massachusetts Street Railway Association.

The Seventh Annual Meeting of the Massachusetts Street Railway Association was held at Young's Hotel, Boston, September 20. The election of officers and committee to hold office for the ensuing year was held. The following officers were elected: President, J. H. Cunningham; 1st vice-president, Amos F. Breed, of Lynn; 2d vice-president, Frank S. Stevens, Fall River; 3d vice-president, Samuel Winslow, Worcester; secretary and treasurer, A. E. Butler, of Lawrence. Executive Committee: Chairman, Alfred A. Glasier, Boston; E. C. Foster, Lynn; Charles Odell, Salem; P. F. Sullivan, Lowell; E. P. Shaw, Newburyport; Prentiss Cummings, Boston; R. S. Goff, Fall River; Charles B. Pratt, Worcester; John Graham, Quincy.

Col. J. H. Cunningham has been associated with the street railway interests of Massachusetts for a number of years, and is at the present time the president of the Plymouth & Kingston Street Railway Company. He is one of the pioneers in the matter of the introduction of electricity as a motive power for street railways, and he was among the earliest purchasers of electric apparatus in the country. Col. Cunningham has served the Association as its president for two years, and has given excellent satisfaction. During his administration, the Association has increased its membership until at the present time there are approximately thirty different street railway companies composing the membership of the Association.



J. H. CUNNINGHAM,

PRESIDENT MASSACHUSETTS STREET RAILWAY ASSOCIATION.

Addresses were made by President Cunningham and by Mr. Glasier, chairman of the Executive Committee, Hon. E. P. Shaw, P. F. Sullivan, manager of the Lowell & Suburban Street Railway Company, and others.

THE Philadelphia postal authorities are considering the question of operating postal cars on the electric railway lines in that city.

THE street railway war in Savannah resulted last month in a reduction of fares to one cent.

Kinks in Station and Railway Practice.

COMPRESSED AIR FOR CLEANING GENERATORS.

An ingenious system for keeping generators, commutators and other parts clear from copper dust is employed at the power station of the Reading Traction Company, of Reading, Pa. A Westinghouse air compressor maintains a pressure of eighty pounds of air in a receiver which is connected by pipes to various parts of the power station. The ends of these pipes are provided with short pieces of rubber hose which end in nozzles, so that a blast of air can be directed against any part of the commutator or any part of the generator while in operation or when shut down. Thirty-four dynamos are in use at this station, but the management has had no difficulty in keeping them all clean and preventing short circuits by this process.

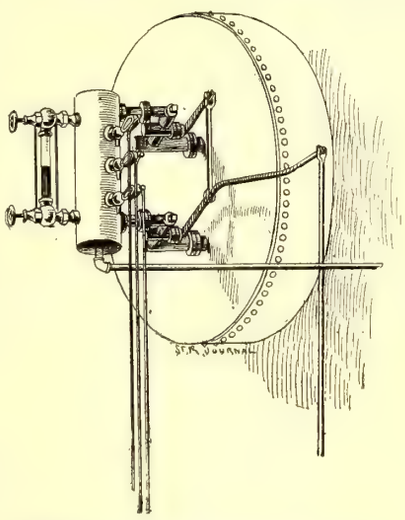
BOY CONDUCTORS.

About two years ago, as a matter of economy, the Nashville (Tenn.) Street Railway Company commenced the experiment of employing boys as conductors, at one-half the amount of wages that were paid to men and, in the opinion of the officers of the road, experience has shown the advantage of the practice. The boys range from sixteen to eighteen years of age, and it is found that they give as good satisfaction in performing the duties of conductors as did the men, and the company has no difficulty in securing all the boys needed at $5 per week.

Further economy in this department has been secured by requiring three conductors to run four car lines, four conductors to run five car lines, etc., by requiring conductors to leave their cars just before reaching the end of the line and board the returning car. The motorman, of course, remains on the car and takes it to the end of the line, and brings it back to the first meeting point without a conductor. There is seldom any passenger who will board the car between the last meeting point and the end of the line, but if this does occur the motorman collects the fare and turns it over to the conductor on his return trip. This plan, as stated, has worked very satisfactory, and a saving of 25 per cent. or more is made in the wages of conductors.

WATER GAUGE SHUT-OFF DEVICE.

A new device for instantly shutting off the water and steam for water gauges, in case the gauge glass should break, is shown in the accompanying engraving. The device was designed by James Anderson, chief engineer of the eastern power house of the Brooklyn City Railway.



WATER GAUGE SHUT-OFF DEVICE.

The boilers in this plant are of the Babcock & Wilcox type, and were described in the December, 1893, issue of the STREET RAILWAY JOURNAL. They are run at a high pressure, and as the water gauges are some feet above the the reach of the attendants standing on the floor, it was desirable to have some arrangement for instantly shutting off the water in case of breakage of the gauge glass. The pipes connecting the gauge to the boiler are provided with shut-off cocks, the handles of which are connected together by a connecting rod. One of the handles has an extension, in the end of which is attached a rod extending down within easy reach of the workman.

This rod is provided with a handle which is held by a catch to the boiler front, holding the shut-off cocks in the open position. Should the gauge glass break, the valves are instantly closed by a single pull on the handle.

TRANSFER OF PASSENGERS WITHOUT TICKETS.

The system of transferring passengers employed on the line of the Nashville (Tenn.) Street Railway is different in a number of points from the usual method. The company has seventeen different lines, radiating from the Public Square, which is about the central point of the city. At a point within 200 ft. of the Public Square the company has erected a transfer station, built similar to a railway station building, through which all of the cars of the various lines pass. From this station passengers may transfer from one line to another.

At the entrance of this station is located a registering turnstile, through which people may pass, having paid their fares at the gate, and occupy comfortable seats in the waiting room of the station until their car arrives. Passengers coming in on cars are supposed to have paid their fare on the car, and are therefore entitled to transfer to another line. The company has transfer agents at this station, who register all the passengers who get on a car, and then issue to the conductors special tickets with the number of people transferred punched out, which the conductors turn in with their trip reports. The conductors do not handle tickets, except those issued to them by the transfer agents, which they turn in the same as money, as they are registered by the transfer agents on each trip, and the conductor is charged according to the register. This is necessary in order that the register may show at all times the correct number of people on the car, and also to enable the company to keep account of the number of passengers transferred each day.

The transfer station is equipped with all of the conveniences of a railway station; a lunch counter, where confections, fruits, etc., can be obtained, and it has been found to be a great convenience to patrons, especially during inclement weather. If a passenger should go outside of the station, unless he leave on a car, he loses his right to transfer; this prevents any exchange of transfer tickets sometimes practiced with other methods of transferring.

Mekarski Motors in Paris.

The Mekarski system for street railways by means of compressed air has been adopted on three lines operated by the General Omnibus Company, of Paris, according to *Engineering*. The lines in question are amongst the most important of the whole Paris system, and one, that from the Louvre to Sèvres and Versailles, has a length of about twelve miles. The two other lines are 6.3 and 5.7 miles long respectively. Trains of three cars, seating fifty-one persons each, and drawn by a compressed air locomotive, will be used. The locomotives will be supported on six wheels, all coupled. They will weigh eighteen tons each, considerable adhesion being required to mount an incline of 1 in 23, which occurs on the Sèvres line, when towing three cars, each of which, in the loaded condition, weighs eight tons. Twenty three of these locomotives are to be built, of which six will be kept in reserve. The air pressure to be carried in the reservoirs will be 1,138 lbs. per square inch, and a sufficient quantity of air will be carried to enable the locomotives to run twelve miles without recharging.

AFTER a year and a half of delays, owing to the City Council, the St. Charles Street Railway Company, of New Orleans, has at last obtained permission to equip with electricity. The stockholders, several months ago, made the necessary financial arrangements, and it will not be long before this large and important line will be converted to more modern methods.

THE Indianapolis & Broad Ripple Rapid Transit Company put its line in operation September 14. The company was only able to run one car per hour, but these were crowded with passengers, and a more frequent service with trailers was commenced shortly after. The road is now running very successfully.

THE COMING CONVENTION AT ATLANTA.

The Thirteenth Annual Convention of the American Street Railway Association at Atlanta promises to be the largest, livest, and in every respect the most successful in the history of the Association. The local committee has been extremely busy preparing for the reception and entertainment of the delegates and to insure a pleasant time for all. It wishes particularly to call attention to the importance of securing rooms in advance, and any who wishes to do so should address Wm. W. Kingston, Chairman Local Committee on Hotels, Equitable Building, Atlanta.

The topics upon which papers will be read by regular committees are printed on the cover of this issue. In addition, special papers will be read on the following subjects: "A Practical System of Long Distance Electric Railway Work," "Brake Shoes," "Power Brakes vs. Hand Brakes," "Taxation," and "Destructive Arcing of 500 Volt Fuses."

HOW TO GO TO ATLANTA.

The Secretary of the Association has issued a circular giving the arrangements made for reduced fares. All the traffic associations, except the Western Passenger Association, have authorized the sale of tickets at reduced rates—namely, a fare and one-third for the round trip. This concession applies to all attending the meeting—delegates, supply dealers and accompanying friends. The traffic associations that have extended this courtesy are the Trunk Line Association, the Southern Passenger Association, the Central Traffic Association, the New York and Boston Lines Passenger Committee, the Boston Passenger Committee and the Railway Association of Michigan.

Some of the rules governing reduced rates are as follows:

Each person must purchase (not more than *three* days prior to the date of the meeting) a first-class ticket (either unlimited or limited) to Atlanta, for which he must pay the regular tariff fare, and upon request, the ticket agent will issue a certificate of such purchase, properly filled up and signed by the said ticket agent.

Where the journey is made over more than one line it may be necessary for the passenger to purchase separate local tickets, and procure certificates thereof for each of the lines over which he travels in going to Atlanta, as some lines do not honor the certificates of any other line. The passenger should ascertain from the ticket agent what portion (if not all) of his journey can be covered by the certificate procurable of him, and purchase his ticket and secure a certificate filled in accordingly. In case a ticket on the certificate plan cannot be procured at the starting point, the person should purchase to the nearest point where such a ticket can be obtained, and there repurchase through to Atlanta, requesting a certificate properly filled out by the agent at the point where the repurchase is made.

Tickets for the return journey will be sold by the ticket agent at Atlanta at one-third the highest limited fare, to those *only* who hold certificates signed by the ticket agent at the point where through tickets to Atlanta were purchased, and countersigned by the clerk of the Convention, certifying that the holder has been attending the Convention. Mr. N. W. L. Brown of the Atlanta Consolidated Street Railway Company, has kindly consented to serve as clerk of the meeting for this exclusive purpose.

The secretary suggests to all who will attend the meeting, who desire to transact business at any other city *en route* to arrange to do so on the trip to Atlanta, as the going ticket will, of course, carry with it in most cases stop-over privileges, while the return ticket will not.

The annual dinner will take place on Thursday evening, October 18. Each company that is a member is entitled to the free admission to the banquet of two of its officers. Each additional officer, or any other gentleman in attendance at the meeting, not an officer of a member company, will be charged $10; ladies' tickets, $5 each. In order to facilitate the work of the executive committee, the secretary has requested that all who expect to attend the banquet give him notice to that effect in order that definite arrangements may promptly be made.

Special provisions, as already announced, will be made for the entertainment of all ladies who may attend the Convention.



HOTEL ARAGON, ATLANTA.

HOTEL ACCOMMODATIONS.

There will be ample hotel accommodations for all who attend the meeting. The rates at the hotels are as follows: Hotel Aragon, American plan, $3 to $5 per day; European plan, $1.50 to $3 per day. Kimball House, $2.50 to $5 per day. Markham House, $2 to $4 per day. Hotel Marion, $2 to $4 per day. National Hotel, $2 to $3 per day.

The headquarters of the Association are to be at the Aragon, which is located on Peachtree Street in the principal residence portion of the city, and at the highest elevation in Atlanta. Adjoining the Aragon is the Grand Opera House, said to be the third finest in the United States. The Capitol City Club is opposite, and the Governor's mansion is on the same street one block away. The hotel is comparatively new, having been opened on the 14th of last November, and is conducted on the American and European plans. The building is of the Spanish Romanesque style of architecture, is six stories in height and has a frontage of 104 ft. on Peachtree Street and 200 ft. on Ellis Street. The first story is chiefly in Georgia marble and the other five stories are constructed of pressed brick with terra cotta and marble trimmings. Half of the sixth story is fitted up as a roof garden, where musical entertainments are held during the summer months. The main entrance is on Peachtree Street, and is 20 × 60 ft., with marble floor and quartered oak wainscoting nine feet high, the wood work being of cabinet finish.

The café is located on the first floor fronting Ellis Street and is 40 × 70 ft., adjoining which are two private dining rooms, 15 × 20 ft., each. These rooms are beauti-

fully furnished, draped with velours and laces, and adorned with tropical plants. The main dining room is on the second floor and is 40 × 60 ft., furnished in quartered oak, with large buffets and fireplaces on each side, and is brilliantly lighted by two elliptical windows of thirty feet each. The ceiling is paneled with heavy oak beams, and is decorated in the center in Sixteenth Century style. The breakfast room adjoins the dining room and is appointed in pure Castilian style. The parlors front on Peachtree Street, and are richly furnished in keeping with the other appointments. The rooms are single and en suite, ranging in size from 10 × 12 to 20 × 26; all the suites are provided with baths, and there are public baths and lavatories on each floor. The gas, electric light, heating fixtures and call bells are of the most modern design. The store rooms, kitchen, power plant and heating apparatus occupy separate buildings. There are many unique and striking features about the interior finish and furnishings of the hotel, which must be seen to be appreciated, as a description fails to convey a correct idea of their richness and beauty. The attention paid to the guests on the part of the management and the cuisine are quite in keeping with the furnishings and designs above described, so that the delegates who seek a home here during the Convention may be assured of superior accommodations.

The Kimball House, is the oldest, largest, and probably the most extensively known hotel in the city. It is situated in the very heart of the city, in close proximity to the Union Depot. The building is practically a fireproof structure, six stories in height, with 450 rooms and accommodations for about 1,000 guests, and has a reputation of being one of the most perfectly planned and best arranged hotels in the South. The main office occupies the rotunda on the ground floor, with entrances from the three principal streets. The center arcade is open to the skylight and is 60 × 100 ft., with light and airy corridors and spacious arcades on each floor, so that the guests are afforded delightful promenades, and ample room for social parties, while from each corridor a full view is had of the office and of the movement of the guests on the ground floor. The main dining room is located on the parlor floor and is well arranged for light and ventilation. The table is abundantly supplied with the best the market affords, and the cuisine being perfect in all its details. The large rooms opening on the corridors and balconies of the second and third floors are especially well adapted for the headquarters of manufacturing firms, and for the display of such small plans and appliances as they may wish to bring to the attention of the delegates. This hotel being larger than the others will doubtless entertain a greater number of delegates and supplymen.



LOOKOUT INN, LOOKOUT MOUNTAIN, CHATTANOOGA.



THE KIMBALL, ATLANTA.

LOOKOUT INN ON LOOKOUT MOUNTAIN.

Delegates and their families going to the national convention of the American Street Railway Association will find it exceedingly pleasant to stop over a few days at Chattanooga and visit Lookout Mountain, on top of which is located the magnificent Lookout Inn, a marvel of architectural beauty, one of the most commodious, the most luxuriously furnished and best equipped all-the-year-round resort hotels in America. The handsome structure faces the rising sun, and from its towers may be seen some of the most glorious sunsets in the world, rivaling even the wondrously beautiful Italian skies.

The Inn is an entirely modern structure, is four stories high and has a frontage of 365 ft. It has accommodations for 500 guests. The table is very superior, the menu embracing all the delicacies of the season, from the tropics to the arctics. The service and appointments are unsurpassed. It is lighted by electricity and heated by steam. There are billiard, reading and smoking rooms, and all the comforts and conveniences of the finest city hotels.

A broad tableland, covered with forests of pine and oak, surrounds the hotel. The tableland varies from one-quarter to five miles in width and extends southward for seventy-two miles. There are splendid drives in all directions, and a fine boulevard built at a cost of thousands of dollars. The readers of the Street Railway Journal who have visited Lookout Mountain, will agree with us when we state that the world-famous view from the Point Rock is a magnificent one. Some views in the Alps may

excel it in rugged grandeur, but none in the sublimely peaceful prospect. With the faint blue outlines of the Great Smoky Mountains in North Carolina in the distance on the east, and Waldens Ridge on the west, and the silvery waters of the Tennessee River in the foreground, describing that picturesque convolution known as "Moccasin Bend," the scene is one which will repay the traveler for a journey across the continent. From this point, too, may be viewed some of the most celebrated battlefields of the Civil War. The street railway officials will be interested in the toboggan railway, down which ordinary electric cars run for nine miles at high speed, propelled alone by gravity.

Lookout Inn will be one of the regular stopping points of the Convention delegates en route to and from Atlanta, and those who visit the historic heights will find it one of the most interesting and delightful spots in all the Southland.

EXHIBITORS AT THE ATLANTA CONVENTION.

The number of manufacturers of street railway appliances and others who have expressed their intention of exhibiting at the Atlanta Convention seems to be larger than ever before. The facilities for exhibiting, as we have already mentioned, are excellent, and all those to whom space has been awarded may be confident that they will have opportunity of showing their exhibits to excellent advantage.

The list of applicants, with the space awarded, includes the following:

	Sq. ft.
Baltimore Car Wheel Co., Baltimore Md	240
Bass Foundry & Machine Co., Ft. Wayne, Ind	200
Brill, J. G., Co., Philadelphia, Pa	800
Brooklyn Car & Veneer Works, Brooklyn, N. Y	100
Card Electric Co., Mansfield, O	400
Carnegie Steel Co., Ltd., Atlanta, Ga	200
Central Electric Heating Co., New York	160
Chapman Valve Manufacturing Co., Chicago, Ill	160
Consolidated Car Heating Co., Albany, N. Y	320
Crawford, R. A., Manufacturing Co., Pittsburgh, Pa	160
Creaghead Engineering Co., Cincinnati, O	320
Cutter Electrical & Manufacturing Co., Philadelphia, Pa	160
Davis Car Shade Co., Portland, Me	200
De Witt, E. F., Co., Lansingburgh, N. Y	320
Fitzgerald-Van Dorn Co., Lincoln, Neb	160
Fulton Truck & Foundry Co., Mansfield, O	400
General Electric Co., Atlanta, Ga	400
Genett Air Brake Co., New York	80
Georgia Equipment Co., Atlanta, Ga	120
Graham Equipment Co., Providence, R. I	160
Hale & Kilburn Manufacturing Co., Philadelphia, Pa	100
Hartford Woven Wire Mattress Co., St. Louis, Mo	100
International Register Co., Chicago, Ill	120
Jackson & Sharp Co., Wilmington, Del	800
Johns, H. W., Manufacturing Co., New York	240
Johnson Co., The, Atlanta, Ga	600
Keller, H., Printing Co., New York	100
Lewis & Fowler Manufacturing Co., Brooklyn, N. Y	240
Loughridge, J. E., Philadelphia, Pa	100
McGuire Manufacturing Co., The, Chicago, Ill	300
McLean Armature Works, Chicago, Ill	100
Mark Railway Equipment Co., Chicago Ill	100
Mather Electric Co., Manchester, Conn	400
Meaker Manufacturing Co., Chicago, Ill	160
Michigan Electric Co., Detroit, Mich	160
Munson, C., Belting Co., Chicago, Ill	160
New Haven Car Register Co., New Haven, Conn	240
Niles Tool Works, Hamilton, O	160
Nuttall, R. D., Co., Allegheny, Pa	160
Ohio Brass Co., Mansfield, O	160
Paige Iron Works, Chicago, Ill	1200
Peckham Motor Truck & Wheel Co., New York	320
Pennsylvania Steel Co., Philadelphia, Pa	100
Price Railway Appliance Construction Co., New York	100
Rochester Car Wheel Works, Rochester, N. Y	160
Scarritt Furniture Co., St Louis, Mo	100
Smith, C. G., New York	160
Standard Railway Supply Co , Chicago, Ill	160
Sterling Supply & Manufacturing Co., New York	400
Stirling Co., The, Chicago, Ill	160
Street Railway Advertising Co., New York	100
STREET RAILWAY JOURNAL, New York	100
Street Railway Review, Chicago	100
Veneer Seating & Church Furniture Co., Brooklyn, N. Y	100
Wadhams Oil & Grease Co., Milwaukee, Wis	160
Walker Manufacturing Co., Cleveland, O	200
Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.	1120

EXHIBITS AT THE ATLANTA CONVENTION.

THE STIRLING COMPANY, of Chicago, will be represented by Thos. Deegan.

THE JOHN STEPHENSON COMPANY will be represented at the Convention by John A. Tackaberry and D. W. Pugh.

THE FIBERITE COMPANY expects to have a very handsome exhibit at Atlanta, one that will do credit to the Medbery insulation.

THE FULTON TRUCK & FOUNDRY COMPANY, of Mansfield, O., will exhibit trucks, double and single, wheels of special double tread, sand boxes and other specialties.

THE SIEMENS & HALSKE ELECTRIC COMPANY, of Chicago, will probably be represented at the Convention by Augustine W. Wright, the vice-president of the company.

THE STANDARD RAILWAY SUPPLY COMPANY, of Chicago, will, as usual, show its various specialities, including the car stove, of which it has made a specialty for a number of years.

J. E. LOUGHRIDGE, of Philadelphia, will make an interesting exhibit which at the present time cannot be fully described owing to certain foreign patents which are now pending.

THE STERLING SUPPLY & MANUFACTURING COMPANY, will have an exhibit of its registers, fenders and sand boxes. Mr. Carson will represent the company and have charge of its exhibit.

THE CUTTER ELECTRICAL & MANUFACTURING COMPANY, of Philadelphia, will exhibit the C—S automatic cut-out, and will be represented by W. E. Harrington and Charles E. Bibber.

THE NEW HAVEN CAR REGISTER COMPANY, of New Haven, Conn., will make a special exhibit of fare registers, and will have a number of representatives on the ground to look after its interests.

E. F. DE WITT & COMPANY will exhibit two sand boxes operated by foot power, of a new type in which the sand and knives are in the car itself, thus requiring a smaller hole through the car floor.

THE JACKSON & SHARP COMPANY, of Wilmington, Del., is building two cars for exhibition at the Atlanta Convention, and may be depended upon to do its share toward making a creditable exhibition of street cars.

THE CENTRAL ELECTRIC HEATING COMPANY'S exhibit will consist of the American car heater only. The company will be represented by Edward B. Wyman, manager of the railway department, and one or two other representatives.

THE BALTIMORE CAR WHEEL COMPANY, of Baltimore, will show two of its Lord Baltimore electric trucks, which are now well known to street railway men. The company will be represented by J. Paul Baker, secretary of the company.

THE FITZGERALD-VAN DORN COMPANY, will show its regular drawbar, and also drawbars for elevated railroads similar to those furnished to the West Side Metropolitan Elevated of Chicago. W. T. Van Dorn, manager, will have charge of the exhibit.

THE KELLER PRINTING COMPANY'S railroad ticket department will exhibit improved fare, transfer and time limit tickets, as well as a dating machine in operation. J. F. Bushe, manager of this department, will be present at the Convention exhibit.

THE DANIELS STEEL RAILROAD TIE COMPANY, of Youngstown, O., will probably be represented by Thomp Burton, president and manager of the company, who, though quite ill at present, expects to be able to attend the Convention in October.

THE LEWIS & FOWLER MANUFACTURING COMPANY will show, as usual, a very complete line of registers, stoves, car trimmings and other street railway supplies. The company will probably be represented by L. E. Robert, S. A. Morrell and George Whipp.

THE J. G. BRILL COMPANY, of Philadelphia, will have a simple, but very extensive exhibit, which will include three cars and an electric sweeper in operation; a snow plow, several trucks and a number of other general appliances in the way of street railway supplies.

THE MCGUIRE MANUFACTURING COMPANY, of Chicago, will make an extensive exhibit consisting of car trucks and car stoves, air brakes and a combination snow plow and sweeper. The company will be represented by W. A. McGuire, president, and W. J. Cooke, vice president.

THE INDUSTRIAL MUTUAL INSURANCE COMPANY, of Boston, Mass., will be represented by Benj. Taft, secretary and assistant treasurer of the company. Mr. Taft will be accompanied by his wife, and expects to give some time to the enjoyment of the social features of the Convention.

THE BASS FOUNDRY & MACHINE WORKS, of Fort Wayne, Ind., expects to have an exhibit at the Convention, which will consist of street car wheels both chilled cast iron and steel tired, and axles both hammered iron and hammered steel. P. F. Leach will represent the company.

THE HARTFORD WOVEN WIRE MATTRESS COMPANY, of Hartford, Conn., will exhibit its woven wire and link fabric car seats covered with plush and rattan; also its new armless car seats, reversible, intended for electric cars, etc. The company will be represented by its St. Louis agent, H. E. Evans.

C. G. SMITH, of New York City, will make an elaborate display of all of the company's manufactured articles intended for use on street railways, such as headlights, both oil and electric, combination center lamps, etc. Thos. C. Millen, the Western salesman, will be present to look after the interests of Mr. Smith.

THE MATHER ELECTRIC COMPANY, of Manchester, Conn., will have a prominent exhibit consisting of its 100 K. W.,new type multipolar railway generators and several of its new Manchester type slow speed motors. The company will be represented at the Convention and at its exhibit by Thos. C. Perkins, the vice-president.

THE GENERAL ELECTRIC COMPANY, will make quite an elaborate display of its different styles of motors, including the G. E. 800. Type K controller will be shown. Motors will be mounted on different exhibition cars, which will be shown in service on the street railway lines in Atlanta. Motors and generators and a complete outfit of overhead material will be shown.

THE FULTON TRUCK & FOUNDRY COMPANY will make an exhibit of one single steel truck "Imperial," one double steel truck "Imperial," the company's motor lift, sand boxes, drawbars, track cleaners, door fasteners, and a ticket destroying machine. The company will be represented by W. E. Haycox, president and manager, and Frank A. Rogers, special sales agent.

THE DAVIS CAR SHADE COMPANY, of Portland, Me., will have an exhibit consisting of a full sized section of an open street car, containing a sample of its waterproof curtain for use on such cars and also a *fac simile* of one side of a closed railway car showing various styles of curtains adapted for use in closed street cars and railway coaches. The company will be represented by C. M. Fuller.

THE CARD ELECTRIC COMPANY, of Mansfield, O., will make an exhibit which will consist of one single motor equipment of thirty-five horse power, one double interurban equipment, one commutator turning device, a new series multiple controller, some canopy switches and fuse blocks for street railway service, pneumatic switches, etc. Geo. F. Card, the engineer of the company, and Reid Carpenter, the president, will probably represent the company at the Convention.

THE PAIGE IRON WORKS, of Chicago, have secured space in section F of the exhibition hall, and will show special work both in girder and T rails. A feature of the T rail exhibit will be a section of track laid on steel ties using suspension joints, brick pavements, etc., like that now in service at Terre Haute, Ind. The company's engineer, E. S. Nethercut, will have charge of the space, and Alonzo W. Paige, the president of the company, will also be in Atlanta during the Convention.

THE CONSOLIDATED CAR HEATING COMPANY, of Albany, N. Y., expects to show two full sized car seats with complete electric heater equipment, several special patterns of cross seat, panel, office and house heaters, a temperature regulating switch, special snap switch, and a special automatic cut-out. The company's consulting engineer, Jas. F. McElroy, its agent for electric heaters, N. H. Ransom, and its general western agent, Edwin A. Smith, will represent the company at the Convention.

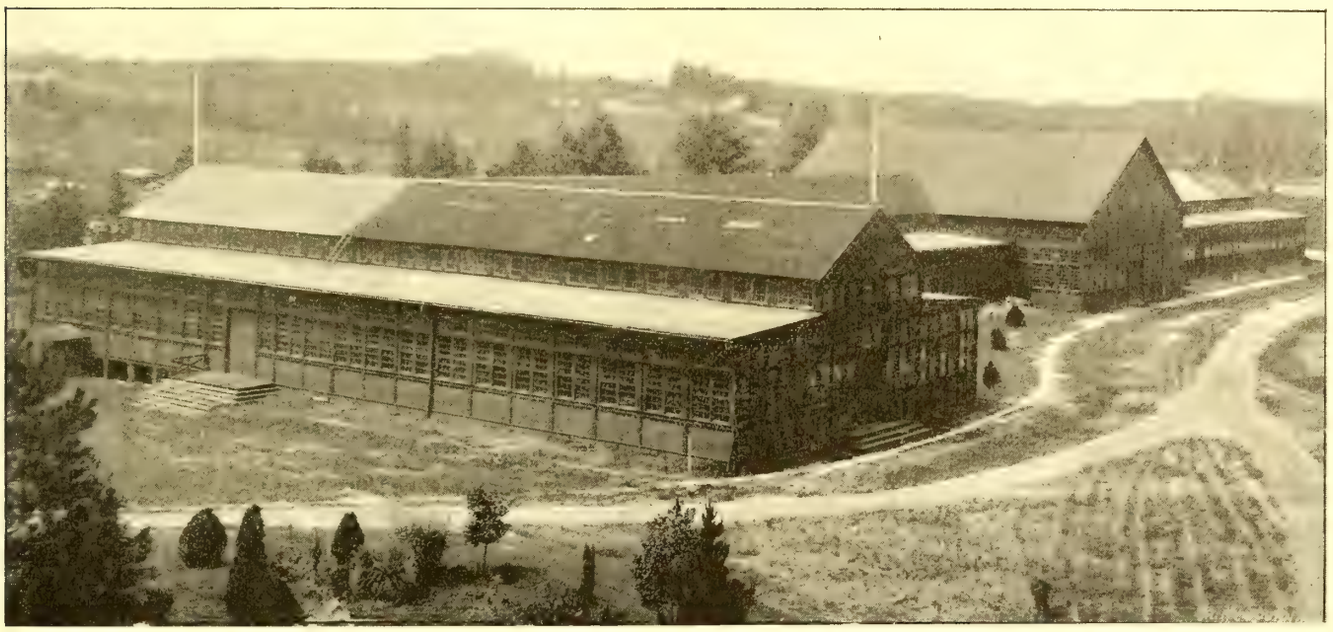
THE R. A. CRAWFORD MANUFACTURING COMPANY, of Pittsburgh, Pa., will have its pick-up fenders and wheel guard fenders on exhibition. It has been arranged to display the company's four different types in the Convention Hall. The wheel guard fender will be attached to a Peckham truck, on which will be mounted a special Sperry electric car. The company will be represented by its president, R. A. Crawford, and its general agents, C. N. Wood, of Boston, and C. J. Mayer, of Philadelphia.

THE WADHAMS OIL & GREASE COMPANY, of Milwaukee, Wis., will place on exhibition samples of Wadhams high grade cylinder, dynamo and engine oils, especially adapted to Corliss engines, special, graphite greases for motors, Wadhams graphite curve grease and special curve grease brushes, as well as various styles of compression grease cups for the crankpin, main and line shafting and other journals. The exhibit will also contain Wadhams truck soap and soapstock for cleaning greasy floors. E. A. Wadhams and G. A. Streeter will represent the company.

THE PECKHAM MOTOR TRUCK & WHEEL COMPANY will have an elaborate exhibit, which will include a Peckham truck under a Sperry electric car, another truck under a Jackson & Sharp open car, the Peckham "Standard" extension truck, and the "Extra Long" cantilever truck. The truck under the Sperry car will be equipped with Sperry electric brakes. Mr. Peckham will also exhibit car wheels, parts of his trucks, etc. Mr. Peckham himself will be in attendance at the Convention, and will also have several other representatives there.

THE OHIO BRASS COMPANY, of Mansfield, O., will be represented by C. K. King. This company has 160 sq. ft. of floor space, and will exhibit a full line of the materials which it manufactures, including the well known type W construction material, Wood's adjustable pole bracket, Wood's flexible pole bracket, adjustable switches, Mansfield strain insulators, Wood break strain insulators, motor bearings, trolley wheels, trolley harps and the reversible and adjustable track brush holder which the company has recently made arrangements to handle exclusively.

THE GRAHAM EQUIPMENT COMPANY, of Providence, R. I., will exhibit one of its steel snow plows for service on electric railways of both single and double track. Those in attendance at the convention will be directed to the company's excellent exhibit of eight trucks now in service on the Atlanta Traction Company's line. These trucks were sold in April, and are now in daily service. J. H. Graham, president, G. S. A. Gardiner, vice-president and treasurer, and C. O. Lenz, electrical engineer of the company, will be in attendance to look after the interests of the Graham Company.



VIEW OF CONVENTION HALL—PIEDMONT PARK, ATLANTA.

THE CREAGHEAD ENGINEERING COMPANY, of Cincinnati, will make an exhibit of its specialties, which will be in charge of T. J. Creaghead, president, and G. R. Scrugham, who will represent the company. The exhibit will include a full line of flexible brackets for single and double track construction made for wood and iron poles, Creaghead trolley insulators, trolley ears, overhead frogs, section insulators, strain insulators, trolley wire splicers and other devices for overhead equipment. Printed matter regarding all of these specialties will be furnished in abundance for the information of those attending the Convention.

THE MICHIGAN ELECTRIC COMPANY, will have an exhibit, which will consist of a complete line of the "Michigan" electric railway specialties, covering trolley wire hangers of all styles (span wires, single and double curve, angle iron and pipe bracket-hangers) splicing plates, strain insulators, switches and crossovers. This is the line of specialities formerly known as the "Zimmerman." The company will also exhibit a signal light for electric street cars for which it is making some very decided claims. The company's exhibit and its interests will be looked after at the Convention by J. E. Lockwood, the president.

THE ROCHESTER CAR WHEEL WORKS, of Rochester, N. Y., will make a handsome exhibit of car wheels of its manufacture, both for street railway and steam railroad service. Street car wheels will be shown ranging from 20 ins. to 36 ins. in diameter, and in weight from 140 to 400 lbs. Steam railroad wheels will be exhibited ranging from 24 ins. to 36 ins. in diameter, and from 250 to 750 lbs. Some fractures of wheels will also be shown, as well as other details of interest in this line. The company will be represented by F. D. Russell, general manager of the street car wheel department, and George C. Morse, the general sales agent.

THE INTERNATIONAL REGISTER COMPANY, of Chicago, will have on exhibition various samples of its well known portable registers, as

well as special registers made for the West Chicago Street Railroad Company and the Kansas City Cable Company. Samples of its standard form of aluminum stationary register will be shown, as well as samples of the new stationary register type "F," which will be here shown for the first time. This machine is an exact reproduction of the company's portable register on a larger scale. It will show the trip register in large, plain figures instead of by pointer, as in the standard machines. The company will be represented by its secretary and manager, A. H. Englund.

The R. D. Nuttall Company, of Allegheny City, Pa., which is one of the oldest and most reputable supply houses in the country, will have an extensive and exceedingly interesting exhibit of its manufactures at the Convention. Among its other exhibits the company proposes to display all the latest and most improved overhead supplies now on the market, the well known Nuttall improved trolley, the company's trolley harps, wheels, gears, pinions of different styles and construction in steel, iron and malleable iron. The Nuttall trolley harps in malleable iron and brass will form a special feature. In addition, there will be displayed by the company a number of turnbuckles, and in fact a complete line of overhead material made by this company. F. A. Estep, the president of the company, is expected to personally attend the Convention.

The Genett Air Brake Company, of New York City, will show quite an elaborate exhibit, which will include the first air brake apparatus made by the company. This will be shown for the purpose of comparison with the most recent apparatus. The newest enclosed double acting compressor and brake outfit will be shown, as well as a brake compressor testing pump for the purpose of showing how little power the compressor consumes. Besides this, the controller handles, showing how the grips and brakes are operated simultaneously or individually, will be exhibited, as well as various detail parts and the materials used in their manufacture. The company will be represented by its general manager, E. J. Wessels, and its master mechanic, Geo. S. Lee. The Company, in addition to its other exhibit, is equipping two cars on one of the Atlanta lines with its air brake system, which will be in working order by the time of the Convention.

Samuel P. Ferree has secured a space twenty feet square, which he will divide into four parts, to be given up to his separate interests namely, the Brooklyn Car Wood & Veneer Works, the Veneer Seating & Church Furniture Company, the Price Railway Appliance Construction Company and the Street Railway Advertising Company. The Brooklyn Car Wood & Veneer Works will make the same exhibit as at Reading, Pa., on September 6 and 7, and laterat Syracuse, N. Y., on the 18th and 19th. Some additions will be shown. The Veneer Seating & Church Furniture Company will display seats and seatings. Both of these exhibits will be in charge of Wm. B. LeVan, Jr. The Price Railway Appliance Construction Company will exhibit joints and electric bonds, as shown at the Reading Convention, and it is expected that James M. Price, the inventor of the system, will be in attendance. The Street Railway Advertising Company will exhibit a series of advertising cards in racks. Samuel P. Ferree will attend the Convention as an interested representative of all these exhibits. Mr. Ferree will be accompanied by his wife and daughter.

The Walker Manufacturing Company has secured space and will exhibit a complete car equipment of its manufacture. There will be one truck with two motors, with all the necessary appliances to operate these, including two series parallel controllers, one rheostat, one lightning arrester, one canopy switch, one trolley, one fuse box. In addition there will be a single motor, not mounted, but open so that the inside of the machine can be inspected. Extra gears, pinions, gear housings, etc., will also be shown. These motors will be supplied with current, so they can be operated, and every facility will be given to the street railway managers to thoroughly examine and inspect the apparatus in operation. The Walker Company will also exhibit a 200 H. P. generator at the Convention, which will be run as a motor. This exhibit will, therefore, show the general design and construction of the entire street railway equipment, both generators and motors, of the company. The Walker Manufacturing Company will be represented at the Convention by the following: Frank Billings, vice-president, W. H. Bone, manager, S. H. Short, H. McL. Harding, Ed. Kohler, J. M. Atkinson, B. M. Barr, H. A. Darrall, The Breese & Mansfield Company and a number of other representatives.

The H. W. Johns Manufacturing Company, of New York, will be represented by an exhibit of its moulded mica trolley line insulators and a full line of overhead frogs, crossovers, rail bonds, section insulators and other pieces which go toward making a complete line of overhead materials. The exhibit will be situated in section E at one of the main entrances to the building. Some of the pieces to be on exhibition will be the well known round top hangers, the new five-eighths inch swivel hanger, the hinged sleeve bracket arm hanger, the Giant strain and swivel pull over, the No. 1 and No. 2 Giant strains with combination large eye and clevis ends, the Brooklyn strain with Giant strain combination for affording double insulation for feed-in span-wires, the most successful "H. W. J." mechanical clip, which has no loose parts and requires but an instant for the insertion and secure retention of the trolley wire, the Perry mechanical clip, the Philadelphia trolley wire splicing sleeve, the iron clad feed wire insulators with seven-eighths and one and a quarter inch top grooves of No. 0000 B. & S. and 500,000 C. M. feed wires respectively, the Emerson, Grautan and and Philadelphia section insulators, "Noiseless" frogs, plain and adjustable brass crossings, the Lincoln insulated and also adjustable insulated crossings, the Grautan, Johnson and other rail bonds, tree insulators, moulded mica, weatherproof sockets, vulcabeston field magnet spools, commutator rings, controller insulating pieces, etc. It is expected that W. F. D. Crane and Henry G. Issertel, of the New York office of the company, J. W. Perry, of the Philadelphia branch, E. B. Hatch, and Herbert Luscomb, of the Johns-Pratt Company, of Hartford, will be in attendance, with possibly one or more of the local salesmen of the H. W. Johns Manufacturing Company.

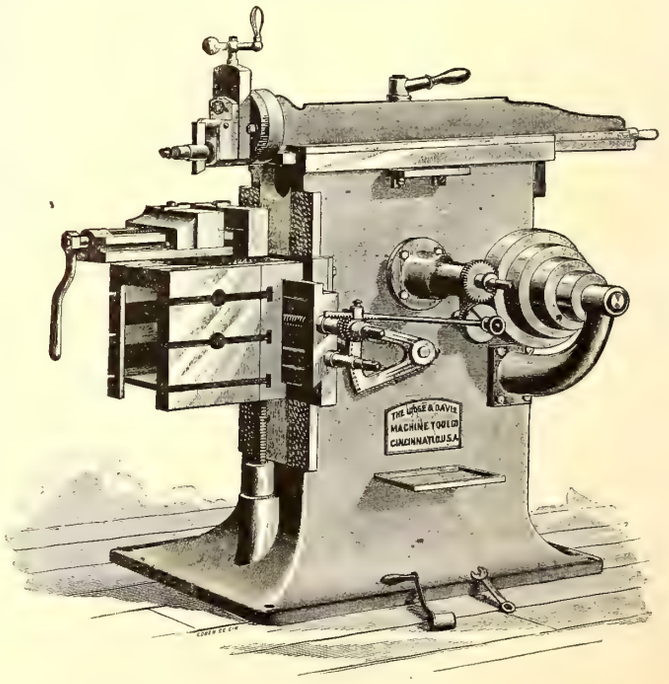
The Westinghouse Electric & Manufacturing Company. The guests at the Convention will have a very good opportunity of inspecting a number of Westinghouse generators and motors, as well as general station appliances in full operation. On the Atlanta Consolidated Street Railway Company's station are operated two 300 K. W., belted generators, and a short time since the company also shipped to the same place, a 500 K. W. generator for direct connection to a Rankin & Fritsch engine, running at ninety revolutions per minute. The generators in the power house of the Consolidated Street Railway Company are connected to a marble panel switchboard of the Westinghouse standard type, which is arranged to accommodate three generators and two feeders. The instruments on this board are all of the Westinghouse marble and glass construction. The generator circuit breakers, instead of breaking only one side of the circuit, are arranged to break two of the connections between each generator and the board, and in this way prevent all possibility of the machine bucking. The Atlanta Consolidated Street Railway Company is also operating four cars, each equipped with two thirty horse power motors of the Westinghouse type, No. 12, and controlled by the Westinghouse No. 14 series multiple controllers. The Atlanta Traction Company is operating four double equipments of No. 3 Westinghouse single reduction motors, which have been in use about three years, and judging by the fact that two more double equipments of the No. 12 motor were recently purchased by the Atlanta Company from the Westinghouse people, the Westinghouse would seem to be giving satisfaction.

The Westinghouse Company does not expect to have any special exhibit at the Convention, but it has shipped two No. 12 motors of thirty horse power each, with No. 14 series multiple controllers, to the Brill Company, of Philadelphia, and its apparatus will be used to equip one of the Brill cars; three No. 3 motors, two of thirty horse power and one of twenty-five horse power, for the equipment of a snow sweeper; two thirty horse power motors will propel the sweeper, and one twenty-five horse power motor will be used to drive the brooms. The latter will be controlled by a "D" controller, while the two motors will be controlled by No. 14 controllers. The Brill Company proposes to send this sweeper and car to Atlanta, and will have them in operation on the tracks of the Atlanta Consolidated Street Railway Company during the Convention.

Sixteen Inch Shaper.

The illustration presented herewith is of a sixteen inch pillar shaper, which employs the usual slotted lever for obtaining the quick return motion, and means are provided for taking up wear between the sliding block and slot. The upper end of the lever carries a roller which works in a slot formed in a nut, which is fitted to slide upon the under surface of the ram, and can be adjusted to any desired position, while the machine is in motion for adjustment of the ram.

The length of the stroke is adjusted by a screw, which holds the crankpin in any position without the necessity for locking it, and this can also be done while the machine is in motion, the graduated arc, seen at the right of the machine, having the same angular movement



SIXTEEN INCH SHAPER.

as the slotted lever, and plainly indicating the length of stroke for which the machine is set.

The rack which moves the feed pinion on the horizontal screw is so supported that it works the same regardless of the angle at which it

stands, and it requires no attention or adjustment whatever when the cross rail is moved up or down.

The cross feed screw can be operated from either end of the cross rail, and the elevating screw is turned by applying the crank to the squared shaft at the right of the cross rail.

The table is detachable, and, when removed, leaves a surface to which work or special fixtures can be attached. Other features of the machine are indicated by the engraving. It is made by the Lodge & Davis Machine Tool Company, Cincinnati, O.

The Trenton Trolley Wagon.

The accompanying illustration shows a new wagon for use in overhead electric railway construction, which is manufactured by Linburg, Sickel & Company, of Trenton, N. J. The wagon itself is constructed of thoroughly seasoned white oak. The best steel Concord express axles with chilled boxes are used, and oil tempered springs of special construction are provided. The body is furnished with lockers for tools, and with steps and hand rail at the rear end.

The tower is very strongly constructed and firmly braced. The corners are fitted with four angle-iron slides on each section of the tower, and so adjusted that the corners of the upper section slide easily within the corners of the lower section. The upper section of the the tower is elevated by an iron chain passing over revolving sheaves fitted on sliding bearings and winding on an iron cylinder secured under the sills of the body. The cylinder is revolved by a compound gear, by means of which the tower can be quickly elevated by one man.

The swinging platform at the top, which in the illustration is shown in its extended position, is lightly but strongly made. It is secured at the center of the tower by a heavy wrought iron pivot,



TRENTON TROLLEY WAGON.

which passes through an iron transom plate suitably fastened. Stout iron rollers are let in and secured to the lower surface of the framework of the platform, and these rollers pass over the upper surface of a large, flat, iron circle firmly secured to the top of the tower. At the inner end of the platform is a positive iron clutch, which can be adjusted in an instant, and which holds the platform firmly in any position in which it may be placed. The platform is provided with folding guard rails

When not in use the upper section of the tower can be lowered, the platform extended in line with the body, and the guard rails on the platform folded, making a compact, well balanced wagon which can be driven rapidly without danger of upsetting. With the tower and platform extended the whole structure is perfectly rigid, and will sustain the weight of several men on the extended platform without tipping or swaying. The wagon can be placed outside the tracks, and all work can be done on the wires from the platform without interfering with the running of the cars. The tower can be raised sufficiently high to string or repair all trolley, guard or feed wires without difficulty or inconvenience, and can be set at any height desired. The platform can be turned to extend over either side of the wagon.

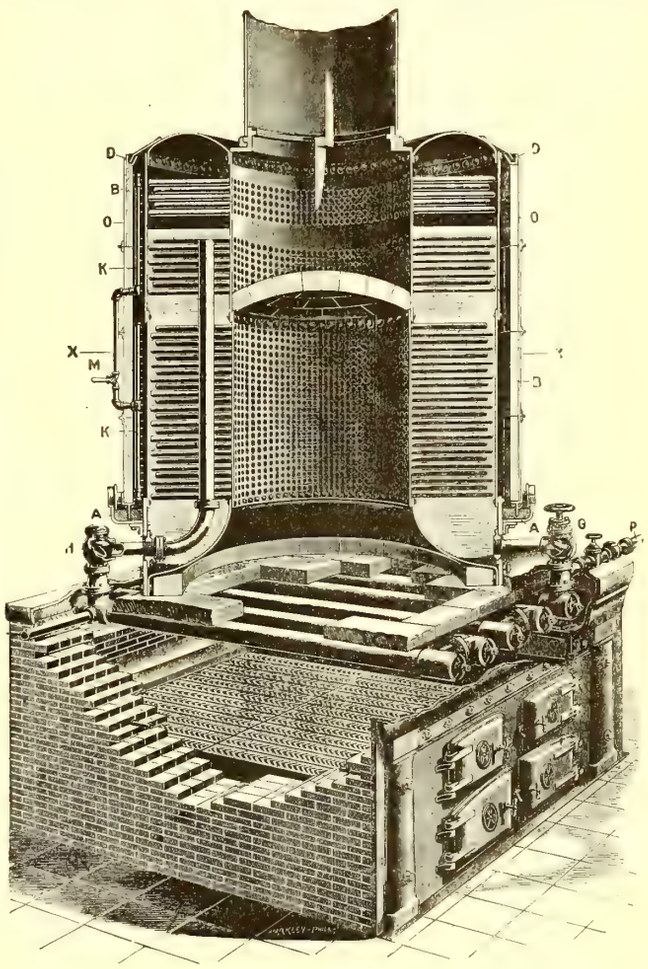
The Chicago Interurban Street Railroad Company, has been incorporated, with a capital stock of $1,000,000. The incorporators are E. Hervey Plummer, Ellsworth Ansen and George P. Taylor.

The Berry Boiler.

Reference is made on page 605 to the use of the Berry boiler by the Philadelphia Traction Company in its station at 32d and Dauphin streets, Philadelphia. A view of the boiler, which was supplied by Robert Wetherill & Company of Chester, Pa., is presented herewith. It consists of two vertical cylindrical shells one inside of the other, united at the top by a crowned ring and at the bottom by a cone-shaped ring or crown sheet. Since these heads cover a comparatively narrow space, they are of thin steel and do not require bracing, and are, therefore, sufficiently flexible to accommodate any inequality of expansion in the two shells, and because the fire is applied to all sides of the boiler alike, no destructive strains can arise from this cause.

Tubes of small diameter (never larger than two inches outside diameter) radiate from the inner to the outer shell in every direction, forming braces for each. These tubes are placed in vertical rows in the inside sheet and are alternately diverged or "staggered" in the outside sheet. By this arrangement the rapid circulation of the steam and water upward, near the inner shell, is not obstructed, and the downward movement of the cooler water near the outside sheet is afforded the same facility, while the strength of the outer shell is not reduced below the percentage of the seams.

Secured to the heavy base sheet of the boiler is a circular ring or trough, *A*, which is partly filled with sand, and the outside rim of which forms a track upon which a casing or smoke jacket is mounted



BERRY BOILER.

so as to revolve around the boiler, the lower edge of the casing projects into the sand, and prevents the passage of air, while it allows the casing to freely revolve. This casing is lined throughout with fire-clay tile, *B*, which provides an insulating air space inside the casing.

Secured to the inner side of the revoluble casing is a flue cleaning device, consisting of a pipe, *K*, having a series of blast nozzles arranged to stand opposite the center of each tube in one of the vertical rows. This pipe is connected through the casing to a three-way cock, *M*, which is supplied with steam from the boiler through a flexible pipe. By revolving the casing the nozzles are made to register successively with each row of tubes, and a blast may be sent alternately through the upper and lower sections of tubes to clean them of soot. To aid in this effect a gate is provided in the arch, which may be opened to change the course of the draught directly up the chimney. A series of doors is also provided in the casing of sufficient width to allow of the cleaning of any of the tubes with a brush or scraper.

To avoid arches and other unsatisfactory brick work in the furnace, a continuous coil of four-inch tubes is provided to carry the furnace covering. Through this coil all the feed water passes as well as all the blow-off water, in addition to which a continuous circulation of great rapidity is maintained by means of the arrangement of pipes in the boiler.

The points of excellence claimed, as determined from practical performances are:

First. The economy of space occupied, which, owing to the great concentration of the heating surfaces, their high efficiency and the upright design, is very small—one square foot of floor space per horse power allows ample room for boiler and firing room.

Second. Economy in cost of maintenance and operating service.

Third. The convenience of cleaning inside and outside surfaces, (a) by means of the circulating and purifying coil which is a part of each boiler and which effectually prevents the deposit of scale or sediment upon the heating surfaces, and (b) the revoluble casing and flue cleaner which keeps the fire surfaces always clean.

Fourth. Perfectly dry or superheated steam is uniformly furnished.

Fifth. Simplicity and economy in first cost of installation. No purifiers or separators or other expensive accessories are needed with this boiler.

Sixth. The highest degree of safety and durability, due to the character of the materials used (all steel); the enormous strength of the structure, entire freedom from the destructive strains or unequal expansion; the wide range of the water line above the danger point, the "sectional construction" of the circulating coil over the fire, the perfect circulation of the water in the boilers, and the entire freedom from scale or sediment on the heating surfaces.

Seventh. The highest economy of fuel, resulting from "perfect combustion" in a convenient and roomy furnace, ample draught area, close contact and slow movement of gases over the surfaces, large ratio of heating surface to grate surface, perfect insulation, perfect circulation of water and uniformly clean surfaces inside and out.

Large area through the tubes and upward draught requires a much smaller smokestack to obtain requisite power compared with other boilers.

The Works of the American Engine Company.

The extensive works of the American Engine Company, at Bound Brook, N. J., occupy a large plot of ground between the Lehigh Valley and Reading Railroads.

The buildings are substantial brick structures, mainly two stories in height, and cover a space of about 150 × 300 ft. The accompanying illustrations show a few of the various departments. The main machine shop, shown in the lower right hand engraving, measures 144 × 64 ft., and is thoroughly equipped with new and special machinery, and has the last modern facilities for handling work, the machine tools were supplied by the Niles Tool Works, Bement & Miles, the Putnam Machine Company and the Bridgeport Machine Tool Works. A ten ton, three-motor electric crane, built by the Industrial Iron Works, of Bay City, Mich., is provided for lifting and transporting heavy parts, and hand traveling cranes for small individual pieces. Among the special machine tools is a 6 × 6 × 26 ft. planer, built by the Niles Tool Works. On this machine the engine beds are finished complete, the planing, boring for the bearings for the main shaft, and the bolt holes for the cylinder heads being done at one setting, insuring perfect alignment of all parts.

Adjoining the main shop is a smaller machine shop, measuring 64 × 50 ft., equipped with the latest type of machine tools. Next to this department is the grinding room, which is fitted with Brown & Sharp grinding machinery for grinding the bearing surfaces of the engines.



VIEWS AT THE WORKS OF THE AMERICAN ENGINE CO.

The erecting and testing shop is located in the eastern end of the building, and is not shown in the illustrations. This department measures 40 × 80 ft., and is provided with a twenty ton electric crane, built by the Morgan Engineering Company. Foundations for setting up and testing both vertical and horizontal engines are provided.

The blacksmith and forging department is located in a well lighted building adjoining the erecting shop, and is equipped with all the necessary apparatus for turning out a high class of work. Among the tools is a Morgan Engineering Company 12,000 lb. steam hammer.

The draughting and pattern shops are located in large, well lighted rooms in the second story of the building. A view of one of the draughting rooms is shown in the upper left hand engraving.

The company makes a specialty of simple and compound, medium speed, horizontal side crank engines, and simple, compound and triple expansion vertical engines.

These engines have a special gear, which, it is claimed, gives all the advantages of the Corliss steam distribution, while maintaining the simplicity of the single valve gear.

The shipping facilities are of the best. Sidings from the Lehigh Valley Railroad extend into the grounds, while the Central Railroad of New Jersey and the Reading Railroad pass close to the works.

New Vertical Engine of the Ball Engine Company, Erie, Pa.

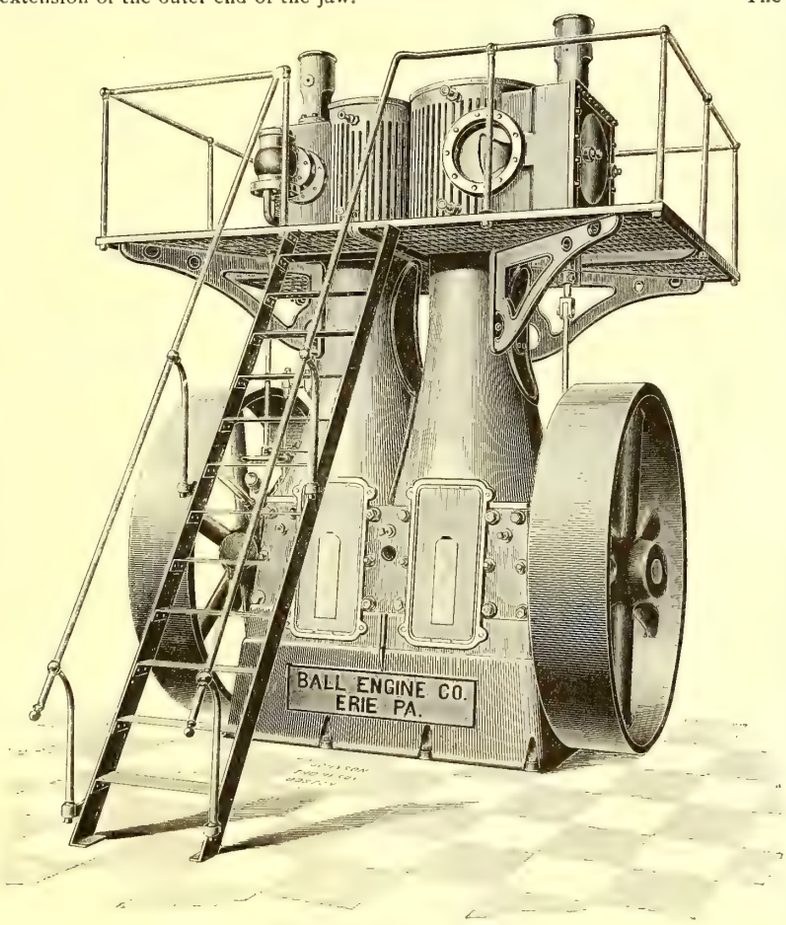
In the design of this engine the makers—taking advantage of their large experience of engine driving in electric stations—have tried to place themselves in the position of station owners and operators.

It was desired to arrange an engine whose structure should be of such a form that the main pieces should be absolutely rigid and indestructible, and, while having this feature, allow ease of access for adjustment or removal of any part that is subject to wear, and while covering these points, to produce an engine whose steam distribution is symmetrical on both sides of all the pistons, whether one, two, three or four are used; in other words, an independent valve motion for each and every cylinder employed, and each of these being a perfect engine in itself.

By reference to the cut it will be seen that the main proposition as to strength and indestructibility is fully covered in the symmetrical form of the upright housings which are made to constitute one double housing, by having one side of each planed and bolted together in the center of the middle shaft bearing. This substantially is still further increased by the operation of planing the bottom of both housings to one continuous flat surface, to meet the planed surface of the top of the single base plate to which the bottoms of the housings are substantially bolted.

The introduction of the shaft into this engine is accomplished by arranging the shaft boxes in a large jaw, cutting into one side of the housing deep enough to bring the center of the shaft in a plane with the center of the housing, finished spots being provided to meet correspondingly finished surfaces upon the cast iron boxes.

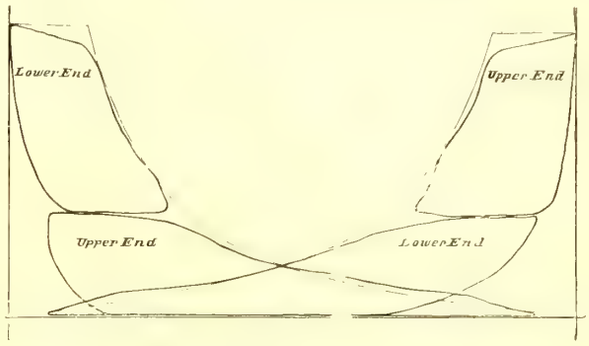
These boxes consist of one lower, two quarter, and one top box for each journal, and these are provided with removable babbit metal shells, upon which the journals bear. These shaft box jaws are in turn closed by the use of heavy struts or plates, having on their inner faces a V-shaped tongue on each end, which fits into a corresponding groove planed on each side of the jaw. These struts are fitted so that when bolted in solidly by the four bolts in each, the jaw is closed and completes the symmetrical strength of the four corners of each housing, each strut being fitted so that there can be neither contraction nor extension of the outer end of the jaw.



BALL VERTICAL ENGINE.

Each housing is also pierced by the large rectangular opening on each side (shown covered by a door bolted on) as wide as the space between the inner edges of the struts, and extending both high and low enough to allow the cranks with their connterbalancing disks to pass. Hence, with shaft, boxes and struts in place to close up the engine, it is only necessary to put up and secure large doors, which in turn are provided with a small shutter plate covering an opening large enough for the insertion of one's hand, to feel the connecting rod strap when the engine is in motion, and the necessary wrenches to keep up the crank boxes when so desired, while the adjustment of the journal boxes is accomplished by turning the three set screws shown in each strut, the two in the center reaching the quarter boxes, while the third one above operates either in or out a wedge which fills between the upper side of the jaw in housing and the top box; thus giving independent adjustment for three parts of each box, which is perfectly free to move at right angles to the axis of the shaft, thereby giving for all positions of adjuststment of the quarter boxes a full bearing for the shaft.

Above the openings for the shaft the housing becomes a round taper column, having on two sides of its inner surface the cross-guide surfaces which are cast in place and bored out coincident with the boring and facing of the upper end for the reception of the cylinders and the lower end for its seat upon the base. The other two sides of each housing are pierced by elliptical openings, making easy access to the crosshead and upper end of the connecting rod.



INDICATOR DIAGRAMS—BALL VERTICAL ENGINE.

With all of the above in view, it will seen that in adopting this form of housing a structure is obtained that is strong, convenient of access when desired, clean as to any dirt leaving the engine, and entirely closed as to any dirt from the outside entering the engine, along with a natural ventilation past the shaft boxes, up the column and out of the ellipitical openings therein.

The shaft is of one piece of forged steel from end to end, the crank pins being 180 degs. apart and cut out of the solid, down to their round diameter and, as are the journals, ground to a perfectly round, smooth running surface. The pins are provided with centrifugal oiling holes in addition to the regular supply through the usual tube reaching from the upper to the lower end of the connecting rod.

Covering each pair of crank bells is a pair of disks carrying a sufficient amount of counterweight to give a perfect running balance to the cranks and the reciprocating parts, so there is practically no vibration to be communicated to the housings and hence to the upper works of the engine.

The connecting rods are of forged steel, the upper end being solid and cut out for the reception of the brass crosshead box and the removable crosshead pin, the latter being very carefully tapered through the crosshead and held in place by a fine threaded nut; the lower end being provided with an excellent design of strap which, owing to the arrangement of bolts and cross keys, constitutes a solid end rod for the crank as well as the upper end, and both ends are provided with the very best arrangement of wedge adjustment that can be conceived of, and which in operation does not alter the length of the rod. The crossheads are of the double plate, pocket type, as used in many makes of Corliss engines, are provided with taper shoes to compensate for any wear that may occur against the guides, the shoes being of cast iron with the running surface entirely covered with babbit metal, the area of which has been made exceedingly liberal. The piston rods are of crucible steel screwed into the crosshead. The stuffing boxes are adapted for the use of fibrous packing unless otherwise ordered. The pistons are of the double plate held up to a solid collar and taper by a well fitted nut. The piston packing is made up of two self adjusting, parted rings and a broad junk ring for centering and guiding the piston in the cylinder.

The cylinders are made of charcoal iron, mixed in such proportions of hard and soft as to produce a very strong, close grained iron, which enables the surface to take a mirror polish. They are provided with single valves each of which is practically one piece so far as the motion and wear are co ncerned.

The high pressure valve is of the double faced, telescopic, relief type, with boiler pressure on the inside and sufficient amount of unbalanced area being left on the faces that the force of the steam on the inside forces the two faces apart, causing each to rub against the seat with sufficient force to keep the surfaces polished and steamtight through the entire life of the engine. The low pressure valve is of the common letter D type with improved proportions and construction, is provided with a round relief area upon its back and operating against the chest cover, thus having a large, well proportioned valve that runs with the greatest ease and yet follows up its wear without attention from the outside.

In substantiation of the main proposition contained in the production of this engine, there is presented an indicator diagram showing that where single valves of proper design are used the steam distribution can be made so perfect that it is simply folly to continue the chase

after an ideal perfection that involves a vast amount of complication as an increase of first cost, maintenance and continuous attention, which is not justified by the results obtained.

To state this in another way, the one great governing fact in the use of steam is recognized; namely, that a small leakage will more than destroy the useful effect of very elaborately worked out valves and motions. The makers have, therefore, confined themselves to the work of perfecting and simplifying the simplest and best form of steam valve that is possible.

As an instance in point showing the absolute control which a correctly adjusted governor may have when such a governor has a good valve to handle, we wish here to relate a few facts that were developed in a recent test:

The engine is employed in electric railroad driving and is supplied with steam at 125 lbs. gauge pressure, and exhausts into a practical uniform vacuum of twenty-four inches, and was driving (at the time this test for total variation from standard speed was made) 425 to 435 I. H. P. To observe the variation a tachometer was attached to the main shaft. When all was in readiness and the full load was on, the switch controlling the whole current leaving the station was opened, thus dropping the entire load instantly, and the engine made a momentary flutter up to 235 revolutions and back again to 233 revolutions. The circuit was kept open while the attendant counted ten and was closed as suddenly as it had previously been opened, when the tachometer showed the engine making the same momentary flutter down to 231 revolutions and back again to 233, taking up instantly a load of about 400 I. H. P.

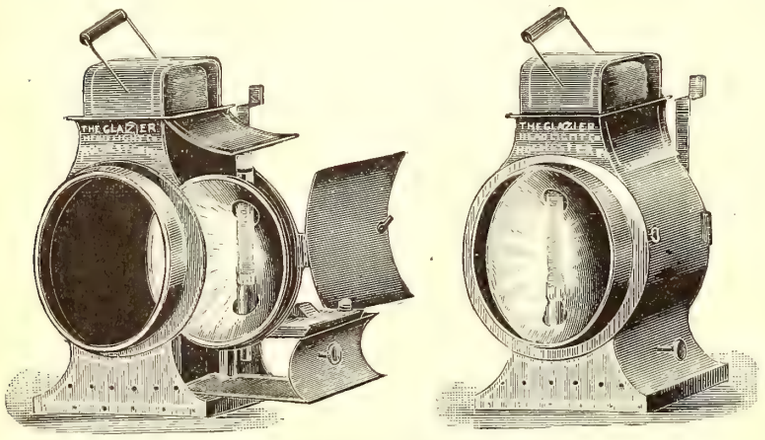
This test demonstrated that the governor was in absolutely isochronous adjustment, that the valves were absolutely steamtight, and that this degree of control over an engine of this magnitude, using such a pressure and discharging into a vacuum, has never been and probably never will be excelled.

This engine is guaranteed not to vary in speed from full load to no load, and *vice versa*, more than 1 per cent.; hence as the test showed but .86 of 1 per cent. it was conceded that the guarantee was fulfilled in very good form. The governor is made of the best materials, the points of severe contact being provided with hardened pins and renewable soft bushings, thus throwing the wear into those parts that are easily and cheaply replaced. The outward appearance of the engine is neat, symmetrical, and at once demonstrates that in this arrangement has been accomplished a great reduction of floor space required for this amount of power.

Referring again to the indicator diagram, there is shown an arrangement of combined diagrams, which shows clearly the grade of expansion realized in a non-condensing engine, showing a good argument for the claim that when the various theories of steam distribution with their attendant complication are carefully considered, where single solid valves with their simple driving mechanism can be made to do as well as these diagrams demonstrate, it is a waste of energy and money to extend into mere complications.

New Headlight.

The Glazier Headlight Company is placing in the market a new motor headlight illustrated in this page. A headlight of this design with door, in side of case, is very unique and practical in many ways. The reflector slides in at the bottom therefore, has something to stand upon, when taken out of the case. The hand wheel is outside of the case



NEW HEADLIGHT.

so that the wick can be raised and lowered without opening the door, a very desirable point in a windy night. The chimney does not have to be removed to draw the reflector and oil fount out of the case.

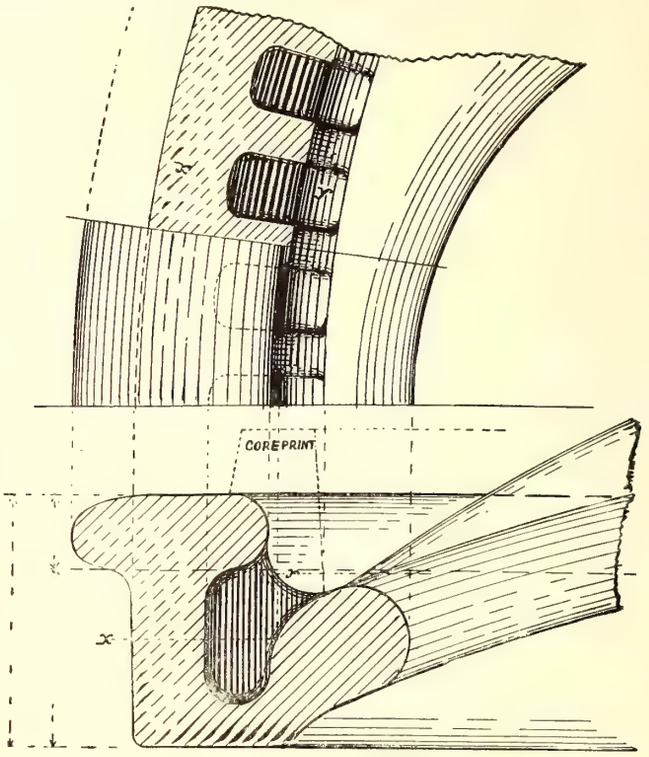
The lamp is made of heavy tin, reflector copper with a student burner, and to stand the jolting of motor cars. All that have inspected this headlight pronounce themselves as well pleased with it. The lamps are made in two sizes, ten and twelve inches.

The Indiana Electric Railway Company, of Elkhart, Ind., which has been endeavoring for some time to get a franchise for this city, but has not succeeded, has decided to operate under the old franchise of of the defunct Citizens' Street Railway Company. This will be a part of the electric line between this city and Goshen, a distance of ten miles.

A New Type of Car Wheel.

A new type of car wheel has been brought out by A. Whitney & Sons, of Philadelphia, made under a patent granted to L. R. Faught, their mechanical engineer. A section and also a side view of the wheel showing the construction and appearance are given herewith.

As will be seen, the peculiarity of the wheel consists in the rim being divided circumferentially into a series of independent but connected cavities or cells, located between the inner and outer diameters of the



ELEVATION AND PLAN OF CELLULAR CAR WHEEL.

rim of the wheel. These cells diminish the heavy body of metal usually massed in the rim, reducing particularly the thickness of the part which forms the tread, but in such a manner as not to decrease its strength.

Several advantages are claimed for this form of wheel.

First.—It overcomes the difficulties ordinarily attending the production of a deep, durable and uniform chill on the tread of heavy wheels intended for use under severe conditions of service. In casting a heavy wheel of ordinary form, the heat of the mass of metal in the rim and also that communicated through the arms or spokes, has a tendency to reduce the depth of the chill, so that the necessary strength is obtained at the expense of durability of the tread, and this in spite of the fact that heavy loads carried call for increased rather than diminished hardness on the tread, as well as greater strength.

Second.—The rim of the wheel is more elastic under the strains and concussions of severe service.

Third.—The comparatively light section of the rim insures the metal being more dense, and consequently harder in the chilled portion, from the well known fact that smaller bodies of cast iron are denser than greater ones. The light section also reduces any tendency to blow holes and shrinkage cavities.

Fourth.—The cellular section equalizes the shrinkage strain on the wheel at the time of casting, lessening any tendency to fracture from heating caused by excessive or prolonged use of brakes.

The cellular form of rim does not necessarily alter the weight of the wheel, but wheels of this form are considered stronger for the same weight than the ordinary form. It is held that the principle of a cellular tread is applicable to all forms or cast iron or cast steel wheels.

Samples of this wheel will be shown at the forthcoming convention of the American Street Railway Association at Atlanta.

At the half-yearly meeting, held August 17, at Bristol, of the Imperial Tramways Company, which controls a number of street railways in Great Britain and Ireland, a dividend of 6 per cent. for the preceding year on the preferred stock and one-half per cent. for the year on the common stock was declared. The Dublin South District Tramways, which are controlled by this company, reported gross receipts of £11,000 a year. Arrangements have been made for equipping this line by electric power. The Reading Tramways reported an increase in passengers of 63,000 during the previous six months. An increase on the Corris Railway was also reported. J. Clifton Robinson, the managing director, was extended a vote of thanks by the stockholders.

Flexible and Adjustable Bracket for Poles.

The steel or iron pole and flexible adjustable bracket and fixtures for electric railway construction, illustrated herewith, are manufactured by the Wrought Iron Bridge Company, of Canton, O. The pole No. 1 is constructed of four tee irons. The tees are as long as the pole, so there will be no splices in the latter. The connecting pieces, or bands, are accurately forged to shape, and riveted to the stem or leg of the tees, and abutting against the head of the tees, making a very strong pole, and yet elastic enough to prevent its bending from any sudden blow or strain. For first class construction and neat appearance, the lattice, or built-up iron pole, has proven most substantial. Owing to its open construction, the pole is easy to paint inside, as well as outside. There is also an advantage in the open construction in setting the pole, as the concrete can run inside the base of the pole as well as around the outside of the pole, and owing to the fact that there are no joints in this pole, it is not apt to become loose from jars to which poles are subject.

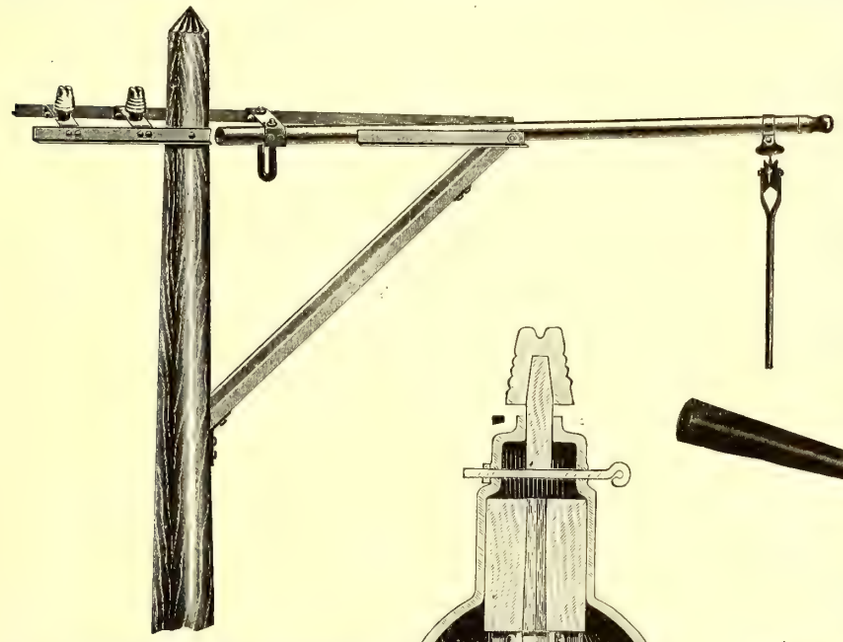


FIG. 1.—FLEXIBLE AND ADJUSTABLE TROLLEY BRACKET.

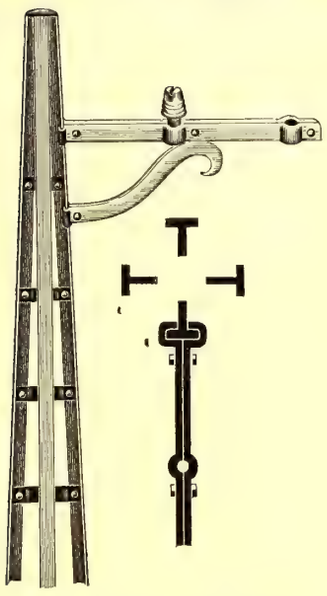


FIG. 2.—ADJUSTABLE CROSS ARM.

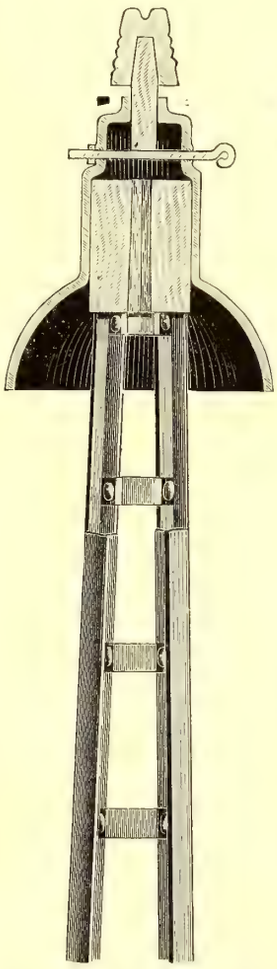


FIG. 3.—POLE TOP WITH HARD WOOD INSULATOR.

The bracket No. 3 has a number of special advantages, as it is neither too rigid nor stiff. The horizontal arm, or pipe, that supports the trolley wire, is pivoted, so that the trolley wire is suspended in an even more flexible manner than that attained with the span wire construction, since the end of the supporting arm next to the pole acts as a counterweight, enabling the trolley wire to yield to the upward pressure of the trolley wheel with no jar or shock. The horizontal member of the bracket that supports the pipe, or arm, embraces the top of the pole, and cannot pull off the poles when the trolley wire breaks.

Practical tests of this bracket on one of the largest electric railways in the United States has proven it to be an arrangement of great value. It not only saves the expense of constructing one extra line of poles, but there is a great saving in overhead material, such as trolley wheels, insulators, clamps, overhead switches, etc. The poles and brackets are made in any lengths, to suit requirements.

Fig. 3 represents the pole top of the same manufacturers, made of one solid casting. It is insulated from the pole proper by the hardwood blocks, as is plainly illustrated. This makes a very strong top, with the eye-bolt through the top of the hood. Any slack in the trolley suspension wire can readily be taken up. Fig. 2 represents an adjustable cross arm, for wire suspension in telephone and telegraph work. The cross arm or bracket can be put on the pole at any height, and may be shifted without taking down the wires.

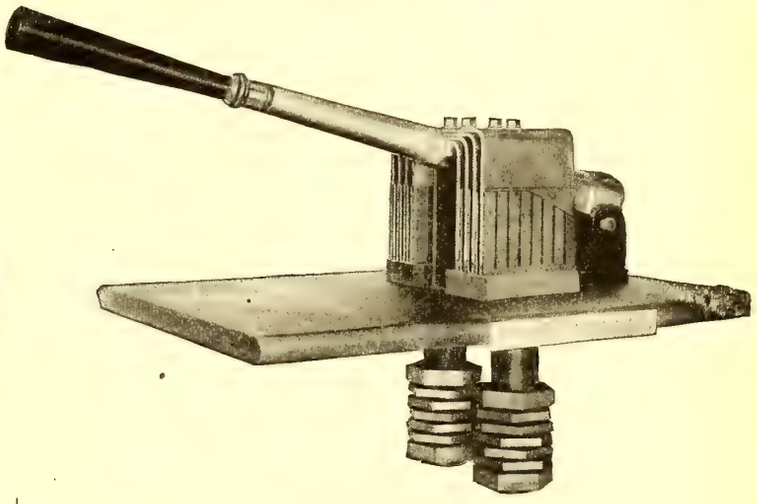
These poles and brackets were designed and patented by Leroy S. Pfouts, of Canton, O.

7,000 Ampere Switch.

With the advance of electric traction and the consolidation of street railway interests, there has been a gradual tendency toward larger power stations with larger generating units, and consequently, proportionately larger station apparatus.

As late as April, 1893, a switch which was guaranteed to successfully rupture a circuit carrying 3,000 amperes of current, at a potential of 500 volts, was considered a giant in breaking capacity; and it remained for the Ajax switch, described in the technical papers of that date, to demonstrate the utility of such large, quick break switches, and the ability to open a circuit carrying 2,000 H. P. of electrical energy at 500 volts potential, without the slightest injury to either the operator or the apparatus. During the interim, Ajax switches have been designed for 4,500 amperes (50 per cent. larger than any attempted before), and several such are in actual service on street railway circuits.

We now are enabled to illustrate another advance in switches; the switch in the cut representing a new "plunger type" Ajax switch of 7,000 amperes capacity. This switch is guaranteed to break its full rated capacity at 500 volts potential, or nearly 4,700 H. P. It was



7,000 AMPERE SWITCH.

ordered by the Electric Traction Company, of Philadelphia, through the General Electric Company, which is building the switchboard for its new Delaware Avenue power house.

Except the carrier and stand, which do not form any part of the circuit, the entire switch is made of commercially pure copper, and provision is made for clamping direct to a laminated bus bar, consisting of six bars, each $5 \times \frac{1}{4}$ ins., or a total of seven and a half inches sectional area; which is also the minimum of sectional area in any part of the switch. The contact area, finish and action are of the well known Ajax formula. The switch is compact in form, and occupies a space only 14×13 ins. on the switchboard. A handle of unusual length is required to operate these large and close fitting blades, which overhangs the switch proper, several inches; the total length of the handle from the pivot is forty-one and a half inches, and terminates in a highly polished piece of old mahogany.

As a continuous current circuit breaker, it is believed the subject of this sketch is the largest yet attempted. It is needless to say that it has not yet been tested to its limit.

THE JOHN STEPHENSON COMPANY, LTD., has many contracts on hand. This company seems to have no difficulty in securing orders for cars, its works being always busy—an excellent commentary on the high standard of work which this company maintains. Many railway managers who have employed the cars of the Stephenson Company for many years insist on using them, and will be satisfied with no other make. Among the recent contracts closed by this company are cars for Jacksonville, Fla.; Bridgeport, Conn.; Metropolitan Traction Company, of New York, Columbia Railroad Company, of Washington, D. C.; St, Petersburg, Russia; Cape Town, South Africa, and Mexico. The Washington order is for forty closed cable cars with a twenty foot body, very similar in design to those used on the Broadway Railway in New York.

Rail Joints and Bonds.

By James M. Price.

If there be a "sore place" in the great railroad system, covering the land with a network of tracks for the flying locomotive trains, which no physician has yet healed, probably it is found in the defects of rail joints, everywhere seen in low joints, rails battered down at their ends, while elsewhere fit for service, and in the perpetual "knocking at the joints," which makes all motion tremulous, while wearing away the rolling stock. The rail itself is year by year improving in its section for strength and endurance, and the quality of the track, as regards the ballast and the laying, is steadily attaining a higher average, yet the defects of the joints seem, like the poor, to be "always with us," and the annual breakage of splices adds alike to the expenses and the risks of the railroads.

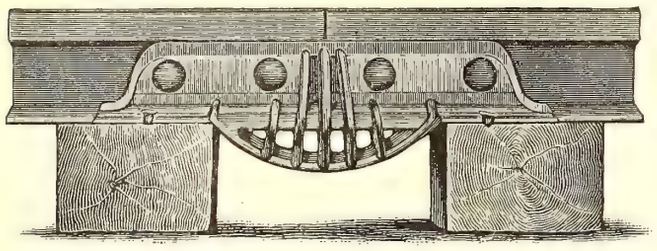


FIG. 1.—LITTLE GIANT JOINT.

Is there no cure for this? The defects of splice bars have been under discussion for years in the various societies of engineers; is it not time to look for something better? Probably no railroad man will assign a higher value, as a splice, to any form of splice bars than to the heavy angle bars in use on several trunk lines, and weighing per pair of plates from 54 to 80 lbs., without the bolts, while they run in length from 30 ins. upwards. Now, as to these, the longer they are the more they are exposed to the constantly reversed strains, upwards and downwards, at their center, since every wheel as it approaches, comes over and recedes from that center. These are numerous, and not at all confined to three severe wrenches upon the splice, but the most damaging are these three, two of them upward in their strain at the middle of the splice and the middle one downward. The two arise from the leverage at the center from the ends of the splice, with the tie as a fulcrum, the splice being boxed in its whole length, between the flange of the rail on which it sits and its head. Not less than 15 per cent. of the splices may be expected to break, from this tearing strain, during the life of a good steel rail. Meanwhile, from the day of their first use, the inevitable wear begins on the two slanting surfaces which constitute their upper and lower faces, with a tendency to become loose, and without giving the slightest help to the rails in the way of a footing upon the tie or resistance (except by the bolts) to a lateral strain. I believe it to be possible so to adjust the metal of the joint, without increase to the number of its parts, as to double its footing upon the tie, and to add, quite independently of the bolts, a great lateral security to the rails, arising from the spikes, and, of course, still further increased by the action of the bolts. This will eliminate the tendency to roll at the ends of the rails.

The joints proposed are the "Little Giant" and the "Eagle" joints—the former for rails of 70 lbs. in weight per yard, or less, the latter for rails 70 to 100 lbs. in weight. As these are similar, a description of the "Little Giant" will answer for both. It consists of a jaw, embracing the flanges of the two rails at their ends, in combination

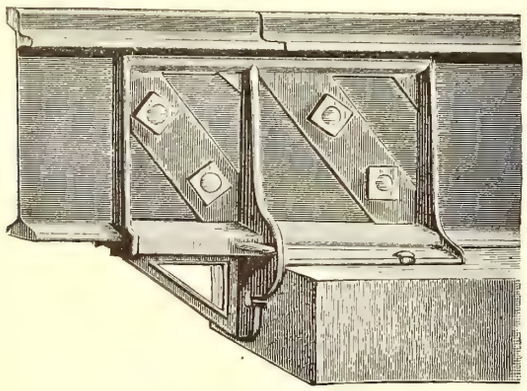


FIG. 2.—K JOINT.

with encircling ribs, a suspended arch or truss attached to the ribs, and feet placed well forward upon the ties. The truss is also attached to the inner edge of these feet, and suspended from one to the other between the ties. All is one piece of metal. In other words, the enormous strength of this combination of parts arises from bestowing the most metal upon the points of greatest strain, securing these beyond peradventure, and, at the same time, attaining by their relative shape and position a permanence for the joint not to be hoped for in splice bars. The joint plate carries the flanges of the rails, as well as their heads. This, too, without leverage from the tie against the center of the splice, as with splice bars, for these joints are never extended beyond the ties.

It will be noted that the grasp of the flanges by the jaw of these joints, while the heads of the rails are supported by the top of the joint plate, assures a continuity of level for the upper surface of the rails never before attained. Meanwhile, the expansion and contraction of the rails take place within these jaws, without disturbance to them. These conditions assure the attainment of the long desired continuous rail, for whatever vibration the rails may undergo at their ends, they will take together, these joints holding their grip. The action of the feet upon the ties and of the jaws grasping the flanges concurs in delivering a steady inward pressure at the top of the joint plate. Here an alignment ledge presses against the top of the "web" of the rails. It follows, therefore, that as wear occurs the inward pressure from these sources will keep the top of the joint plate against and under the heads of the rails, without regard to the action of the bolts—the precise opposite of the result of wear with splice bars. Remove the bolts from a pair of these, letting the spikes remain in place, and no train can pass over that joint without throwing the splice bars out, from the vibration of the flanges. The exact converse has been proved with the Price joints. Two plates had been put to place in the track, without spikes or bolts, when a heavy train bore down upon the workmen. After the train had passed they were unable to loosen the joint plate from the rails by the bare hand. It was pried off, after jarring, to measure roughly the strength of its adherence.

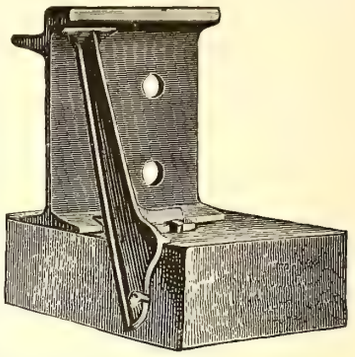


FIG 3.—BRACE CHAIR.

The K Joint for Girder Rails.—A brief examination of the cuts will show that this joint has been devised upon similar lines to the "Little Giant" and the "Eagle" joints. The K joint is, however, a "supported," they are "suspended" joints.

The leading variations in the type of this joint from its fellows, is the powerful diagonal bracing, and the attachment of the joint to the tie, by spiking an under brace to the side of the tie, while the foot upon the tie is spiked to the upper surface. This arrangement gives to the joint unprecedented steadiness, by committing the tie itself to it.

The spikes, driven in planes at right angles to each other, protect one another. In like manner with the "Little Giant," the pressure from the jaw and feet is delivered against the top of the joint plate, with its alignment ledge, keeping it steadily to place, no matter what the wear. To do away with the tie plates and the inefficient tie rods, I substitute for these brace chairs, as shown in the Fig. 3, used com-

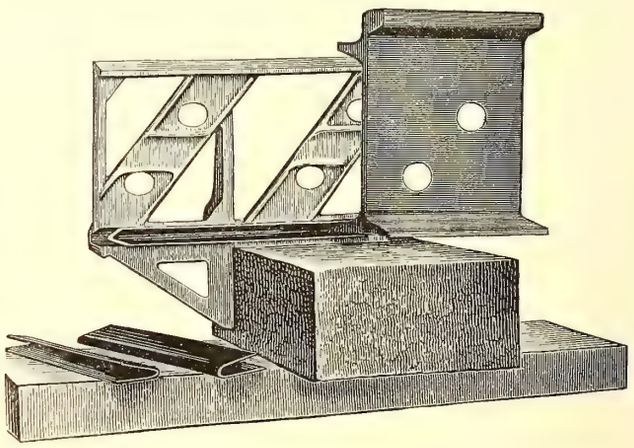


FIG. 4.—K JOINT WITH BOND.

monly on alternate ties, on the outside of the rails and coming closely under their heads, while intermediately and on the inside always, I place socket chairs, to receive and grasp the flanges, with a vertical plate alongside of the tie, and spiked to it.

All parts, therefore, of this construction for girder rails, have a base plate upon the tie, as part of their structure, which constitutes the flat bottom upon the ties of joints, brace chairs and socket chairs, alike.

These base plates do not meet under the rails, and therefore give to the construction increased elasticity over any to be had with tie plates, which they replace. So great is the economy of metal in this construction over the cumbrous array of high splice bars, sure to double the defects of those of half the height in use upon trunk lines, tie rods and tie plates now being largely sold and laid, that this new construction, which doubles the footing of the rail upon the ties at the joints, and which asks no help from the paving to hold the rails erect, can be furnished for about the same cost.

The base of rail and joint together covers a span of ten inches for a nine inch girder rail, and for the "Little Giant" of about eight and one-half inches for a height of T rail of four and one-quarter or four and one-half inches.

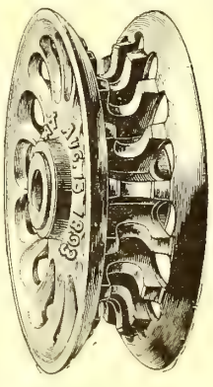
The Price Bond.—A trouble greater than "low joints" for steam

roads, and far more menacing to the management of street railways, confronts these gentlemen and many other interests, in the increased damage of electrolysis to water mains and gas pipes. To meet and master the liability of this, wherever there is waste current flowing from the trolley lines, copper bonds of wires or rods are extensively in use. Yet, as the section of a nine inch girder rail is practically about nine square inches, allowing for the greater conductivity of copper over iron, the ratio of 6 to 1, the section of copper which would be an equivalent in conductivity to the rail itself, should measure about one and one-half square inches. I am aware of no bond now on sale which measures the sixth part of this area. Besides this inequality of the bond to the rail in the power of conduction, I do not find that one of them is being laid with entire exclusion of the earth from direct contact. But the earth is of itself a composite body, in a chemical sense, and besides the salts of which it is largely composed, there are several wastes liable to be found in it, which came from deposit. Now all of these, under the influence of a steady current of electricity, however weak, are liable to engender the destruction by electrolysis of adjacent metals, all the more if these be of different natures, as copper and iron, copper and lead, lead and iron, etc.

It is also apparent that the manufacturers of these various bonds have, in every instance known to me, asked the electric current to leave the rails for the copper at a distance of some inches from the end of the rail, the current to return to the next rail at the same distance beyond their point of meeting. The only motive for this, apparently, is to accommodate the bond to the splice bar joint, instead of making the substitution of a joint far better in lieu of it, a joint, too, that will receive the bond within it; and so exclude the earth from all contact whatever. Add to this, that by so locating the bond, we get "the short haul," much esteemed in railroading, for the electricity. To ask it to pass, under satisfactory cover, altogether excluding the earth, from any share in the business or from any chance of meddling, from edge to edge of the rails, with a contact of the copper with them exceeding by many fold that of the bonds in use, appeared to me an object to be earnestly striven for. The Price bond, as applied to each of the joints described above, consists of a plate of copper, bent into shape resembling a V in section, placed upon the flanges of the two rails on each side, and inclosed altogether within the jaws of these joints, by driving up. As the jaw has the effect of a double inclined plane, it will hold all it gets of pressure, when spiked and bolted. It will be seen that the copper is thus compressed firmly between two stout surfaces of iron and steel, with large and admirable contact with each. The electric current is, therefore, not asked to traverse a slender copper rod, embedded in the earth, and with a very small contact at either end with the rail. It is thus not liable to produce electrolysis from the action of the salts of the damp earth, under the influence of a steady current of electricity, upon the copper of the bond and the iron of the rail at their point of junction. A recent test of this bond in comparison with others, each without its joint plates, made by Prof. A. Rowland, of the Drexel Institute, Philadelphia, showed a very large saving in power for the Price over other well known bonds.

Ice and Sleet Cutting Trolley Wheels.

In our last issue we noted the fact that the Storm Manufacturing Company, of Newark, N. J., had recently obtained control of both the U. S. and Canadian patents on the ice and sleet cutting trolley wheel, formerly manufactured by Messrs. Haight & Clark, of Albany, N. Y. Last year this wheel was introduced to a few of the prominent trolley lines in this country, and we are informed, without a single exception, every line which tried it and used it was enthusiastic in its praises. The object of it is to provide a trolley wheel that will automatically remove the incrustation of ice from the wires so as to leave the latter clean and in perfect order for the transmission of the electric current. When a coating of ice forms on a trolley wire it is usually on the lower side. This is caused from the water flowing down preparatory to dropping off of the wire, but becoming congealed, remains until it is removed by mechanical means or is melted by the heat of the atmosphere.



ICE AND SLEET CUTTING TROLLEY WHEEL.

The manufacturers have recently issued a circular describing fully the merits of this wheel, and also containing a number of indorsements from well known roads who have used it, which they will send upon application. They expect to make a display of these wheels and to be represented at the Convention in Atlanta in October, by C. A. Hoagland, of John A. Graham & Company, who will explain the merits of the invention to all who are interested in it.

THE firm of Warren & Lozier are very busy at their shops, 465 Greenwich Street, New York, where a general repair work of all kinds is carried on. The firm has been awarded all the electrical repair work for a number of prominent electrical firms, and has a completely equipped electrical and mechanical shop. The firm is composed of A. K. Warren and R. T. Lozier, both of whom have had a long training in electrical work.

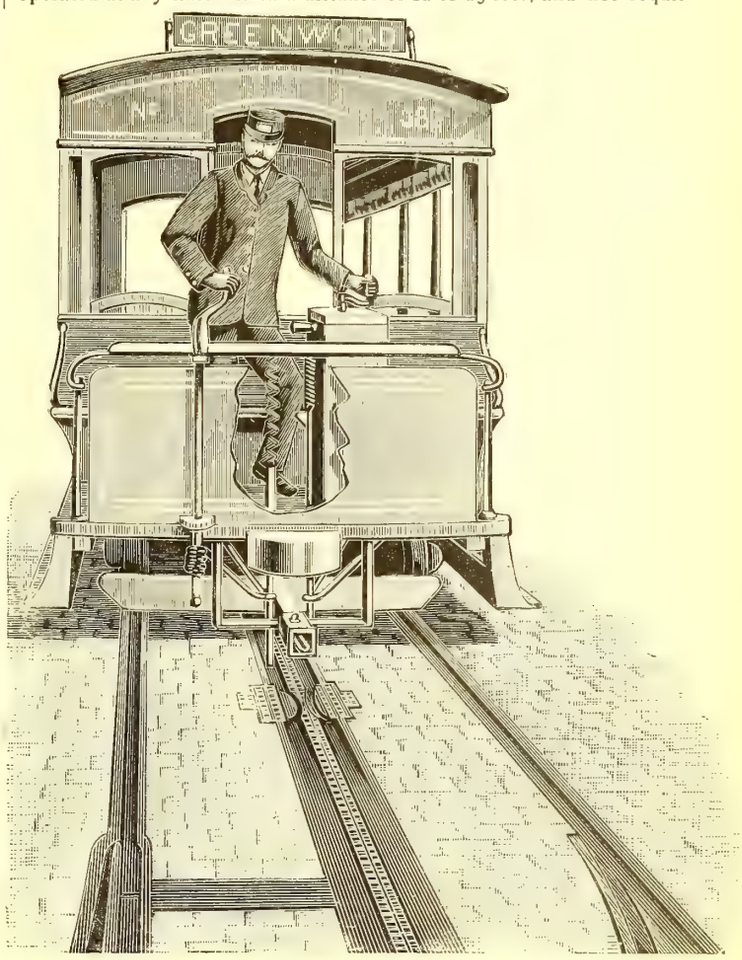
A DISASTROUS fire occured in Portland, O., September 23, by which eighteen car loads of electric machinery, consigned to the Portland General Electric Company, were destroyed.

The Battie Automatic Switch.

A simple and effective automatic switch has recently been patented by Dr. F. B. Battie, of 345 West 45th Street, New York, and is shown in the accompanying engraving.

The switch consists of an iron plate 22 feet long and 13 inches wide, located in the centre of the track. In this plate are two movable lugs.

Passed through the lugs underneath is a horizontal bar on which the lugs are pivoted. Two vertical steel rods are attached to the front platform of the car by a spiral spring 12 inches in length. These rods are provided with steps by which they are pressed down to engage the lugs, which throw the switch. By pressing down one or the other of the vertical rods the car is switched to the right or left as desired. The length of the switch plate is sufficent to allow the switch to be operated at any time within a distance of 12 to 15 feet, and not requiring the motorman to press down the vertical rod at any given moment. The operation can be seen from the platform of the car 15 feet before the car wheels reach the switch tongue.



THE BATTIE AUTOMATIC SWITCH.

The centre plates are only 13 inches wide, and equally adaptable to electric or cable roads.

The switch has been in operation on the Atlantic Avenue Railway of Brooklyn for the last six weeks, and has given excellent satisfaction.

Recent Work of the Mather Electric Company.

The Mather Electric Company, of Manchester, Conn., reports the sale of one of its 180 K. W., improved, new type multipolar railway generators, with complete station equipment, to the Hartford & West Hartford Horse Railway Company, for the Hartford (Conn.) power house. The generator is to replace a 200 K. W. generator of other manufacture, which after a two weeks' attempt on the part of its makers to make run successfully, was thrown out. In thirty-six hours after placing the order, the Mather Electric Company had the road running successfully. In that time, the old generator had been removed and two temporary generators installed. The Mather Company reports, as a sign of the revival of the electrical business, the closing in three consecutive days of contracts for more than 1,500 H. P. of its standard apparatus, consisting of direct connected and belted generators and Manchester type slow speed motors. This with the other work the Mather Company now has on hand will compel it to at once increase its working force, although part of the works is now being operated at night. The company also reports the sale of one 125 H. P., direct connected, new type multipolar generator to the South Chicago Street Railway Company. This order was secured through J. Holt Gates, of Chicago, the well known and energetic Western contractor of the Mather Company.

Thirteenth Annual Meeting of Ohio State Tramway Association.

The thirteenth annual meeting of the Ohio State Tramway Association was held at Toledo, September 26, 1894, and a report of the proceedings was received as we were about to go to press.

The meeting was called to order by President A. E. Lang at the Boody House at 11.30 A. M. In opening the meeting President Lang made the following remarks:

"Thirteen years ago the Ohio State Tramway Association was organized and held its first meeting in Cincinnati.

"In our article of association we announced as our object—our reason for being: 'The promotion and advancement of knowlege, scientific and practical, in all matters pertaining to the construction, equipment, maintenance, operation and management of street railways, and the establishment and maintenance of a spirit of fraternity between the members of the association, by social intercourse and exchange of information and ideas to the end that the best railway service may be attained at the least cost.'

"We have found that our annual meetings have accomplished their purpose; that we have gone home each year richer in knowledge, for each has shared with the others; richer in fraternal spirit, for the sharing of the one involves the increase of the other; and with that increase a conviction that the interest of one road and one locality is the interest of all.

"Thirteen years ago we had nothing but horse railways in Ohio. Now we have 900 miles of electricity, 46 miles of cable road, 100 miles of horse road, with the certainty that in a brief period of time the long-suffering horse will have severed all connection with street railways.

"We have concluded a year chequered with light and shadow. The financial depression, so widespread and so deeply felt throughout the country, touched us all, but the return of better times touches us also as promptly, and we can look with confidence to a time of renewed prosperity. 'Age cannot wither nor custom stale the infinite variety' of problems and perplexities which we have to meet and solve. Some of these we must discuss at this meeting.

"One which is thrusting itself upon our notice, is the suburban road. Within the last two years many miles of suburban roads have been built, and many more will follow. These desire entrance into our cities, or some satisfactory arrangement for the transfer of passengers and packages. This, therefore, opens up a new field for our consideration. Unless suburban roads are encouraged to contract with existing companies, they will seek independent entrance to the centers of our municipalities, and in so doing are likely to strongly compete with, if not seriously to injure established lines of travel.

"The suburban lines are not inimical to the interest of the city lines, and their building should be encouraged. If they desire an exchange of traffic, or entrance to business centers, it is better for the community, and for ourselves, that we contract with them, upon fair terms, and so let them enter. The company of which I am president has recently contracted with a suburban road, whereby the cars of the same are received by us and brought into the city. At the last session of the legislature an act was passed authorizing such contracts.

"Another problem is that of protection against loss by fire. It has been suggested that the street railway companies of the United States form an association, similar to certain New England associations, in which contributions are made to a fund for liquidating the loss. Recent excessive increase in rates on the part of existing insurance companies has a tendency to excite immediate consideration of this important subject.

"There is, perhaps, no other enterprise which to-day urges one forward to such a degree, which calls for the consideration of so many different subjects—subjects involving the interests and welfare of the public and the preservation of vested capital, as does the enterprise we represent. It is, therefore, wise and prudent that we seek to extend the membership of our Association, and that we come together annually to discuss these questions and to exchange ideas.

"In conclusion I desire to express to the Association my thanks for the honor of being elected to serve a second term as its president—especially as I was absent at the time of my election.

"This meeting will end my official career, but I shall still remain an active member of the Association and shall do all that lies in my power to promote its best interests."

The following members and visitors were present:

A. E. Lang, president Toledo Consolidated Street Railway Company, Toledo, O.

Chas. L. Wight, secretary Toledo Consolidated Street Railway Company, Toledo, O.

W. S. Jewell, manager Toledo Consolidated Street Railway Company, Toledo, O.

D. Robison, president Toledo Electric Railway Company, Toledo, O.

Jas. J. Robison, superintendent Toledo Electric Railway Company, Toledo, O.

B. P. Foster, manager Toledo & Maumee Valley Railway Company, Toledo, O.

J. K. Newcomb, president Delaware Electric Street Railway Company, Delaware, O.

I. Kelly, superintendent Columbus Street Railway Company, Columbus, O.

Reid Carpenter, president Mansfield Electric Railway Company, Mansfield, O.

M. A. Hanna, president Cleveland City Railway Company, Cleveland, O.

J. B. Hanna, secretary and treasurer Cleveland City Railway Company, Cleveland, O.

Chas. Wason, engineer Cleveland Electric Railway Company, Cleveland, O.

John J. White, Fort Wayne, Ind.

J. A. Hanna, the McGuire Manufacturing Company, Chicago, Ill.

W. E. Cox, Wharton Rail Company, Philadelphia, Pa.

R. Mitchell, Bartholomew Rail Joint Company, Maumee, O.

H. H. Foster, Dreher Manufacturing Company, New York City.

C. M. Fuller, Davis Car Shade Company, Portland, Me.

E. P. Sharp, Webster & Beach Railway Supply Company, Boston, Mass.

E. A. Smith, Consolidated Car Heating Company, Albany, N. Y.

Jno. H. Dale, Dale Manufacturing & Electrical Supply Company, New York.

Jno. B. Bennett, Street Railway Journal, New York.

The following Street Railway apparatus was exhibited:

The Bartholomew Rail Joint Company showed its new rail joint.

The Davis Car Shade Company had samples of its shades and fixtures.

The Webster & Beach Railway Supply Company showed samples of its new overhead material.

The Consolidated Car Heating Company showed an improved switch in connection with its electrical heating apparatus.

The McGuire Manufacturing Company showed its latest design in trucks.

The new companies admitted to the Association are the Delaware Electric Street Railway Company and the Toledo & Maumee Valley Railway Company.

At 2 P. M. the Association went into executive session and elected the following officers for the ensuing term: W. F. Kelly, Columbus, president; Reid Carpenter, Mansfield, vice-president; Wm. A. Lynch, Mansfield, chairman executive committee; J. B. Hanna, Cleveland, secretary and treasurer. There were no papers read, but the following interesting subjects were thoroughly discussed by all the members: "The Best Means of Detecting Dishonest Conductors," "A Desirable and Satisfactory Fender or Life Guard," "The Best Qualifications for Conductors and Motormen," "The Treatment of Low Joints, and How Best to Prevent Them," "The Best Method of Controlling Employes and the Collection of Our Fares."

At the invitation of Mr. Foster, manager of the Toledo & Maumee Valley Railway Company, the members and guests had a charming ride over the new line of this road, which extends down the Maumee Valley some twelve miles.

In the evening a banquet was given to the members and visitors by the Toledo Club at its beautiful club rooms, and was a thoroughly enjoyable affair in every respect. Of the toasts given, one was "The Press and Street railway Companies and the Relations of the Press and of the Street Railways," which was very happily responded to by Robinson Locke, of the Toledo *Blade*. Mr. Locke is the son of "Petroleum V. Nasby."

The next meeting will be held in Sandusky, and will be a two days' session, one day to be given up to boating and fishing at Kelly's Island.

Street Railway News.

Extensions and Improvements.

Battle Creek.—There is considerable talk in the city about rebuilding the electric railway. L. N. Downs, of New York, and F. N. Rowley, of Kalamazoo, are interested in the matter.

Caldwell, N. J.—The North Jersey Traction Company has applied for permission to construct an electric railway through Bloomfield Avenue. The application has developed a violent opposition on the part of the anti-trolley citizens.

Charlottesville, Va.—A plan is on foot to consolidate the Charlottesville & University Street Railway Company and the Charlottesville & University Electric Light Company. In this event the present horse car line would be changed into an electric one.

Chicago, Ill.—The Lake Street elevated road is to be extended immediately to Wabash Avenue, and is to be equipped with electric motive power.

The North Chicago Street Railroad Company has applied for a permit to construct a system of poles for its electric lines on the North Side, for a distance covering a territory of over five miles.

Dayton, O.—The City Railway Company has received the consent of property holders for the construction of an electric street railway from 3d Street, along Broadway to Dayton View

Galt, Ont.—The electric railway between Galt and Preston has proved such a success that it is now to be extended to Hespeler.

Laredo, Tex.—The Laredo Electric & Street Railway Company has just received two new boilers of 140 H. P. each, and will have an engine of 240 H. P.

Marion, Ind.—The Queen City Electric Railway Company is seeking a franchise for an extension of its line to the Soldiers' Home.

Marion, O.—An application, signed by Godfrey Leffler and three other members of the Marion Street Railway Company, has been made to the Council, asking for a franchise to cover a route from Reed Avenue to Center, to connect there with the line now being built.

Newark, N. J.—The North Jersey Traction Company has applied for a franchise to run electric cars from the terminus of the Irvington trolley line through Union County, the line to pass through Hilton, Maplewood and Millburn.

Norwalk, Conn.—The Norwalk Tramway Company intends to extend its line to Rowayton before winter.

Oakland, Cal.—The Oakland Consolidated Street Railway Company contemplates making an extension of its track three miles in length. The company has also made an application for a franchise to the Berkeley trustees, for the laying of a track on Blake Street from Shattuck Avenue to Dana Street and on Dana Street to Dwight Way.

THE Highland Park & Fruitvale Electric Railway Company has asked the Council to extend its franchise on 11th Street for one year, in consideration of its surrendering a franchise which it holds on a number of side streets in East Oakland.

Pawtucket, R. I.—The council has received a petition from the Pawtucket Street Railway Company asking for permission to build and operate an electric road over the same route that was covered in the petition of the Moshassuck Valley Railroad presented lately.

Plainfield, N. J.—The line of the Plainfield Street Railway Company will soon be extended to both Dunellen and Netherwood. Later it will be run to Hillside Cemetery and the Crescent cycling track.

Quincy, Mass.—The Quincy & Boston Street Railway Company has been granted a location in Neponset, from the bridge to the tracks of the old Mattapan branch of the New York, New Haven & Hartford Railroad.

Royersford, Pa.—The Town Council has granted street franchises to the Pottstown and Norristown Passenger Railway Companies. The tracks of the former company, which now run to Sanatoga Park, will be extended to Royersford, where they will connect with those of the Norristown Company, which will extend its line by the route of Collegeville and Trappe.

Rutland, Vt.—The Rutland Street Railway Company has contracted with the Westinghouse Company to equip its road. It has also ordered five electric cars from the J. G. Brill Company of Philadelphia.

St. Louis, Mo.—The Citizens' Railway Company, it is reported, will replace the cable system with electricity. The change will be made by November 1. The line will also be extended to the city limits.

New Roads.

Akron, O.—The Cleveland & Akron Electric Railway Company has filed an amendment of its charter so as to enable the company to extend its lines over the streets and highways of any municipality in Cuyahoga or Summit County, also to furnish electric light, heat and power, to deal in electrical appliances of any kind and own and operate pleasure resorts.

Aurora, Ill.—The franchise of the Aurora City Railway Company and the Elgin, Aurora & Fox River Valley Electric Railroad Company have both been extended one year by the Supervisors.

Charleroi, Pa.—The Charleroi, California & Brownsville Electric Street Railway Company, of Charleroi, Washington County, Pa., was organized August 29. James McKean, of Pittsburgh, is president. Other stockholders are C. F. Thompson and A. C. McKean, of Charleroi; J. W. Crawford, of Duquesne; William I. Berryman, of Washington, Pa.

Chicago, Ill.—The Chicago & Grand Avenue Street Railway Company is a new company. The capital stock is $50,000. The incorporators are John Gnaedinger, H. F. Kolze, Lesser Franklin, Cassius C. Clark and Edwin D. Seaton.

THE Southwestern Suburban Rapid Transit Company, of Chicago, has been incorporated, with a capital stock of $1,000,000. The incorporators named are Arschan H. Minassian, Newton Wilcoxson and Frank M. Sherman.

Harrisburg, Pa.—The Riverside Electric Railway Company, has been incorporated with a capital stock of $50,000. Wm. K. Alricks, of Harrisburg, is the president of the company, and others interested are J. Q. Denney and T. D. Greenawalt, of Harrisburg.

Hartford, Ind.—The Hartford Electric Street Railroad Company is a new corporation having a capital stock of $10,000. The directors are G. E. Reynolds, Albert Reynolds and Merle Allen Walker.

Hatboro, Pa.—There has been chartered the Willow Grove & Hatboro Street Railway Company; capital $18,000. The president is John H. Fow, of Philadelphia; and O. E C. Robinson, of Hatboro; J. F. Cottman, of Jenkintown; Charles F. Ehrenpfort, of Willow Grove, are some of the directors.

Hempstead, L. I.—The Hempstead Traction Company has been incorporated to build and operate a street railway four miles long. The capital stock is $50,000, and some of the directors are William Kennelly, of New York City; John F. Davis, of Brooklyn, and J. S. Lawrence and A. D. Lewis, of Hempstead.

Indianapolis, Ind.—The company which proposes to build the new gas belt electric road was formally incorporated September 5, under the name of the Indianapolis, Anderson, Alexandria & Marion Electric Railway Company. Among the directors of the company are Francis M. Dice and N. J. Clodfelter, of Crawfordsville; A. M. Painter and V. C. Quick, of Alexandria. The capital stock is $100,000.

Lancaster, Pa.—The Lancaster & Susquehanna Railway Company was incorporated September 4, with a capital stock of $100,000. John L. Graybill, of Lancaster, is the president of the company, and other stockholders are John B. Bausman and John Hertzeler, both of Lancaster.

Lewisburg, Pa.—A charter has been granted to the Milton & Lewisburg Street Railway Company. The capital stock is $36,000. Officers: President, Benj. H. Throop, of Scranton; directors, Horatio N. Patrick, Charles T. Bellamy, Henry H. Sivelly, of Scranton; Geo. E. Stevenson, of Waverly.

Lower Pottsgrove, Pa.—The Sanatoga, Royersford & Collegeville Electric Railway Company was recently incorporated, with a capital stock of $150,000, to construct and operate an electric railway at Lower Pottsgrove, Montgomery County, Pa. John C. Lynch, of Royersford, Pa., is the president of the company, and the other stockholders are P. W. Smith and C. R. Eberle, of Philadelphia.

Lyons, Ia.—The City Council has granted a twenty-five year franchise to the Electric Railway & Park Company, for an electric line extending to Joyce's Park. The new road will be two miles long, and in operation within three months.

Newburgh, N. Y.—Steps have been taken for the incorporation of a company to construct an electric railway from Newburgh to Walden. Benjamin Norton, H. B. Norton, Joseph Dickey, Major W. H. Weston and B. B. Odell, Jr., are the parties interested.

North Attleboro, Mass.—An association of local capitalists has notified the Board of Selectmen of its intention of forming a company and applying for a charter to run an electric railroad between North Attleboro and Attleboro.

Peekskill, N. Y.—A company is being formed here to build and operate an electric trolley railroad through the principal streets of the village. Charles E. Hammond, Dr. J. N. Tilden, of Peekskill; G. D. Hiscox and B. J. Rogers, of New York, are among the directors.

Philadelphia, Pa.—The Northern Electric Passenger Railway Company, was incorporated September 12, with a capital stock of $100,000, to construct and operate an electric railway in Philadelphia and Montgomery Counties, Pa. A. C. Milliken, of Pottsville, Pa., is the president of the company, and other stockholders are Charles S. Davis and S. S. Evans, both of Philadelphia.

THE Philadelphia Suburban Passenger Railway Company was incorporated September 19, with a capital stock of $600,000. Geo. D. Widener, of 1202 N. Broad Street, Philadelphia, is president of the the company, and other stockholders are David H. Lane, Geo. R. Yarrow and R. F. Bower, all of Philadelphia.

Pittsburgh, Pa.—The Highland Park & Pietler Street Railway Company was incorporated September 17, with a capital stock of $12,000. H. S. A. Stewart, of Pittsburgh, is the president of the company; others interested are Jas. J. Donnell and Jno. B. Jackson, both of Pittsburgh.

Reading, Pa.—The Reading & Pottstown Electric Railway Company was incorporated September 12, with a capital stock of $100,000, to construct and operate an electric railway from Woodvale in Berks County, to Pottstown in Montgomery County. John A. Rigg, of Reading is the president of the company, and other stockholders are R. L. Jones and S. E. Rigg, both of Reading.

Syracuse, N. Y.—There has been incorporated the Syracuse & East Side Railway Company, to construct a street surface road, about ten miles in length, from here to the town of DeWitt; capital, $200,000.

Waukesha, Wis.—Col. A. M. Jones, George Harris, P. J. Buckley, Thomas McGill and T. E. Ryan are said to be stockholders in a company organized to build an electric line between here and Pewaukee.

New Publications.

The Ajax Lightning Arrester. Published by C. S. Van Nuis. New York.

Mr. Van Nuis's name is well known to all station managers through his well known "Ajax" switch, lightning arresters, etc. This catalogue is descriptive of the lightning arrester, and is handsomely illustrated and printed.

Hints to Engineers Operating Small Electric Light Plants. By E. P. Roberts and W. B. Stewart. Published by the Correspondence School of Technology, Cleveland, O. Price 10 cents.

This little pamphlet, which contains twenty-seven pages of reading matter, is just what its name indicates, and is made up of various hints intended for the advice of operating engineers. Its practical nature is its striking characteristic.

Toronto as Seen From the Street Cars: A Tour by Trolley. Published by the Toronto Railway Company, Toronto, Ont.

We have mentioned occasionally in these columns publications of the nature of that whose title is given above, published by street railway companies, and covering the interesting features in the cities in which they operate. A very tastefully arranged book of this kind is that published by the Toronto Railway Company. It is illustrated by a number of good engravings of views along the line, also of the power station of the company. It is well written and reflects great credit on the compiler and publishing company.

Steam Tables and Engine Constants for Facilitating all Calculations upon Indicator Diagrams, etc. Compiled from Regnault, Rankine and Dixon. By Thos. Pray, Jr. 125 pages, 85 of which are tables. New York. D. Van Nostrand Company. 1894. Price $2.

This work, by an accomplished engineer, has been carefully and conscientiously compiled as a serviceable manual for steam engine calculations. Every table in the work was carefully computed and has not been copied from other sources. Numerous rules for calculations are given, and the whole matter has been given a great deal of care in its preparation.

Alternating Current Wiring and Distribution. By William LeRoy Emmet. 76 pages, 29 illustrations. New York. *The Electrical Engineer.* 1894. Price $1.

This little book is very practical in its nature, concise in its descriptions, and presents in a clear and intelligent way some of the exceedingly difficult problems connected with alternating current distribution. The author states that the object of the work is to point out the practical significance of some of the laws governing the distribution of alternating currents, and to explain those laws in such a manner that their nature and relative importance may be realized by practical men without further study of more complete works. Mathematical expressions and scientific terms have been avoided wherever possible.

Steam, its Generation and Use. Twenty-eighth Edition. LaVapeur, sa Production et Son Emploi, and Dampf, dessen Erzeugung und Verwendung. Published by the Babcock & Wilcox Company, New York.

The demand for "Steam," the well known treatise on this subject published by the Babcock & Wilcox Company, has been so large as to call for another edition, the twenty-eighth of the series, and to induce the publishers to issue French and German editions of the work. A Spanish edition was published some time ago. The work, as our readers probably know, takes up the subject of the generation of steam from a broad standpoint, comparing the advantages of water tube and tubular boilers for different classes of work and giving the reasons which led to the adoption of the Babcock & Wilcox type. A partial list of users of Babcock & Wilcox boilers is given in the work.

Electric Lighting Plants, Their Cost and Operation. By W. J. Buckley. 8vo. 275 pages. Numerous diagrams and folding plates. Chicago. William Johnston Printing Company. 1894. Price $2.

The purpose of this book, as expressed by the author in his preface, is to give to intending purchasers of lighting plants such details as may aid them in forming a fair estimate of the cost of construction and operation of the proposed station. The book is written expressly for the buyer, and with this end in view many details are given regarding the first cost as well as the cost of operating by different methods of steam and electric plants. The writer has had much practical experience in the employ of what is now the Fort Wayne Electric Corporation, with which he has been identified as a salesman since 1885. As might be expected, therefore, the book deals very largely with the Fort Wayne Company's apparatus, but there is no intention on the part of the author to conceal this fact. The book ought to be an exceedingly valuable one for buyers.

A Laboratory Manual of Physics and Applied Electricity. Arranged and Edited by Edward L. Nichols, Professor of Physics in Cornell University. 8vo. 436 pages, 245 diagrams and two folding plates. New York. Macmillan & Company, 66 Fifth Avenue. 1894. Price $3.25.

This is the second volume of this manual, and comprises "Senior Courses and Outlines for Advanced Work", as arranged by Professor Nichols and his assistants, Messrs Moler, Bedell, Hotchkiss and Matthews. Its four parts are devoted to experiments with direct current apparatus, experiments with alternating currents, senior courses in heat and photometry and outlines of advanced work in general physics. The work as a whole cannot be too highly commended. Its brief outlines of the various experiments are very satisfactory, its descriptions of apparatus are excellent; its numerous suggestions are calculated to develop the thinking and reasoning powers of the student. The diagrams are carefully prepared, and its frequent citations of original sources of information are of the greatest value. Part II on alternating currents is the work of Dr. Bedell who is a well known writer on this class of subjects. Part IV is the special work of Dr. Nichols whose broad gauge character as a physicist is admirably shown in the brief introductory chapter in which he outlines the requisites of the successful investigator. Typographically the book is very clean; only a few errors are to be found such as that in the name of Professor Thompson's well known work on page 8, and that in Professor Dugald C. Jackson's name on page 82.

Electricity at the Columbian Exposition, including an account of the exhibits in the Electricity Building, etc. By J. P. Barrett, Chief of Department, Chicago, R.R. Donnelley & Sons Company, 1894. 8 vo., 501 pages, illustrated.

This is a very handsomely illustrated volume, describing the various exhibits of electrical apparatus at the World's Fair, last year. The matter is arranged under twenty-eight chapter headings, such as dynamos, switchboards, telegraphy, etc., and in each of these the most prominent exhibits in that class are more or less briefly described or rather, to be more accurate, the apparatus shown in the exhibits is given a brief description, very similar to that which would be found in the trade catalogues of the various companies. In general, these descriptions are plain statements of the merits claimed by the makers for the different apparatus, but the statements as to the simplicity of construction, low cost and cheapness of operation have not been edited out of the text quite as often as they might have been. Several names of companies are misspelled, appearing as "Sturdevant," "Schuckertt," "Wurtz," etc. One of the special merits of a certain switch is spoken of as "worthy of mention as the light is on till off." Of a certain measuring instrument we are informed that "in the arc light field it has no peer." The author's well known and well understood prejudice against the overhead trolley is set forth at some length in the introduction of the chapter on electric railways. Here we are told in all seriousness of that "inconvenient, uncomely and highly objectionable feature, the overhead trolley," and of many cities that prefer "to contend with the disadvantages of horse cars and steam until some solution could be found for the evil." The author confidently predicts, "the early and complete retirement of the overhead trolley." The author's fellow townsmen seem to think differently, since the Chicago companies, notwithstanding the professor's solemn prediction, have, perhaps, 100 miles of trolley construction well under way. One of the best features of the book is its description of the Intramural Railway, with figures of traffic and operation not before published. The pictorial features of the work are also worthy of special notice.

Personal.

Mr. Robert J. Hill, chief engineer of the Chicago City Railway Company, was in New York last month, and called at our office.

Mr. James M. Hopkins, of the Barney & Smith Car Company, of Dayton, O., was in New York last month and reported an excellent business.

Mr. Samuel L. Phillips has been elected president of the Metropolitan Railroad Company, of Washington; *vice* W. J. Stephenson, deceased.

Mr. C. E. Schaff was appointed assistant general manager of the Cleveland, Cincinnati, Chicago & St. Louis Railway Company last month. Mr. Schaff will have his office at Cincinnati, O.

Messrs. C. A. Andrews, Jr., treasurer of the Pettingell Andrews Company, of Boston, and F. X. Cicott, manager of the railway department of the company, were in New York last month on a business trip.

Mr. W. M. Ramsay has resigned his position as general manager of the Federal Street & Pleasant Valley Railway Company, of Pittsburgh, and is now in California. W. H. Foster has been appointed in his place.

Mr. R. H. Yeats, the consulting engineer of the Calumet Electric Street Railway Company, of Burnside, a suburb of Chicago, was in New York City last week and made a pleasant call at the office of the STREET RAILWAY JOURNAL.

Mr. A. J. Elias, president of the Third Avenue Railway Company, New York, and Supt. John H. Robertson, of the same company, recently made a visit to Chicago, for the purpose of observing the operation of the continuous power brakes employed on the cable railways of that city. Mr. Robertson expresses himself as being well pleased with the operation of the brakes, and states that he will equip an experimental car at once with these brakes, for operation on the Third Avenue lines.

Mr. Charles F. Uebelacker, has been appointed electrical engineer of the Consolidated Traction Company of New Jersey, *vice* E. J. Emerson, resigned. Mr. Uebelacker has been connected with the Consolidated Company for nearly two years, latterly in the position of division superintendent of the Newark and New York electric line, which has been developed under his management to one of the most important in the company's system. Mr. Uebelacker is but twenty-six years of age, was graduated from Princeton in the class of 1890, and immediately obtained a position in the machine shops of the Brush Electric Company of Cleveland. He was soon placed in charge of the entire mechanical arrangement of these important shops, and planned several valuable features tending to economy in production. A little later he was made Mr. Short's private technical assistant, and with him had a most valuable experience in the design and construction of the new types of railway motors and generators. During the year 1892, Mr. Uebelacker was associated with Prof. E. P, Roberts, of Cleveland, as independent consulting engineers, and in December, 1892, accepted a position with the Consolidated Traction Company.



CHARLES F UEBELACKER.

Much credit is due to the Consolidated Traction Company for their quick appreciation of the value of Mr. Uebelacker's engineering training and experience, and we predict for him a highly successful and prosperous career.

Obituary.

We are pained to record the death last month of William J. Stephenson, president of the Columbia and Metropolitan Railway Companies, of Washington, D. C., and vice-president of the American Street Railway Association. Mr. Stephenson was fifty-three years old, and was a native of Washington, where the greater part of his life was passed. Just before the commencement of the late civil war, he entered the office of the Quartermaster General, where he remained for a number of years. He was afterwards connected with the Baltimore & Ohio Railroad Company, and later established a coal and wood business. He was elected president of the Columbia Railway Company several years ago, and in July, 1893, accepted the office of president of the Metropolitan Railway Company, of Washington, upon the resignation of that office by his brother-in-law, George Pearson. He leaves a wife and one son.

Mr. Stephenson was a man of great executive ability, and greatly honored and respected by all who knew him. He always took a great

interest in the meetings and workings of the American Street Railway Association, and was a regular attendant at the conventions.

CESARE ZANETTI, who was connected with the engineering force of the Broadway & Seventh Avenue Railway Company, of New York, for a considerable time during the construction of the cable railway on Broadway, and who has recently been in the employ of the Johnson Company of Johnstown, Pa., as a designer, died at the home of his parents at Turin, Italy, August 6, of consumption. Mr. Zanetti came to the United States from South America about five years ago. He was educated at the University of Turin, and spoke a number of European languages fluently. He was an occasional contributor on engineering subjects to the STREET RAILWAY JOURNAL.

PAYSON K. ANDREWS, who represented the American Car Company at Chicago, died of heart disease, August 22. Mr. Andrews was well and popularly known among street railway men. He was born in Massachusetts, and after engaging in the manufacture of steam engines for a short time, entered the supply business. For a number of years he represented the J. G. Brill Company in Chicago.

Equipment Notes.

The Central Electric Heating Company, of New York, is in receipt of an order from the Chicago North Shore Street Railway Company for the equipment of its cars with the American electric heater.

The Peckham Motor Truck & Wheel Company, of Kingston, N. Y., was awarded an order last month for 165 trucks by the People's Traction Company, of Philadelphia. The wheels for these cars will be supplied by the New York Car Wheel Works, of Buffalo, N. Y.

The Okonite Company, Ltd., 13 Park Row, New York, is doing a good business in its famous insulated wires and cables, and reports that its August sales exceed those for any other month during the current year. The company anticipates an excellent fall and winter business.

"Electric Power," of New York, has commenced the publication of an index to current periodical technical literature. This index gives in a systematic way the titles to the principal articles which have appeared in the electrical press, with brief synopses. This department is under the charge of Max Osterberg, E. E.

The Ellis Manufacturing Company, of Philadelphia, Pa., reports that the new cars for the Delaware County & Philadelphia Electric Railway Company, the contract for which has just been placed, will be fitted with Hansell equalizing motor trucks. These trucks are manufactured by the Ellis Company for either electric or cable railways.

The Consolidated Car Heating Company of Albany, N. Y., has recently received a contract from the Union Railway Company, of Providence, R. I., said to be the largest contract for electric heaters for street cars ever placed. It covers the equipment of 200 cars. The Consolidated Car Heating Company is at present also equipping a number of other street railways.

The Standard Paint Company, of New York, finding its business in the West on the increase, has reopened its Western office at 871 The Rookery, Chicago. This will be in charge of J. C. Shainwald. The electrical branch of the Standard Paint Company's business in the West, will continue, however, to be looked after by the Metropolitan Electric Company, of Chicago.

The Paterson Handle Works, of Paterson, N. J., continue to do a flourishing business in their specialties. The business is now under the management of E. J. & W. E. Hopper, instead of the gentlemen whose names were mentioned in our last issue. They are making a specialty, among other things, of cobble and Belgian rammers. which are mentioned in this issue.

The Ball Engine Company, of Erie, Pa., has received an order from the Alameda, Oakland & Piedmont Electric Railway, Alameda, Cal., for a 400 H. P., tandem compound, condensing Ball engine. The perfect running of two former engines furnished, the good results obtained, together with the absolute freedom from repairs, has decided the Alameda people to again order this type of engine.

James Boyd & Brother, of 14 North 4th Street, Philadelphia, have added to their established business in belting, packing, hose, etc., a department for the manufacture and sale of electric railway supplies. It is their intention to carry a complete stock of such goods after October 1. This department will be in charge of Samuel L. Nicholson, formerly with the Short Electric Railway Company of Cleveland, O.

George Cradock & Company, of Wakefield, Eng., whose ropes have been making exceptionally good records in this country, especially on the tunnel line in Chicago, installed a rope in the tunnel, May 10. It was removed September 8, having run 122 days. The rope was a Lang's lay, and at the time of removal there was not a broken wire in the rope, but it had worn so much, that it was too small for the grippers.

The Sterling Supply & Manufacturing Company, of New York, is doing a large business in fenders, registers and other street railway supplies manufactured by it. Among its recent sales the company mentions a large order from the Columbia Railway, of Washington, D. C., for registers, also an order from the Metropolitan Traction Company, of New York, for the equipment of cars of the Columbus Avenue line. The company has also received a number of additional orders from Yonkers.

The White-Crosby Company, of Baltimore, Md., has been awarded the contract for the proposed electrical subways in that city. The company's bid was $63,487, and while not by considerable the lowest bid, was regarded as the best on account of the excellence of the designs submitted, which in the judgment of the engineer who reported upon the various plans, were the most complete and fulfilled the requirements of the specifications more nearly than those submitted by the other bidders.

The R. A. Crawford Manufacturing Company, has appointed C. J. Mayer, of Philadelphia as its Eastern representative, and C. N. Wood, of Boston, to represent the company in the New England states for the Crawford pick-up fenders and wheel guard fenders for all kinds of electric and cable car service. The company has also just received an order from the Paterson, Passaic & Rutherford Railway Company, of Paterson, N. J., for the equipment of its cars with the Crawford safety appliances.

The Manufacturers' Advertising Bureau & Press Agency, of New York City, which is presided over by Benj. R. Western, has just issued a neat little pamphlet entitled "Advertising for Profit." Mr. Western makes a specialty of trade journal advertising, and numbers among his customers some very prominent manufacturers. The little pamphlet contains a list of these, as well as a number of letters of commendation from clients on the one hand and trade journals with which Mr. Western has done business on the other.

Edward P. Thompson, M. E., and Prof. William A. Anthony have established a firm at No. 5 Beekman Street, New York, to act as consulting engineers for corporations, cities, architects, etc. The firm will make a specialty of electric patent and engineering cases. Both members of this firm are well known, Professor Anthony having been for fifteen years Professor of Physics at Cornell University, past president of the American Institute of Electrical Engineers, and consulting electrician of the Mather Electric Company, and Mr. Thompson a prominent patent attorney and expert in New York City.

The Harrisburg Foundry & Machine Works, of Harrisburgh, Pa., has recently published a series of handsome circulars which are certainly very tasteful and artistic. In one of these publications the company shows views of the Ide and Ideal engines direct connected to various types of generators and dynamos. These are taken from photographs of actual installations, and on the margin of each page is printed a sketch of the plant in which the installation was made. Another publication is that entitled "The Harrisburgh Double Engine, Steam Road Roller." This is handsomely illustrated, and gives in addition full particulars in regard to the rollers.

The Joseph Dixon Crucible Company, of Jersey City, N. J., has recently issued a little circular giving a record of service tests in hoisting tackle recently made by Robert Grimshaw, M. E., at the Brooklyn Navy Yard. Pulley blocks using the Dixon waterproof graphite grease were used, and the report states that this lubricator was employed "as it is the best adapted for anchor handling tackle, which is exposed to both rain and sea water. Graphite being unaffected by sea water or extremes of temperature, and the best lubricant for bearings getting heavy loads and rough usage, is admirably adapted for all machinery and tackle aboard ship, in rigid, temperate or torrid zones."

The Fiberite Company, of Mechanicsville, N. Y., states that among the roads that have recently adopted and made large purchases of the Medbery insulation are the following: The Buffalo Street Railway Company; Union Railway Company, Providence, R. I.; Cumberland Valley Traction Company, Harrisburg, Pa.; Chicago City Railway Company; Philadelphia Traction Company; Consolidated Traction Company, Jersey City, N. J., and Montreal Street Railway Company. The contractors for the Pennsylvania Traction Company are using the Medbery insulation for the forty-five miles of road now being built between Lancaster and Lititz. The North and West Chicago Railway Companies have also adopted the Medbery insulation in their equipment.

The United States Car Fender Company, Bennett Building, corner Fulton and Nassau Streets, New York, of which Lampson S. Harrison, of South Brooklyn, N. Y., has recently been elected president, has placed on the market a new fender for electric and cable cars, entitled the Modemann fender. The fender when not in use is folded up on the dashboard so as to take little room or no room when the car is housed. When in operation, however, it extends in front of the car and completely protects the wheels. It is also provided with wings on each side, covering the steps of the car. In case any person should fall in front of the car the netting will collapse, breaking the fall and receiving the person as though in a basket. A number of prominent railway men have spoken in flattering terms of the fender.

The Berlin Iron Bridge Company, of East Berlin, Conn., is building a large addition to the machine shops of Henry R. Worthington, at Brooklyn, N. Y. This company has also received the contract for an annealing room building for the Naugatuck Malleable Iron Comprny, at Naugatuck, Conn. The building is 94 × 175 ft., with brick walls and iron roof trusses covered with corrugated iron. The Berlin Iron Bridge Company has also received from the Union Metallic Cartridge Company, of Bridgeport, Conn., an order for three large buildings, and from the Larchmont Electric Company, of Mamaroneck, N. Y., the contract for its power station. The building will be 50 × 90 ft. The Berlin Iron Bridge Company reports also having erected for the Mather Electric Company a new building 300 × 50 ft., equipped with improved electrical machinery, and a forty ton electric traveling crane, especially adapted for building large direct connected generators for railway work. The unfinished castings are brought in at one end of the shop and are loaded on the cars at the other end as finished generators.

WESTERN NOTES.

The Stirling Company, of Chicago, last month closed a contract with the West Chicago Street Railway Company for 8,000 H. P. water tube boilers. This is said to be the largest boiler order on record, and aggregates nearly $100,000.

The Fitzgerald-Van Dorn Company, of Lincoln, Neb., reports that business has been very satisfactory so far this year, in fact much beyond its expectations. The company is continually equipping new roads, and from every source letters are received showing the universal satisfaction resulting from the use of the Van Dorn coupler.

Stiebel & Kisinger, of Cincinnati, O., report that they are having a remarkable rush of business, on account of which they have been compelled to order new machinery. They make a specialty of wire connectors and other electrical appliances, the centrifugal street sprinkler, cable carrying sheaves, brake shoes, car wheels, etc.

The Barney & Smith Car Company, of Dayton, O., numbers among its recent orders one for fifty-five cars from the Metropolitan West Side Elevated Railway Company, of Chicago. These cars will be forty-five feet in length, supplied with rattan seats extending lengthwise of the car. A novel feature will be the employment of steel underframing, making a most substantial car.

The International Register Company, of Chicago, Ill., has published a neat pamphlet (pocket edition) containing a short description of the Pratt portable register and accompanied by copies of testimonials from users of the register. These show a unanimity of opinion in regard to the value of the portable register, which speaks volumes for the device. The pamphlet also contains a partial list of the street railways using the register.

The Lodge & Davis Machine Tool Company, of Cincinnati, O., has closed a contract for the equipment of the works of the Speeder Cycle Company, of New Castle, Ind., a recent corporation organized for the purpose of manufacturing a patent bicycle. This company is now erecting quite an extensive plant, and its equipment will include engine lathes, turret lathes, screw machines, milling machines, grinding machinery, etc.

The Siemens & Halske Electric Company, of Chicago, Ill., has just issued two new catalogues, one of which deals with generators and motors, "Type I," consisting of internal pole machines, while the other deals with bipolar generators and motors known as "Type L H." Both pamphlets give illustrations and descriptions of the respective machines, together with lists of the prominent plants in operation and under construction using the Siemens & Halske machines.

The Stilwell-Bierce & Smith-Vaile Company, of Dayton, O., has issued in pamphlet form the extended article published in the July issue of the STREET RAILWAY JOURNAL on the water power plant of the Portland General Electric Company. This pamphlet contains twenty very fine illustrations of the Victor wheels, and general views of the Portland plant, together with some illustrations of the Stilwell-Bierce factories at Dayton, O., where the wheels are manufactured.

L. J. Highland, of Chicago, has secured the contract for building and equipping the Manchester & Northern Railway for $296,000. The road will extend from Manchester, Adams County, O., north via West Union to Winchester on the C. P. & U. R. R., amounting to twenty-five miles of construction. It will be built on the county turnpike most of the way. Fifty-six and sixty pound T rail will be used, and has already been contracted for. The road will do both passenger and freight business, using thirty-six foot passenger cars, which will be equipped with Highland motors, with a maximum speed of twenty miles per hour

List of Street Railway Patents.

U. S. STREET RAILWAY PATENTS ISSUED JULY 17, 1894, TO SEPTEMBR 4, 1894, INCLUSIVE.

JULY 17.

ELECTRIC RAILWAY SUPPLY SYSTEM—William A. Butler, New York, assignor to John Gilmore Boyd, same place. No. 523,104.

Covers the combination in an electric railway system of overhead contact devices arranged at intervals and mechanically connected by a guide, with an elongated conductor carried by a car and having one or more guiding devices which follow said guide.

CONDUIT ELECTRIC RAILWAY—Charles D. Jenney, Indianapolis, Ind. No. 523,146.

Covers the combination in an electric conduit system, of a trolley frame supported on swinging links, whereby it is enabled to swing freely in one direction, and a conductor bar mounted to permit a vertical movement, a framework carrying said conductor bar and capable of a lateral movement, and springs attached to said bar and to said frame and operating to support or carry a portion of the weight of said bar. The conductor rail is placed on one side of the center of the conduit

SWITCHPOINT FOR STREET RAILWAYS—Herbert S. Smith, Brooklyn. assignor to himself, and Frank E. Knight, New York. No. 523.154,

The combination with a switchpoint having a downwardly projecting double incline, of two levers pivoted below the track and having inclines that act against the double incline of the switchpoint, and a cross lever connecting the two levers at one end.

TROLLEY—Joseph Guzowski, Chicago, Ill. No. 523,163.

Covers the construction in a trolley, a frame having an oil chamber, a trolley wheel having side plates and an independently revoluble bushing between said plates provided in its side with a recess or groove, a tube or duct extending from said oil chamber to said bushing, and a wick dipping into said oil chamber and extending through said tube or duct and having its end arranged in said recess or groove.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS—Edward H. Johnson, New York, and Robert Lundell, Brooklyn, assignors to the Johnson Subtrolley Company, New York. No. 523,164.

The second claim for this patent, which has seventeen claims, reads as follows: "In an electric railway system a current feeder or main insulated throughout its length, a series of sectional trolley conductors adjacent thereto and provided with circuit connections and means for connecting them in sequence to the current feeder or main; a second set of sectional trolley conductors having circuit connections with electro-magnetic switching devices for connecting the first set of sectional conductors to the feeder or main, in combination with an electrical generator, having one pole connected to the current feeder or main and the other to a return conductor located throughout its length between the two sets of sectional trolley conductors."

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS—Edward H. Johnson, New York, and Robert Lundell, Brooklyn, assignors to the Johnson Subtrolley Company, New York, No. 528,166

Covers, different forms and details of No. 523,164.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS—Edward H. Johnson, New York, and Robert Lundell, Brooklyn, assignors to the Johnson Subtrolley Company, New York. No. 523,165.

Covers, different forms and details of No. 523,164.

VENTILATOR FOR RAILWAY PASSENGER CARS—John Krehbiel, Cleveland, O., No. 523,167.

In a railway car, the combination with the roof extending unbroken entirely across the car of a furring below, and extending across the roof parallel therewith or substantially so, and forming a chamber between and a ventilator at the sides adapted to communicate with said chamber.

ELECTRIC RAILWAY CROSSING INSULATOR—Henry B. Nichols and Frederick H. Lincoln, Philadelphia, Pa. No. 523,172.

An electric railway crossing insulator, comprising an arm of insulating material having channeled metal wings, a seat of insulating material engaging the recessed portion of said arm and supporting channeled metal arms formed with a recessed casting provided with ends engaging the walls of the recessed portion of said arm, and means for supporting and preventing displacement of said wires seated to the channeled members of said device.

GUARD RAIL FOR STREET RAILWAYS—Gleason F. Starkweather, Chicago, Ill. assignor to the Paige Iron Works, same place. No. 523,182.

A guard rail, for railways consisting of an integral piece vertical on one side from top to bottom, a base protruding horizontally outward from the other side of the web, and a head also extending outward from the web at the upper part of the same and substantially parallel with said foot or base.

CONDUIT ELECTRIC RAILWAY—John W. Eisenhuth, San Francisco, Cal. No. 523,271.

In an underground system for electric railways the combination of supporting chairs, an insulated conduit, mounted thereon, an insulating partition dividing said conduit, conducting wires mounted on each side of said partition in said conduit, but insulated therefrom and a trolley adapted to engage said conducting wires.

ELECTRIC RAIL BOND.—James G. Hallas, Waterbury, Conn. assignor to the Benedict & Burnham Manufacturing Company, same place. No. 523,278.

A bond for the rails of electric roads consisting of a body of uniform size having one or more coils formed from the metal of the bond, ends adapted to be passed through adjoining rails, angular shoulders formed by bending the metal at a right angle, and which are adapted to be set up against the under sides of the rails, and the ends of the bonds to be headed down on the upper side thereof.

BONDING JOINT FOR ELECTRIC RAILWAYS—Andrew L. Johnston, Richmond, Va. No. 523,284.

The combination of a rail having a tapered perforation, with a bonding wire, a sleeve fitted to said wire, and adapted to fit snugly in the tapered perforation of the rail and having a flange bearing against one side of the rail, and a nut adapted to bear against the opposite side of the rail, and to draw the tapered sleeve into the opening in the rail, the contact area of the connection being greater than the cross sectional area of the bonding wire.

ELECTRIC RAILWAY—Henry A. Doty, Janesville, Wis., assignor to Mary E. Doty, same place. No. 523,306.

In an electric railway, the trolley comprising a frame or body, and conducting shoes on opposite sides thereof, the shoes being arranged in pairs, each pair having meeting faces and diverging ends terminating in coils which are fastened to supports on the trolley.

ELECTRIC RAILWAY SYSTEM—Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company of Boston, Mass. No. 523,313.

In an electric railway the combination of a generator and working conductors, with one or more electric lamps arranged in one or more branch circuits in shunt connection with the line circuits, and one or more electric lamps arranged in series with the line circuits or working conductors.

ELECTRICAL CONDUCTOR FOR TROLLEYS—John W. Eisenhuth, San Francisco, Cal. No. 523,319.

An electric conductor for trolleys, etc., comprising a main con-

ductor and a series of short tubular conductors surrounding the main conductor, and having permanent electrical connection therewith, but being partially insulated therefrom.

JULY 24.

ELECTRIC RAILWAY SYSTEM—Albert C. Crehore, Ithaca, N. Y. No. 523,396.

In an electric railway system, the combination of a series of working conductors, a series of electro-magnetic switches for connecting the same to the line normally operated by current taken from the power line, an auxiliary conductor over which the magnets for operating said switches are energized, and a storage battery in the car placed in a branch around the switch magnet, and charged by a portion of the line power current which flows in the motor.

FARE REGISTER AND RECORDER—Charles S. Sergeant, Winchester, and Louis J. Hirt, Boston, Mass. No. 523,446.

The combination of a movable trip register and actuator therefor with counting mechanism operated by said actuator, and the movable support for the said counting mechanism, said actuator and support being constructed and arranged so that each when in abnormal position locks the other from movement.

ELECTRIC SNOWPLOW—Louis J. Hirt, Somerville, Mass. No. 523,471.

The combination with an electrically propelled snowplow, of a metallic truck frame consisting of metallic side bars, each comprising two bars and end bars and intermediate cross bars firmly secured together.

STREET CAR GUARD—Charles A. Barrett, Malden, Mass. No. 523,507.

In a street car, the combination of a guard hinged to an attachment on the car, a latch adapted to engage the guard above its pivotal center and hold it in a raised position, and a latch displacing or tripping device extending to a position to be operated from on board the car, whereby the guard may be released and allowed to drop to operative position.

CAR FENDER—Franklyn S. Hogg, New York, assignor to himself and Barton B. Higgins, same place. No. 523,526.

The combination with the fender having a forwardly and an upwardly extending portion and means for pivoting the fender to a car truck, of sliding rods engaging the rear side of said upwardly extending portion, bearings in which the rods slide, nuts on the rods in front of the bearings for adjusting the forwardly extending portion toward and from the roadbed, and springs forcing the upwardly extending member rearwardly.

CAR FENDER—Eldridge J. Smith, Washington, D. C., assignor to the Automatic Car Fender Company, same place. No. 523,551.

The combination of a vertically swinging pick-up fender, composed of a number of independently movable fingers extending forward from a suitable support, finger raising mechanism and trip devices for holding the finger raising mechanism, and maintaining the fender fingers in their raised position until an obstruction is encountered which actuates the trip devices.

TROLLEY CATCHER—Edwin M. Drummond, Louisville, Ky., assignor of one-half to Joseph O. Haddox, same place. No. 523,625.

A trolley pole support comprising a trolley pole or pole socket, an independently movable spring held ratchet segment, a locking pawl therefor, and a connection between the pole or pole socket and the said ratchet which is adapted to trip the said locking pawl.

GRIP SLOT CLOSER—Frederick W. Gremmels, Kansas City, Mo., assignor of one-half to Andrew Hamilton, same place. No. 523,636.

In a grip slot cover, the combination with the grip rails, casing located upon the grip slot rails, and having the inwardly and downwardly inclined chambers opening at their inner sides and above the grip slot, cover plates mounted in said chambers, and springs also mounted in said chambers and holding the cover plates yieldingly together at their inner margins.

JULY 31.

FARE REGISTER FOR STREET CARS—Edmund H. Duchemin, Newburyport, Mass. No. 523,660.

A duplex fare register with a curved oblong case and dial plate having the circular dial scales of the totalizer at one end, a curved oblong slot for sighting the trip-indicating disk in the opposite end, together with mechanism for operating same.

LIFE GUARD FOR STREET CARS—George A. Parmenter, Cambridge, and Charles S. Gooding, Brookline, Mass., assignors to the Parmenter Car Fender Company of Maine. No. 523,683.

A life guard consisting of a scoop pivoted to swing, combined with a mechanism for automatically depressing said scoop, and with a stop behind the upper end of said scoop, which when the lower end is depressed will securely hold it in position.

CAR FENDER—Edgar Thomas, Pittsburgh, assignor of one-half to Philip M. Amberg, Allegheny, Pa. No. 523,693.

A car fender comprising one fixed and one movable member pivoted together, the latter provided with a rearwardly extended arm, a vertically adjustable hanger co-operating with said arm, and a vertically disposed cushion acting on the said arm to normally keep it in engagement with the hanger.

FARE REGISTER—Leo Ehrlich, St. Louis, Mo. No. 523,930.

A fare register, the combination of a trip register, two or more permanent registers, means for connecting the trip register at will with either one of the permanent registers, and a single handle or operating device for actuating the trip register and controlling its connection with the permanent registers, whereby said device may be operated to actuate the trip register and either one of the permanent registers at will.

AUGUST 7.

TROLLEY WIRE SUPPORT—Levi Yakel, Allegheny, Pa. No. 524,014.

An electric insulator combining a bolt, the lower end of which is adapted to be secured to a fin for an electric wire, a series of asbestos and mica disks alternately strung thereon, a ring, a cap adapted to be secured thereto and means of securing said bolt in said ring and cap.

TROLLEY FOR ELECTRIC CARS—George C. Bourdereaux, Peoria, Ill. No. 524,017.

A trolley consisting of a fork constructed of two separable parts having enlarged hollow heads, bearing blocks retained within said heads, a shaft having tapering ends let into the said blocks, and a trolley wheel mounted upon the shaft and composed of two separable halves enclosing a ring.

CONDUIT ELECTRIC RAILWAY—Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. No. 524,025.

In an electric railway, the combination of a working conductor arranged along the railway, an electrically propelled vehicle, an electric motor for said vehicle connecting with the power or drive wheels, and an independent truck propelled by said vehicle having a collector making contact with the conductor.

MOTOR SUSPENSION FOR RAILWAY WORK—Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Conneecticut. No. 524,117.

In an electric railway motor, a supporting frame sleeved on the car axle and consisting of two side and two cross pieces formed in one piece, one of such yoke pieces constituting the yoke piece or bar for the field magnet of the motor.

CAR FENDER—Alexander Kidd, Brooklyn, assignor of one-half to Robert Wood, New York. No. 524,175.

A car fender comprising a series of members which are coupled together and held by yielding tension devices to present a continuous barrier in advance of the car wheels both when in their normal position and when moved laterally with respect to the track by contact with an obstacle in the path of the fender.

FENDER FOR TRAM CARS—William Dryden Brooklyn. N, Y. No. 524,198.

A safety guard for tram cars consisting of a body, a fender located in the forward lower portion of the body and spring controlled doors or gates located above the fender and constituting the upper front of the body.

STREET RAILWAY CAR FENDER OR GUARD—Emil Kemnitz, Memphis, Tenn. No. 524,207.

A fender comprising a body provided with upright rollers arranged practically in the form of the arc of a circle of large diameter, that is, avoiding marked prominence at any portion of the curve.

INSULATED TROLLEY WIRE SUPPORT—Frank M. Zimmerman, Detroit, Mich. No. 524,232.

In an insulating trolley wire support, the combination of an outer shell, a central screw threaded nut secured to, but spaced from, said shell by an insulating disk, a supporting stirrup engaging with said nut, and a saddle piece adapted to form a grip therewith.

ELECTRIC RAILWAY POLE RATCHET—Thomas J. McTighe, New York, assignor, by mesne assignments, to Frederick, K, Fitch, same place. No. 524,282.

A metallic pole ratchet in combination with a metallic clamping device for attachment to the pole, and insulation electrically separating the ratchet from the clamping device.

TROLLEY WIRE CIRCUIT BREAKER—Thomas J. McTighe and Sumner W. Childs, New York, assignors, by mesne assignments, to Frederick F. Fitch, same place. 524,283.

A trolley wire circuit breaker composed of two end castings united by two lateral parallel insulated rods fixed in said castings, but insulated therefrom.

AUGUST 14.

CAR FENDER—James T. Duff, Pittsburgh, Pa. No. 524,316.

The combination with a car, of a fender comprising a frame having its rear edge pivotally connected to the car and adapted to have its forward end lowered into a position adjacent to the rails, an apron carried by said frame, and a second apron arranged transversely of the car in rear of the fender, and means for operating the fender.

ELECTRIC RAILWAY SYSTEM—Theodore B. Wilcox and Henry Wilcox, Newark, N. J. No. 524,366.

In an electric railway system, a surface plate adapted to be charged by an independent magnet, a main wire leading to the said plate, and connected by a branch to a movable magnetic contact maker within the said plate, one or more magnets, carried by a motor car, for actuating the said contact maker, and charging the said surface plate, the exposed portion of said plate consisting of parts made respectively of magnetic and of non-magnetic material insulated from each other.

ELECTRO-MAGNETIC CONTACT MAKING DEVICE FOR ELECTRIC RAILWAY SYSTEMS—Theodore B. Wilcox and Henry Wilcox, Newark, N. J. No. 524,367.

Electro-magnetic contact device for use with No. 524,366.

ELECTRIC RAILWAY SYSTEM—Theodore B. Wilcox and Henry Wilcox, Newark, N. J. No. 524,368.

Covers different forms of No. 524,366.

CONTROLLER FOR ELECTRIC MOTORS—Joseph H. Jenkins, Lynn, assignor to the General Electric Company, Boston, Mass. No. 524,385.

A controller for electric motors comprising an actuating shaft or spindle mounted in suitable bearings, a circuit modifying device carried by said shaft and means for removing such device from the shaft, without removing the shaft from its bearings.

CONTROLLER FOR ELECTRIC MOTORS—William B. Potter, Lynn, assignor to the General Electric Company, Boston, Mass. No. 524,396.

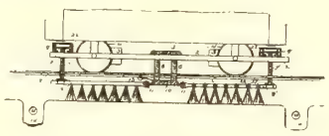
The combination in an electric controller, of a switch having a multiplicity of contacts, and a blow-out magnet having a common pole piece extending from a common core to points adjacent to the several circuit breaking points of the switch.

RADIAL CAR TRUCK—William Robinson, Boston, Mass. No. 524,402.

The combination of a car frame, a main truck frame, a radial frame pivotally connected to said main truck frame, and one or more radiating pins or equivalent mechanical devices secured to said car frame outside of the longitudinal center thereof, said pins or devices engaging said radial frame and guiding and controlling the swiveling movement thereof relatively to said main truck frame.

CONDUIT CLEANING DEVICE—Charles O. Ehlert, New York. No. 524,434.

A device or apparatus for cleaning the interior of slotted underground conduits suitable for electric railways, carried by an electrically propelled vehicle adapted to move above said conduits, consisting of



NO. 524,434.

one or more sweeping brushes or brooms suspended within the conduit from points upon the car, remote from each other, and connected thereto by self adjusting connections, whereby the said sweeping brooms can be adjusted to curved sections of said conduit.

TROLLEY WHEEL AND SUPPORT—David R. Thomas, Baltimore, Md., assignor of one-half to William E. Harendt, same place. No. 524,517.

The combination with a trolley yoke, of a wheel journaled therein, a plug in each end of the bore of the wheel, the outer ends of which plugs are each provided with a shoulder to fit against the side of the wheel, and the inner ends of the plugs being at a distance from each other, each plug being provided with an axial opening, and a pin adjustably secured in the outer end of each arm of the yoke, the inner end of which pin fits within the outer end of the axial opening of its respective plug and forms a support or journal for the wheel.

DEVICE FOR OPERATING STREET RAILWAY SWITCHES—Carl E. R. Christensen, Brooklyn, N. Y. No. 524,540.

A switch operating device adapted to be mounted on the platform of a car, comprising a guide socket with a laterally flared bore, a stem mounted non-rotatively in the bore of the guide, a head piece on the upper end of said stem, a wedge of clam shell form on the lower end of said stem, and a retracting spring.

AUTOMATIC CIRCUIT BREAKER—Anatole C. Carles, Portland Me., No. 524,630.

In a circuit breaker for broken electric wires, a metallic bridge supported in a suitable case and insulated therefrom, a pivoted carrier mounted in said case, a circuit breaking rod having an inclined end set in said carrier and insulated therefrom, the inclined end of said carrier having a plate pivotally attached thereto and adapted to rest loosely upon said metallic bridge, but adapted to be disconnected therefrom by the breaking of the wire.

INSULATING TURNBUCKLE—Louis McCarthy, Boston, Mass. No 524,684.

An insulator comprising two shells having oppositely projecting connections placed within the same and insulated therefrom, a turnbuckle device having the opposite ends of the same placed within the respective shells and insulated from each of the said connections by an interposed mass of insulating material.

AUGUST 21.

STREET CAR FENDER—Thomas C. Rice, Worcester, Mass. No. 524,734.

A shield attachment for a street car adapted to be attached to and extend in an upright position at the end of the car, and consisting of a wire netting or cushion surface curved or bowed outwardly, and provided with a spring or resistance device upon its inner surface to engage the buffer, or other projecting part of the car.

SANDING DEVICE FOR CARS—Henry F. Rooney, Randolph, assignor of one-half to Mary Chisholm, Boston, Mass. No. 524,735.

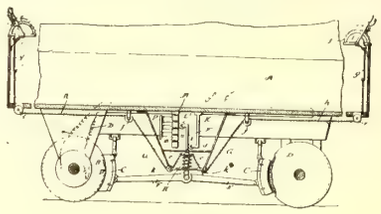
A sanding device for cars, comprising sand tubes uniting in front in a single tube, the closures at their rear ends actuated by levers, rods extending from said levers to an actuating lever in convenient position for the driver, springs holding the closures normally against the mouths of the sand tubes, and shaking devices extending longitudinally in the sand tubes, and with their front ends secured to a rod or bar connecting with an actuating lever in convenient position for the driver.

ELECTRIC RAILWAY SUPPLY SYSTEM—Malone Wheless, Washington, D. C. No. 524,773.

An electrical railway system comprising a car provided with a pair of shoes insulated from each other and from the body of the car, a source of electrical supply having its opposite poles connected to said shoes respectively, and a motor connected by one of its poles to one of said shoes only, and having its opposite pole connected to one of the track rails in combination with track terminal pins in pairs held in boxes set at such intervals apart that the contact shoes on the car will reach one pair before they leave the other, a table and feeder therefrom connected to those track terminals through which the motor circuit is completed, normally open contacts in each feeder connection, an armature for closing said contacts, a pick-up magnet for each armature, having its energizing coil connected to its appropriate pair of track terminal pins whereby when the car shoes meet a pair of track terminals a circuit, including the pick-up magnet of those terminals, and the source of electrical supply on the car will be closed, with the result of energizing the pick-up magnet and thus closing the normally open contacts in the feeder connection appropriate to the track terminals on which the car shoes rest.

CONTROLLER FOR ELECTRIC CARS—Marion B. Monroe, New Orleans, La. No. 524,785.

In an electric car, the combination of a motor, a source of electric supply, a rheostat arranged in an electric circuit between the source of

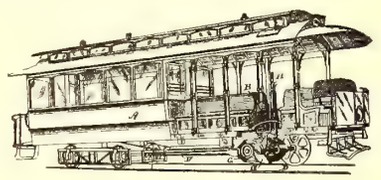


NO. 524,785.

supply and the motor, a vertically movable plunger arranged in the electric circuit and contacting with the rheostat and a suitable means for moving the said plunger.

ELECTRIC RAILWAY CAR—John C. Henry, Westville, N. J. No. 524,823.

An electric car having at one end a swiveling bogie and at the other end a swiveling pony truck, a motor mounted on the pony truck



NO. 524,823.

and a tongue projecting from said pony truck and connected with the bogie by an attachment allowing it to have lateral play.

CAR FENDER—James Rumrell, Boston, Mass. No. 245,841.

A car fender provided with spring actuated grasping and retaining devices, the latter being mounted at the ends to slide in the arms of the fender.

FENDER FOR TROLLEY OR OTHER CARS—Elmer Bockman and Joseph E. Hagan, Philadelphia, Pa. No. 524,883.

A frame having a cross bar hinged to an arm pivotally mounted on a support, hangers on said frame with wheels on their lower ends, wheels on the sides of said frame, and a roller in front of the same having a vertical play in its journal bearings.

CAR FENDER—Robert Thomson, Brooklyn, N. Y., assignor of one-fourth to Joseph Norwood, same place. No. 524,918.

The combination, with a car fender and two braced arms rearwardly extended from standards on the fender, of two sets of clamping boxes at the ends of the car along its sides, and keeper wedges adapted to slide into slots of the front boxes and clamp upon collars on the arms.

ELECTRIC RAILWAY SUPPLY SYSTEM—James F. Cummings, Detroit, Mich., assignor of one-half to Eugene M. Engelman Milwaukee, Wis. No. 524,976.

In an electric power system for railways, the combination with two insulated supply conductors, two distributing conductors divided into sections independently connected by feeders to main supply conductors, of a switch at a central station having contacts connected by independent test lines with the sections of the distributing conductor, an independent source of electricity having one terminal connected to the movable contact of the switch and the other to the ground and an electric indicating device in circuit with said source of electricity.

AUGUST 28.

TROLLEY—Naaman W. Haskins, Brooklyn, N. Y. No. 525,015.

Covers a trolley having a plurality of grooved annular bearings formed at right angles to a common axis.

TROLLEY WIRE SWITCH AND CROSSING—Naaman W. Haskins, Brooklyn, N. Y. No. 525,016

Covers a switch and crossing suitable for use with a trolley wheel made in the form described in the previous patent.

DEVICE FOR PREVENTION OF ACCIDENTS ON STREET CARS, ETC.—Alexander McKerlie, Hamilton, Canada. No. 525,055.

This device has front projecting side arms which have a front bearing provided with a cap. The through angle shaft in the bearings is equipped with brush roller or blades at each side of a centrally located chain wheel.

COMBINED CAR FENDER AND BRAKE—Hampton W. Evans, Philadelphia, Pa. No. 525,071.

This is a combination in a car having wheels and brake shoes adapted to engage therewith and a brake operating lever, of a fender provided with a frame having bent ends or wings. The frame is secured to movable arms connected with the truck frame of the car. There are springs in movable engagement with the arms of the fender for supporting the same at an angle from the truck frame and above the track rails, toggle and bell-crank mechanisms on each side of the car in connection with said fender and brake shoes. The construction and arrangements are such that the brake shoes are either applied by means of the brake operating lever or automatically by means of the fender under the impact of an object brought against the same.

SAFETY GUARD FOR STREET CARS—William H. Rice, Rochester N. Y. No. 525,115.

There is a supporting frame with a roller at the outer end of the frame provided with spring sprockets which stand eccentrically to the roller. A flexible guard is attached at one end to the sprockets and is partially wound thereon, and at the other to the car.

MEANS FOR MOUNTING AND DRIVING DYNAMO-ELECTRIC MACHINES—Andrew L. Riker, New York. No. 525,118.

This is the combination with the armature pulley and driving pulley of a belt for transmitting motion from one to the other. There is a swinging idler around which one side of said belt is looped, so that the pull of the latter operates to draw said idler against the armature pulley, gripping the belt against the same, and means for automatically taking up the slack in the other side of the belt.

CIRCUIT BREAKER—Cummings C. Chesney, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. No 525,134.

A pivoted bridge piece is adapted to be placed and maintained in engagement with said terminals. There is a pivoted weight engaging with the bridge piece, but having a determined range of movement independent of the same, and a tripping device is provided for holding the weight in an elevated position against the force of gravity.

CAR FENDER—Charles E. Struck, Newark, N. J., assignor of one-half to John A. Baldwin, same place. No. 525,167.

This is the combination with the platform of a car of a bumper pivotally secured to the car in front of the platform, and a knuckle connecting the lower extremity of the bumper with the platform.

STATION INDICATOR—Athean C. Allyn, Boston, Mass. No. 525,176.

A roller and curtain of nippers are pivoted to the roller and adapted to extend over the curtain and clamp the same against the roller. The nippers have flanges projecting on the outer sides of their pivots, and a fixed cam having a section which co-acts with said flanges, moves the nippers against the roller and a tapered blade over which the flanges may take when the nippers move away from the roller, and springs impel the nippers away from the rollers.

SAFETY FENDER FOR TRAM, ELECTRIC OR CABLE CARS—Henry S. Robins Philadelphia, Pa. No. 525,233.

The fender has a frame, a yielding bed, carried by the frame and a tubular guard formed of soft, elastic or yielding material. The guard is located at the forward portion of the bed, and means are provided for holding said tubular guard expanded.

STREET CAR—William F. S. Robinson, Somerville, Mass. No. 525,281.

The car has a guard situated in front of the dashboard and extending substantially across it and adapted to be raised from a position in front of the bunter to a position above and clearing the bunter, and to be sustained in either of said positions.

CAR FENDER—William F. S. Robinson, Somerville, Mass. No. 525,285.

The fender is adapted to run on the track in front of the car. A pivoted connection between the fender and truck consists essentially of a substantially horizontal tubé or cylinder pivoted at its front end to the fender and a rod pivotally connected at its rear end with the truck. At its front end is a piston playing in said tube.

SEPTEMBER 4.

CONTROLLING DEVICE FOR ELECTRIC RAILWAY CARS—William H. Conrad, Lebanon, Pa., assignor of two-thirds to Jacob M. Shenk and Willim P. Coldren, same place. No. 525,336.

The combination of an electric switch, a shaft provided with means for turning on and off the current, a revoluble sleeve secured to said shaft, a ratchet wheel secured to the sleeve, a pawl, and an arm on the shaft to release the pawl and a brake chain attached to said sleeve.

CONTROLLER FOR ELECTRIC OR OTHER MOTORS—Elmer A. Sperry, Cleveland, O., assignor to the Sperry Electric Railway Company, of Ohio. No. 525,394.

In combination with electric machines, an electric circuit, an operating handle, means connected with such operating handle for varying the electric conductivity of such circuit, another and separate operating handle, means also connected with it for varying the conductivity of an electric circuit, each handle having a zone or position known as its critical position, the arrangement being such that by manipulation of either handle to or from such critical position, the conductivity is gradually increased or decreased, in combination with interlocking devices between the handles, whereby either is locked when the other is out of said critical position.

SYSTEM AND APPARATUS FOR CONTROL OF ELECTRIC MACHINES—Elmer A. Sperry, Cleveland, O., assignor to the Sperry Electric Railway Company, of Ohio. No. 525,395.

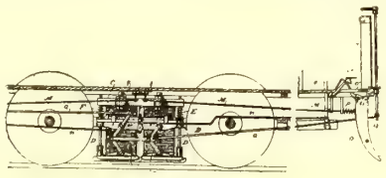
The combination, with a motor, of a current supply, means for gradually increasing the current in the motor circuit from such supply, up to some predetermined point, means for then decreasing the counter electro-motive force at constant speed of such motor and simultaneously decreasing the current flowing in the motor circuit from said supply, as compared with that flowing previous to said change in the counter electro-motive force, and means whereby the current in the motor circuit may be gradually increased from this point.

ELECTRIC RAILWAY SYSTEM—Francis B. Badt, Chicago, Ill. No. 525,480.

The combination of a movable vehicle with a motor transformer thereon adapted to be operated by an external multiphase supply circuit, conductors leading from this supply circuit to such movable vehicle, one or more direct current motors on such vehicle attached or geared to the vehicle axle or axles, and connections from the motor transformer to such direct current motor or motors.

ELECTRO-MAGNETIC CAR BRAKE—Robert T. Murray and Charles M. Allen, San Francisco, Cal. No. 525,505.

A brake for railway cars, consisting of vertically moving brake shoes adapted to form contact with the line of rails, and an electro-magnet which carries the brake shoes and moves with them, independent coils surrounding the core of the magnet, said coils being connected



NO. 525,505.

in series, and with switch plates arranged about a center, a lever pivoted at this center and movable to make connection between the various pairs of plates, whereby the power of the magnet is increased, diminished or destroyed.

CAR FENDER—Thomas Ross, Westerly, R. I. Filed March 8, 1894. No. 525,516.

The combination with a car dasher of a fender composed of an upright member and a pilot member pivotally secured together, each being formed of strips of spring metal, the strips of the upright member curving over at the top and being furnished with roller bearings at their ends.

ELECTRO-MAGNETIC TRACTILE DEVICE—Charles M. Allen, San Francisco, Cal., assignor of one-half to Robert Murray, same place. No. 525,523.

A means for increasing the tractile force of motors, consisting of an electro magnet or magnets vertically movable towards and from the rails, and movably inclined planes engaging the magnet or magnets for raising them, the latter being depressed by gravitation or attraction when energized.

CONDUIT ELECTRIC RAILWAY SYSTEM—Oscar A. Enholm, New York, assignor to W. Dean Smith, same place. No. 525,539.

An underground electric railway system comprising a main conductor, an auxiliary conductor composed of separate or insulated sections, switch mechanism for connecting said sections successively with the main conductor, and positive mechanism connecting said switch mechanisms together so that the operation of one switch to close the circuit from the main conductor to an auxiliary conductor section will mechanically operate to cut out another of said sections from circuit with the main conductor.

STREET CAR TRUCK—Ferdinand E. Canda, New York. No. 525,590.

In a car, a supporting spring, the same comprising an elliptic spring and a coil spring located one above the other, a follower arranged on top of the upper spring and adapted to rest on the lower spring when the upper spring is compressed to its full capacity, and a hollow, verttcal column stand in which the follower has guided movement.

CAR FENDER—Henry W. Eaton, New York. No. 525,592.

The combination, with a car, of a forwardly extending frame hinged thereto, a second frame hinged to the first frame and provided with inwardly extending arms, suspending chains secured to the arms and adapted to be secured to the car, a network covering for the second frame and a netting connecting the chains.

OVERHEAD SWITCH FOR TROLLEY WIRES—Hugh M. Greenwood, Brookiyn, N. Y. No. 525,598.

In an overhead frog, switch or crossing for trolley lines a body and wire arms, one of said arms adjustably connected to said body, whereby its position can be shifted to adapt it to the wires of the trolley line.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. THE STREET RAILWAY PUBLISHING COMPANY, HAVEMEYER BUILDING, NEW YORK.

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by Spencer Trask & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	750,000	Q Feb.	1½	1890	116½	117½
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	10	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	101½	.....
" " " 2d Mort	1873	20,000	M. & N.	7	1893	101½	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	103½	.....
" " " Debenture	1891	200,000	M. & N.	6	1901	111	.....
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	112	114
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	111½	113

BALTIMORE STOCKS AND BONDS.—Corrected by Hambleton & Co., Bankers, 9 South Street, Baltimore, Md., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	2,500,000	Sem-an	4	.....	64	65
City & Suburban Ry. Co	50	3,000,000	.....	1	.....	40	42
Central Pass. Ry. Co	50	300,000	.....	...	.....	68	70
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	16½	17

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort	1892	500,000	.....	5	.....	111½	112
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	107¼	107½
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	107¼	107¾
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D.	5	1942	102	102½
" " "	1891	1,250,000	M. & S.	6	1901	102	102½
City Pass. R. R. Co	1891	2,000,000	"	5	1911	113½	114

BOSTON STOCKS.—Corrected by R. L. Day & Co., 40 Water Street, Members of Boston Stock Exchange, Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,400,000	J. & J.	4	1887	80	82
West End Com'n	50	9,085,000	J. & J.	3	1890–1892	55¾	56

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. Staples & Co., 215 Montague Street, Brooklyn, Sept. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broooklyn City R. R. Co	10	6,000,000	Q.—J.	2	.....	.....	170
Brooklyn Traction Co., pref	100	3,000,000	.....	...	1893	65	.....
" " common	100	6,000,000	.....	...	1893	16	.....
Coney Island & Brooklyn R. R. Co	100	500,000	Oct. 1.	4	.....	.....	160
Long Island Traction Co	100	30,000,000			1893	.....	15

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	103	.....
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	.....	107
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st	.....	3,000,000	J. & J.	5	July, 1916	112	115

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. Kaufman, Charleston, S. C., Sept. 20. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	0	.....	.....	70
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by William B. Wrenn, 108 LaSalle Street, Chicago, Ill., Sept. 22.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	310	315
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	246½	247
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	131¾	132¼

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	100½	101½
Chicago Passenger	1883	400,000	F. & A.	6	1903	109½	.....
North Chicago City, 1st mort	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	100	101
North Chicago Street 1st mort	.....	2,413,000	J. & J.	5	1906	.....	103½
West Chicago Street	.....	4,160,000	M. & N.	5	.....	101⅞	102½
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	100	101½
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	102	102½

CINCINNATI STOCKS AND BONDS.—Corrected by Geo. Eustis & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Sept. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$7,500,000	Q.—J.	5	.....	105¼	105½
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	106½	107
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	63	65
" " " Pref.	100	100,000	.....	6	.....	98½	99½
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	-	.....	22½	23

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati St. Ry	.....	50,000	J. & J.	7	July, 1895	101⅛	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	99¼	100
" " extended	.....	150,000	J. & J.	5	.....	100¾	101¼
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	110½	111½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	104⅞	105¼
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	107	108
" " "	.....	300,000	J. & J.	6	Jan. 1914	105	106
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	90
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	114	115
S.Cov.& Cin. 2d Mort. gold 6's	.....	250,000	J. & J.	...	1932	113½	114½

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. Hayes & Sons, Bankers, Cleveland, O., Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co.	100	12,000,000	.....	....	1893	49	50
The Cleveland City Ry. Co	100	8,000,000	.....	....	1893	58	59

BONDS.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	100	102⅛
" " City " "	1893	2,349,000	.....			100	102

DETROIT STOCKS.—Corrected by CAMERON CURRIE & Co., Bankers and Brokers, 82 Griswold Street, Detroit, Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass., Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	200	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	125	150

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref...	100	$2,000,000	A. & O.	5	Jan. 1891	87½	88½
Louisville St. Ry. Co., com....	100	4,000,000	.....	...	Jan. 1891	35	36

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	100	101
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	116	117
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	116	117
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$600,000	J. & J.	4	.....	45	47
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	.....	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
New Haven Street Ry. Co.....	1894	600,000	J. & J.	5	Jan. 1919	.....	100
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Bridgeport Traction Co.....	1893	2,000,000	J. & J.	5	July, 1923	95	100
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 188 Common Street, New Orleans, La., Sept. 21. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.....	100	1,200,000	Quart.	1½	1867	122	124
Crescent City R. Co.....	100	1,150,000	"	3	1866	77	80
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	37	40
New Orleans City & Lake Co.	100	1,500,000	Quart.	2⅜	1860	106	.....
Orleans R. R. Co.....	50	185,000	"	2	1868	27	.....
St. Charles Street R. R. Co..	50	600,000	"	2½	1863	58⅜	60

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	....	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	100	.....
do do	1893	2,000,000	J & J	6	1943	86½	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	114	.....
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	88¾	90
St. Charles Street R. R. Co...	1881	105,000	J & D	6	'95-'01	...	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, Sept. 20. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (old stock)	50	$2,000,000	M. & N.	4	May, '91.	157¼	158
" " (new stock)	50	2,000,000	.....	...	May, '94.	152	153

BONDS.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by JAMES MCGOVERN & Co., 6 Wall St., New York, Sept. 22.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	.....	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	185	188
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	154	160
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	154	160
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	135	.....
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4½	.....	300	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	49	52
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q.—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	134	135
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	200	206
Third Avenue.....	100	5,000,000	M.—N.	4½	.....	186	188
23d St.....	100	600,000	Q.—F.	2½	.....	290	.....
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	140	.....
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	.....

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	110	111
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	106	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	106	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	107	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	103	.....
Broadway Consolidated.....	.....	7,650,000	J. & J.	5	 1943	109⅞	110
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	111	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	119	120
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	109	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	100	101
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	53	.....
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue.....	.....	7,000,000	J. & J.	5	Jan., 1937	117	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb., 1942	.....	.....

PHILADELPHIA SECURITIES.—Corrected by HUHN & GLENDINNING, 143 South Fourth st. (Bullitt Building), Philadelphia, Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	260	265
Continental.....	50	1,000,000	J.—J.	6	1873	124½	126
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	318	325
Germantown.....	50	1,500,000	Q.—J.	2¼	1858	111	113
Green & Coates.....	50	500,000	Q.—J.	3	1858	124½	126
Hestonville.....	50	2,050,000	.....	...	1859	56	57
Lombard & South.....	25	500,000	A.—O.	8	1861	90	91
People's Traction Co.....	50	10,000,000	.....	...	.....	58½	59
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	155	160
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	80	85
*Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	95	95½
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	227	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	209½	213
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	210	212
Union.....	50	1,250,000	J.—J.	9½	1864	226	230
West Philadelphia.....	50	750,000	J.—J.	10	1857	195	200
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	116½	117¾
Baltimore Traction.....	25	5,000,000	.....	1	1889	16¾	17
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co. *Ex. Allotments.	50	3,000,000	J.—J.	...	.....	12⅜	12¾

BONDS.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	107⅛	108¾
" " Imp.	1892	1,250,000	M.—S.	6	1901	101	102
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100¾	102
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	103½	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..		246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Sept. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Outstanding.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr. 306 Times Bldg., Pittsburgh, Pa., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	...	.....	19½	20
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	59¾	60
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	12⅝	12¾
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	....	63½
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	...	.....	19⅝	20¼
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	35	38½
West End R. R. Co.	50	1,000,000	J. & J.	1	.....	16	20
Second Avenue R. R. Co.	50	1,000,000	J. & J.	2	.....	.....	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.. ..	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	100,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	26	26¼

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O.	5	.927	107	110
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	106	110
Pitts. & Birmingham Traction Co	1892	.....	.....	5	.....	90	92
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	104¼	104½
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	101¾	.....
Second Ave. Electric R. R. Co		500,000	J. & J.	5	1923	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.		500,000	J. & J.	5	1922	101	102
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	.....
Suburban Rapid Transit.	.....	.....	.....	6	.....	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incl'e PlaneCo. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	200,000	J. & J.	6	1910–19	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS Bankers, Providence, Sept. 18.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	.. ..	.....

BONDS.	Date of Issue	Amo'nt Outstand'g	Interest Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	95	100
Newport St. Ry. Co.	.....	50,000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Sept. 18.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	27	30
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	58	60
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	12	18
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	38	40
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	70	75
do do Common.	100	4,000,000	.....	...	1892	19½	20
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	75	80
do do Common.	100	3,000,000	.....	...	1892	14	18
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	36	38

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	98	99
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	100	102
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	95
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	97	98
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	91	95
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	86	88

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH Broker, 440 California Street, San Francisco, Cal., Sept. 12.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	...	.....	.....	100
Geary St., Park & Ocean R.R.Co	100	1,000,000	Monthly	...	.....	.....	102
Market Street Cable Co.	.....	18,750,000	.....	...	.....	37½	38
Metropolitan Electric	.....	1,000,000	Monthly	...	.....	.....	35
Oakland, S. L. & Haywards	.....	.....	.....	...	.....	.....	1/0
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	15	20
Sutter St. R. R. Co.	.....	2,000,000	Quart'ly	...	.....	90	.....

Bonds.	Date of Issue	Am't Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	J. & J.	5	.....	105½	.....
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	.....	107
Geary St., Park & Ocean	.....	671,000	A. & O.	5	.....	105¼	.....
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	117¾	119½
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	.....	117¾
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	112	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	.....	99
Powell Street R. R.	.....	700,000	M. & S.	6	1912	107½	.....
Sutter St. Cable Co.	.....	900,000	M. & N.	5	.....	106	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Broker, Rialto Building, 218 N. 4th St., Sept. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	58	60
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue.	100	112,000	Dec. '88	2	1885	125	135
Lindell	100	2,500,000	.....	...	1890	99½	101
Missouri.	100	2,000,000	Q.—J.	2	1891	200	210
People's	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis	100	2,000,000	J. & J.	3½	1890	147	149
Fourth Street & Arsenal	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban.	100	2,500,000	.....	...	1891	17	19
Southern, Pfd.	.....	800,000	Jan. '94	3	.....	80	85
" Com.	.....	700,000	.....	...	.....	15	25

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	98	100
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	105	107
Fourth St. & Arsenal	1888	50,000	J. & J.	6	1898–1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895–1910	101	102½
Missouri Cable.	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	99	100
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable	1889	800,000	J. & J.	6	1889–1914	90	95
St. Louis Cable	1890	1,500,000	M. & N.	5	1900–1910	101	103
Union Depot	1890	4,000,000	A. & O.	6	1900–1910	104	105
Southern	1884	200,000	M. & N.	6	1904	103	105
Southern	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban	1891	1,400,000	F. & A.	5	1921	84	86
St. Louis & Suburban (Incomes)	1891	300,000	.....	6	.....	70	80

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Sept. 21. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	285	300
Metropolitan R. R.	50	750,000	Q. J.	2	1864	90	100
Columbia R. R.	50	400,000	Q. M.	1	1870	60	65
Belt R.R.	50	500,000	Q. J.	...	1875	... .	40
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	30	40
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	85

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Wash'tn & Geo'tn conv't. 1st.	'83–'99	3,000,000	J. & J.	6	1899–1929	132	135
" " " 2d.	.....	500,000	J. & J.	6	1903–1943	132	135
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1898–1911	100	102
Belt.	1921	240,000	J. & J.	6	1921	80	85
Metropolitan R. R. convert.	1901	200,000	J. & J.	5	1901	100	102

Financial.

THE petition for a receiver for the Savannah (Ga.) Electric Railway has been denied by Judge Falligant, of the Superior Court of Georgia.

$ $ $

THE directors of the Baltimore City Passenger Railway Company have voted to declare dividends semi-annually, instead of quarterly as heretofore.

THE Lynn & Boston Railway Company has petitioned for the right to issue $5,500,000, 5 per cent. bonds, for the purpose of consolidating all the bonded indebtedness of the corporation.

$ $ $

THE Brockton (Mass.) Street Railway Company has applied for permission to increase its stock to the amount of $289,000, and to issue $750,000 bonds, for the purpose of securing absolute control of the leased lines now operated by it.

$ $ $

THE receipts of the Baltimore Traction Company for the first twelve days in September were $36,650, against $32,700 for the same period last year. This is an increase of about $325 per diem. It was estimated that the earnings for the month of September will show an increase of $10,000.

$ $ $

JOHN E. KRAFT, of Kingston, N. Y., and Arthur E. Walradt have been appointed receivers of the Colonial Electric Railway Company, by Judge Alton B. Parker. The Colonial Electric Railway is one of the projects of Goodwin & Swift, of New York City, who recently made an assignment to Mr. Walradt, of New York.

$ $ $

THE following is a comparative statement of the operations of the Scranton Traction Company for the month of July: Gross earnings, 1894, $25,036.31; 1893, $23,058.37; increase, $1,977.94. Operating expenses, 1894, $13,664.38; 1893, $11,921.77; increase, $1,742.61. Net earnings, 1894, $11,371.93; 1893, $11,136.60; increase, $235.33.

$ $ $

THE following is a comparative statement of the operations of the North Shore Traction Company for the month of July: Gross earnings, 1894, $159,720.71; 1893, $160,714.63; decrease $993.92. Operating expenses, 1894, $74,596.34; 1893, $71,399.90; increase, $3,196.44. Net earnings, 1894, $85,124.37; 1893, $89,314.73; decrease, $4,190.36. For the ten months ending July 31, 1894: Gross earnings, 1894, $962,040; 1893, $926,890; increase, $35,150. Operating expenses, 1894, $613,543; 1893, $679,294; decrease, $65,751. Net earnings, 1894, $348,497; 1893, $247,596; increase, $100,901.

$ $ $

THE following is a comparative statement of the operations of the Worcester Traction Company for the month of August: Gross earnings, 1894, $33,628.05; 1893, $28,375.71; increase, $5,252.34. Operating expenses, 1894, $17,602.58; 1893, $28,688.47; decrease, $11,085.89. Net earnings, 1894, $16,025.47; loss, 1893, $312.76; increase, $16,338.23. For the eleven months ending August 31: Gross earnings, 1894, $318,797.53; 1893, $308,518.42; increase, $10,279.11. Operating expenses, 1894, $211,609.41; 1893, $239,878.44; decrease, $28,269.03. Net earnings, 1894, $107,188.12; 1893, $68,639.98; increase, $38,548.14.

$ $ $

THE following is a comparative statement of the operations of the Columbus (O.) Street Railway Company for the month of August: Gross earnings, 1894, $46,593.23; 1893, $49,045.13; decrease, $2,451.90. Operating expenses. 1894, $23,106.25; 1893, $26,606.38; decrease, $3,500.13 Net earnings, 1894, $23,486.98; 1893, $22,438.75; increase, $1,048.23. For the eight months ending August 31, the company reports: Gross earnings, 1894, $362,153.25; 1893, $359,491.17; increase, $2,662.08. Operating expenses, 1894, $174,307.18; 1893, $225,899.86; decrease, $51,592.68. Net earnings, 1894, $187,846.07; 1893, $133,591.31; increase, $54,254.76.

Issue of Trust Notes by the Brooklyn Heights Railway Company.

Owing to the expense of changes from horse to electric power of the Brooklyn City Railway, the Brooklyn Heights Railway Company, lessees of the Brooklyn City Railway, some weeks ago proposed to issue trust notes to the amount of $3,000,000, and these were to be sold at a discount of 15 to 20 per cent., making a total discount of about $450,000. Those who opposed the issuing of these notes contended that the discount was excessive, and Counselor James C. Church was engaged to draw up papers in an action to restrain the issue of $3,000,000 collateral trust notes by the Brooklyn Heights Railroad Company, and to have the company enjoined from disposing of the notes.

The company became aware of this move and resolved to defeat it, and before action was brought found a market for the notes with the New York Guaranty & Indemnity Company. This company took the whole amount, and its action of course upset the injunction proceedings.

EDWARD E. HIGGINS,
Expert in Street Railway Values and Economies.
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Norfolk & Western Railroad Company.

SHENANDOAH VALLEY ROUTE.

The Royal Blue Line & Shenandoah Valley Route will run a special train to the Atlanta Convention of the American Street Railway Association, leaving New York, October 15, 1894, at 3 P. M., and reaching Atlanta at 6 P. M. the next day.

This train will carry the representative men in the street railway and supply business. Among those who have declared their intention of going on this special train are the following named gentlemen:

Benj. Norton, president Atlantic Avenue Railroad Company.
Jas. H. McGraw, STREET RAILWAY JOURNAL.
E. Peckham, Peckham Motor Truck & Wheel Company.
Henry C. Payne, president American Street Railway Association.
P. C. Ackerman, American Electric Company.
T. E. Crossman, assistant to secretary American Street Railway Association.
E. Martin, vice-president Hamilton Street Railway Company.
C. O. Baker, Complete Electric Construction Company.
Wm. J. Richardson, secretary American Street Railway Association.
Lewis Perrine, Jr., president Trenton Passenger Railway Company, Trenton, N. J.
E. J. Wessels, Gennett Air Brake Company.
Geo. F. Porter, secretary National Electric Light Association.
J. B. Griffith, manager Hamilton Street Railway Company.
W. J. Clark, General Electric Company.
Wm. W. Cole, superintendent West Side Railroad Company, Elmira, N. Y.
H. E. Evans, The Johnson Company.
J. H. Woodward, Benedict & Burnham Manufacturing Company, Waterbury, Conn., and a number of others.

A special car will be reserved for gentlemen accompanied by ladies.

As the time is fast approaching when final arrangements should be made by those going to Atlanta, we would be glad to have your order to reserve accommodations for your party on this train.

The railroad fare will be the usual for such occasions, namely, one and a third fare for the round trip on the certificate plan, one fare going and one-third of regular rate returning.

The sleeping car fare will be the regular fare in each direction, or $6.00 a berth, New York to Atlanta; $5.50, Philadelphia to Atlanta; $4.50, Baltimore to Atlanta; $4.00, Washington to Atlanta; and double these figures for sections. Remittance for the going trip from New York, including sleeping car accommodations, one berth and meals is $34.00; from Philadelphia, $31.00; from Baltimore, $26.20; from Washington, $24.50.

If you are going, I will be pleased to receive your check at as early a date as suits your pleasure. Should you find later that you cannot go, money will be refunded on due notice.

Yours truly,
L. J. ELLIS, Eastern Passenger Agent.

The Lake Shore Route.

The Lake Shore Route, between Buffalo and Chicago, is celebrated all over the world as affording the embodiment of luxury in travel. Its new Day Coaches are sixty feet in length, and will seat fifty-eight people, comfortably. They are fitted with the Gould platform and automatic coupler, Westinghouse air brakes and signal, heated with steam taken from the locomotive, and at night are brilliantly lighted with Pintsch gas, for which purpose five elegant bronze chandeliers depend from the roof of the car.

The interior of the coaches is finished in mahogany, highly polished and paneled. Each coach has a nice lavatory and toilet. The latest models contain separate toilet rooms—one for ladies and one for gentlemen. The car seats are of the style known as the Mason tilting, with high, spring backs and broad seats. They are richly upholstered in crimson plush. The windows, which are of plate glass, are large, and each is fitted with a spring-roller curtain, in shade to blend with the interior finish, and every feature is of the best.

The Lake Shore operates a most perfect sleeping car service between the cities of Chicago, Cleveland, Buffalo, New York and Boston, in connection with the New York Central and Boston & Albany Railways. This is not only the direct, best and only double track route between the cities mentioned, but the Lake Shore is the only line from Chicago conveying passengers into New York City without a ferry transfer.***

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IS A NEW INVENTION WHICH PERMITS THE CROSSING OF CAR TRACKS AND OTHER CABLES WITHOUT ATTENTION FROM THE GRIPMAN.

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As soon as a car reaches a junction or crossing, the grip opens automatically, releases its hold and passes the junction or crossing without any attention on the part of the gripman. The grip then takes hold again automatically.

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THE COST OF EQUIPMENT IS SMALL.
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THE STREET RAILWAY JOURNAL

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THIRTEENTH ANNUAL CONVENTION

OF THE

American Street Railway Association,

Held at Atlanta, Ga., Oct. 17, 18 and 19, 1894.

PAPERS BY SPECIAL COMMITTEES.

Report of the Committee on "A Standard Form of Street Railway Accounts."

By H. I. Bettis—Committee.

On September 7, the committee sent to all the members of the Association a classification of expenditures, which could be readily adopted for use upon any road, and so arranged that any or all of these accounts can be subdivided to any degree desired by the road adopting them, without impairing its value as a basis for comparative statements. Accompanying this was a circular letter, requesting the accounting officers of the several roads to carefully examine this classification, noting such items as in their opinion are erroneously classified, and also requesting that sample reports, blanks and special rulings for account books be sent the committee for inspection. The replies received were in the main very full and complete, and showed an interest in the subject, but the number, compared with the number of members with the Association was very small, and in consequence, there was a postal sent out about two weeks later, but with little effect upon the delinquents. The results obtained from the replies received will be taken up later.

Special ruled account books and ruled forms of reports of various kinds are a *means* to *accomplish results*. To standardize the means, we must first of all seek the same or similar results. If we are seeking the uniform results, uniform methods may be employed, and will naturally *be* employed, those which are the simplest in form and manner of filling out being preferable. For this reason the committee urges you to take some steps toward adopting a standard classification, that the end to be accomplished by all will be uniform, and this done the standardizing of forms and methods of street railway accounting will follow.

At the time the subject was assigned, and until the returns came in from the circular letters, the committee was not aware that a classification of accounts had been presented to the Association at one of its earlier meetings in 1884, and long before this committee had even a speaking acquaintance with the street railway business. Had the committee been aware of the fact, it might have understood that its particular function was to prepare a set of blanks, to conform with the classification presented in 1884. It is, perhaps, just as well, for with the progress in street railway affairs in the past ten years, the classification presented then, for roads operated entirely by animal power, is nearly out of date, and it would be better to frame one which can be adapted to all classes and kinds of roads, with any or all kinds of motive power, which we believe you will find to be the case of that presented with this report.

In adopting a standard classification as a basis for reports from all roads, we must decide upon the *minimum* number of accounts into which it can be divided, and yet give all the information that the majority would desire. Each of these accounts must be carefully analyzed, and so closely defined that each particular account shall have at all times the same constituent elements on every road. This much decided, any company wishing any more detail may divide and subdivide, until there are twice or thrice the number of accounts; but still retaining the distinctive features of each particular group.

With companies formed under the laws of Great Britain, this is provided for by the "Companies Act" by which all railroad corporations are obliged to keep their accounts according to the forms and methods prescribed by the Government, and the books are regularly passed upon by a board of examiners, besides annual or semi-annual audits of the assets, liabilities accounts and vouchers by independent auditors, or chartered accountants. By this system of government supervision and inspection, the methods and reports are necessarily uniform and afford a means for comparative statements, and statistical information, unexcelled by any in the world in precision and accuracy. In the United States the Interstate Commission and the railroad commissioners of many states, have to a certain degree exercised their power in the same direction, demanding yearly reports for publication. In the case of street railways this information is only taken for purely statistical purposes, and so far as the street railway interests are concerned, it could be very well dispensed with.

An English writer upon this subject says:

"Uniformity in railway accounting in every respect is greatly to be desired. Much has already been done in this direction and the periodical reports of our English, Indian, colonial and foreign railways under English control are models of completeness. There is, however, room for improvement. If the able administrators of American railroads could see their way to adopt a more uniform method of compiling their published accounts, setting forth the particulars of capital authorized, raised and expended, revenue earnings and disbursements, assets, and liabilities on defined principles, and in a manner intelligible to any ordinary man of business, it would tend greatly to improve the value of *sound* railway securities."

This is recognized by every thinking man amongst us, especially those who have to do with the securities of our roads, and yet in the construction, equipment and operation of our tramways, we are far in advance of any country in the world, and English capitalists have not been slow to perceive this and demonstrate their faith in our work, by investing in our street railway properties. Before doing so, they prefer to have the accounts examined by an independent auditor, as is the custom among themselves, nor can we blame them for this business-like proceeding—it has been instilled into them. Were there a more uniform system of reports and accounting, there is no doubt but that the stock and bonds of our wonderful street railway properties would find an open market abroad.

The classification presented in 1884 was too elaborate for a small company, many directors and managers not caring for information in such minute detail, even on many of our largest and best equipped roads, there being seventy divisions of the operating expenses, while that submitted to you now has but thirty, and even this might be simplified.

The interests of this committee are, first, last and all the time, with the owners of the property, the stockholders and their directors, and by conjunction with the bankers who secure a market for their loans, and with the bond purchasers. These are the parties whose money and energy have built up our magnificent structures, and they should receive such information concerning the operation, earnings and expenditures as will enable them to know the value of their investment. The managers and superintendents occasionally look at these monthly reports, and are pleased to carry them before the directors in person, if the totals make a good showing, otherwise they are apt to be mailed. Results are what they all want, and it matters but little to them whether the report is divided into 100 distinctive classes of receipts and expenditures, or ten. The road has earned a certain amount, and a certain percentage of that is irrevocably gone, and the subdivision of accounts could not have saved it. This might seem to be an argument in favor of the abolition of everything but the profit and loss account, but we do not go so far as that; we would advocate that the reports be much simplified, and that the standard be simple and concise enough for the smallest road and the most conservative ideas.

The stockholders and directors, having invested their precious dollars with others in an enterprise which has given every promise of noble returns in due time, are anxious to know the results from their venture, and from time to time wish for a report which can be compared with those of other companies in the same or similar fields.

The banker who has your bonds to put upon the market, asks for a statement of your earnings and expenses from the time the road was started. There is, perhaps, another road similarly situated, and with a certain amount or capital, which, to his knowledge, has issued bonds to a certain amount, and this road is not only paying the interest on those bonds, but a certain dividend upon its stock. By a comparison of the reports of the two roads, he makes his calculations which are submitted to the dear public, and purchasers for the bonds are readily found. The creditors, too, and their name is legion, the supply men, manufacturers of cars, electrical, cable and other machinery, are all interested in your financial reports; the lawyers, judges and receivers sometimes knock at the door for a copy of this valuable document. How necessary, then, that it should be all that is required of it.

Who of all this list cares to go into the minute detail of a lengthy report? Very few, if any. These are the persons who take the greatest interest in our affairs, and they seldom have the time or the inclination to wade through the petty and cumbrous detail. Who is it, then, that has served us this "kettle of fish"? None of the parties mentioned could have laid it at their door; they don't want it. We hold the divining rod in our hand, and it points to the auditor and the accounting officer, the secretary and treasurer, the figure fiend, the statistician, assisted by those managers and superintendents who leave the road to work out its own salvation while they record its progress or degeneration, as the case may be. Statistics costing us thousands of dollars per year, laid away upon the shelf to gather the dust of ages, and, after years of repose, finally consigned to the flames. These statistical fiends appear to believe their only security is in being surrounded with such a mystery and maze of figures as will cause their colleagues to hold up their hands in amazement that any human being can exist in an atmosphere of such dense knowledge and remain perfectly sane.

Don't understand this committee to imply that all accounting officers are of this class. There are some of them who belong to the same as this committee and are perhaps too lazy to produce so much fire and perform such intricate work, but so long as the stockholders require nothing better we are secure.

In making *tests* our managers often require statistics as to mileage made by special gears, brushes, truck wheels, trolley wheels and much other similar information. This is perfectly proper and necessary at times for the good management of the road, but it is a side issue, and not to be considered in making up our standard forms. Not only should we seek uniformity in our reports, but in our methods as well. For instance, we find from the sample pages of some of the account books sent the committee that it is the custom on some roads when a bill is *paid* to charge it to the account for which the material was used. While on other roads the charge to expense is made when the material is received and by others when it is used. This committee holds that the latter is the only correct method, as when material is purchased or paid for we are simply making an exchange of cash for another form of assets, and there is no expense until the material is used.

As an illustration of the incorrectness of the first method, let us take a road which should do a splendid summer business and during the month of August there is a county fair, which makes that the best month in the year. Then we will suppose that in the early summer they purchased enough supplies to last them several months, amounting to several thousands of dollars, and the bills all fall due or are paid in August; by this method the charges for several months expense all goes into the expenses of one month. In consequence of such methods the reports for August will be very misleading, and whereas it should show up as the best in the year, it is a question if it is not the worst. Charges to expense should be made as closely as possible in the months to which they belong. When we are of one accord on matters like this, and can agree upon a classification, the balance of the work of standardizing forms of accounting will be very easy and soon accomplished.

There is but one other point upon which the committee wishes to touch, and that is the construction and equipment accounts. There is a great temptation for managers whose roads are running down on account of bad times, no travel, poor motors, bad track (all, of course, due to the mismanagement of his predecessor); we repeat, a great temptation to steer as many items as possible into the construction and equipment account. This is downright fraud, but it is done, nevertheless. Nor are the managers and accounting officers wholly to blame for this. Many of the roads are too heavily capitalized in the start, contracts are let with a huge profit for some one, and the road gets whatever may fall to its lot, sometimes only the broken crust. Burdened with a capital stock of $2,000,000, it could be paralleled by a better road, with better equipment, for perhaps half the money. Next come the bonds to the amount of another couple of millions, and secured by a mortgage upon the property. Half built in the first place, and with inferior equipment and with interest on a funded debt of more than the entire cost of the road, perhaps the officials of the company think that the game must go on, and that the particular part they are to play is to bluff it as long as possible until the receiver calls time.

The committee might dwell at length upon the distinction between the transportation charges and the maintenance charges, which was found to be somewhat confused on many of the reports sent in response to our request, but time is too short. We will say in conclusion, after careful examination of the blank forms and statements sent us, that 40 per cent. are practically the same as the reports used by the committee, and correspond in general detail with the classification submitted to you. Thirty per cent. have practically the same headings, but in each there are instances where expenditures upon the property or maintenance charges are mingled in a confused way with those expenditures which add nothing to the property, either present or future. In 5 per cent. the items are grouped under distinctive headings, but with no regard to the divisions as generally used. In 25 per cent., although the accounts are subdivided to a considerable extent, and some of them have very elaborate statements, the grouping into distinct classes is entirely ignored.

From this you may see that, should the Association adopt the classification submitted, 40 per cent. of the roads would be all right as they stand, and 30 per cent. more would need to change but two or three items—principally putting the repairs of the power plant under the same head as repairs of the balance of the equipment, where it undoubtedly belongs. Twenty-five per cent. more would but need to arrange their accounts systematically, instead of having them in a jumbled state, as most of them have the charges made to the proper accounts, but not arranged systematically in the reports.

Nearly 40 per cent of those replying to the circulars sent out by the committee expressed their approval of the classification sent them, and also a desire that it should be adopted by the Association. None said anything against it.

CLASSIFICATION OF EXPENDITURES FOR STREET RAILWAYS.

Construction and Equipment.	1.—Superintendence and Organization. 2.—Engineering. 3.—Right of Way. 4.—Building Construction. 5.—Track and Roadway Construction. 6.—Overhead Line Construction. 7.—Car Equipment. 8.—Snow Plows and Sweepers. 9.—Power Station Equipment. 10.—Tools and Machinery. 11.—Improvements and Betterments. 12.—Real Estate.

OPERATING EXPENSE.

GENERAL OPERATING EXPENSES.
- 21.—Salaries General Officers and Clerks.
- 22.—Miscellaneous Expense General Offices.
- 23.—Insurance.
- 24.—Legal Expense.
- 25.—Injuries and Damages.
- 26.—Contingent Expense.
- 27.—Park Properties.

TRANSPORTATION EXPENSE.
- 28.—Car Service.
- 29.—Car House Expense.
- 30.—Lubricants and Waste for Cars.
- 31.—Supplies.
- 32.—Wrecking.
- 33.—Operating Power House.
- 34.—Fuel.
- 35.—Lubricants and Waste for Power House.
- 36.—Water.
- 37.—Hired Power.

MAINTENANCE OF WAY AND BUILDINGS.
- 38.—Repairs Roadway and Track.
- 40.—Renewals of Rails.
- 41.—Renewals of Ties.
- 42.—Repairs and Renewals Paving.
- 43.—Repairs and Renewals Supply Wires.
- 44.—Repairs and Renewals Bldg's, Docks, &c.
- 45.—Repairs and Renewals Overhead Lines.

MAINTENANCE OF EQUIPMENT
- 46.—Repairs of Cars.
- 47.—Repairs of Electric Equipment.
- 49.—Repairs of Steam Plant.
- 50.—Repairs of Electric Plant.
- 51.—Repairs of Tools and Machinery.
- 52.—Miscellaneous Expenses.

The classification as given here is not subdivided to the extent that some might think desirable, but sufficiently for any practical purposes, as any further division would be purely statistical.

There are two principal divisions of expenditures, viz.: 1. Construction and Equipment. 2. Operating Expenses. The latter is divided into four groups: 1. General Operating Expense. 2. Transportation Expense. 3. Maintenance of Way and Buildings. 4. Maintenance of Equipment.

The construction and equipment charges only include expenditures which *add to the original value of the property.*

The first two divisions under the head of Operating Expense—i. e. *General Operating Expense and Transportation Expense*, include only such expenditures as are necessary for operating the road, while the other two divisions, viz.: *Maintenance of Way and Buildings and Maintenance of Equipment*, include all expenditures made upon the property itself, necessary to keep it in perfect repair.

These maintenance charges are purely Operating Expense, but are essentially different from the first two divisions of the Operating Expense in that they add materially to the present or future value of the property while the General and Transportation charges do not.

The classification as presented is especially prepared for electric railways, but can be easily adapted to use on cable, horse and steam roads, in fact, has been used successfully on a combination of electric, horse and steam roads.

For use upon horse roads.—All the subdivisions of General Operating Expense would be the same.

Under the head of Transportation Expense, for No. 31 would be substituted *Supplies.* Including miscellaneous supplies such as are constantly needed for the operation of horse cars and could not be chargeable to repairs.

For No. 33 would be substituted *Stable Expense*, including wages, stablemen and hostlers.

For No. 34, *Fuel*—would be substituted *Provender and Bedding.*

The latter expense in each case being that in horse roads which is offset by the corresponding expense on electric roads.

Proceeding, we would find that the subdivisions under the head of Maintenance of Way and Buildings are all right for Horse Railways except that No. 43 and No. 45 would be omitted.

EARNINGS AND EXPENSES.

	EARNINGS.	This Year.	Prev'us Year.	Increase.	Decrease.
....	Cash Fares				
....	Sale of Tickets				
....	Chartered Cars				
....	Freight				
....	Mail				
....	Express				
....	Advertising				
....	Miscellaneous Earnings				
	Gross Earnings				
Act No.	OPERATING EXPENSES. GENERAL EXPENSES.				
21	Salaries				
22	Advertising and Office Expense				
23	Insurance				
24	Legal				
25	Injuries and Damages				
26	Contingent				
27	Parks				
	Total				
	TRANSPORTATION EXPENSES.				
28	Car Service				
29	Car House Expense				
30	Lubricants and Waste for Cars				
31	Electrical Supplies				
32	Wrecking				
33	Operation Power House				
34	Fuel				
35	Lubricants and Waste for Power House				
36	Water				
37	Hired Power				
	Total				
	MAINTENANCE OF WAY AND BUILDINGS.				
38	Repairs Readbed and Track				
39	Removing Snow and Ice				
40	Renewals of Rails				
41	Renewals of Ties				
42	Repairs and Renewals Paving				
43	Repairs and Renewals Supplementary Wire				
44	Repairs Buildings and Structures				
45	Repairs Overhead Line				
	Total				
	MAINTENANCE OF EQUIPMENT.				
46	Repairs Cars				
47	Repairs Armatures and Fields				
48	Repairs all other Electrical Apparatus				
49	Repairs Steam Plant				
50	Repairs Dynamos and Switchboard				
51	Repairs Tools and Machinery				
52	Miscellaneous Expense				
	Total				
	TOTAL OPERATING EXPENSES				
	NET EARNINGS				
	FIXED CHARGES.				
	Interest Accrued				
	Taxes				
	TOTAL FIXED CHARGES				
	SURPLUS EARNINGS				
	DEFICIT				

BALANCE SHEET.

RESOURCES.		
CONSTRUCTION AND EQUIPMENT.		
Superintendence		
Engineering		
Right of Way		
Buildings and Structures		
Track and Roadway		
Overhead Line		
Cars		
Snow Plow and Sweepers		
Power Station		
Tools and Machinery		
Improvements and Betterments		
Interest and Discount		
Total Construction and Equipment		
INVESTMENTS		
Total Investments		
CASH ASSETS.		
Cash		
Accounts Receivable		
Notes Receivable		
Supplies on Hand		
Total Cash Assets		
SUNDRY ITEMS		
Treasury Stock		
Total Sundry Items		
Total Resources		
LIABILITIES.		
CAPITAL STOCK.		
The Paterson, Passaic & Rutherford Electric Ry. Co		
Total Capital Stock		
FUNDED DEBT.		
Total Funded Debt		
CURRENT LIABILITIES.		
Accounts Payable		
Notes Payable		
Total Current Liabilities		
SUNDRY ITEMS.		
Accrued Interest		
Accrued Taxes		
Total Sundry Items		
PROFIT AND LOSS.		
Total Liabilities		

(Under operating expenses item No. 39 in above form can be included in No. 38, and item No. 48 in No. 47; hence these two numbers are omitted in schedule.)

Under the head of Maintenance of Equipment, instead of No. 47, No. 49 and No. 50 we would have—*Renewals of Horses, Repairs and Renewals of Harness, Shoeing, Veterinary Services.*

To adapt this classification for use on suburban steam roads we would have the General Operating Expense the same.

Under the head of Transportation Expense. No. 28 would not include the wages of engineers and firemen, only conductors and brakemen, and for No. 33 would be substituted *Locomotive Service.* This being the corresponding expense to Operation of Power House.

All others would remain unchanged except that No. 35 would be *Lubricants and Waste for Locomotives* instead of *Power House*, and No. 37, *Hired Power*, would be omitted.

Under the head of Maintenance of Way and Buildings no change would be necessary except that as with horse roads No. 43 and No. 45 would be omitted.

Under the head of Maintenance of Equipment, for No. 47, No. 49 and No. 50 would be substituted, *Repairs of Locomotives.*

CASH STATEMENT.

RECEIPTS.		DISBURSEMENTS	
Balance from Last Month		Accounts Payable	
Cash Fares		Notes Payable	
Sale of Tickets			
Chartered Cars			
Freight			
Mail			
Express		Intrest (Sundry)	
Advertising		Interest (Coupon)	
		Dividends	
		Sundry Expenditures	
Accounts Receivable			
Notes Receivable			

RECAPITULATION.

EARNINGS, EXPENSES AND NET EARNINGS CURRENT MONTH.

	Passengers.	Motor Mileage	Trailer Mile'ge	Earnings	Expenses	Per Ct. Ex. to Earn'gs	Net Earnings	Ex. per Mile.
Mo. of '9								
" '9								
Increase.								
Decrease								

CHARGES TO CONSTRUCTION AND EQUIPMENT.

Superintendence	
Engineering	
Right of Way	
Buildings and Structures	
Track and Roadway	
Overhead Line	
Cars and Motors	
Snow Plows and Sweepers	
Power Station	
Tools and Machinery	
Improvements and Betterments	

Having had no experience with cable roads the committee cannot say just what substitution would be necessary, but feel very confident that the same classification could easily be adapted for use upon such roads as well.

CONSTRUCTION AND EQUIPMENT ACCOUNTS.

Too much care cannot be exercised in charges to these accounts. Nothing should be charged to Construction and Equipment except that which adds to the first or original cost of the property.

1. **Superintendence and Organization Expense.**
   Salaries of superintendent of construction, assistants, wages of clerks and others employed in the offices of this department. Expense of the office, furniture, fuel, lighting, supplies for office, miscellaneous and personal expense of Superintendent and assistants while on business. Includes stationery and printing for this department. Also all expenses of organization not coming under either of the following heads:
2. **Engineering.**
   Wages and expenses of engineers and draughtsmen on preliminary and construction work.
3. **Right of Way.**
   Salaries and expenses of right-of-way agent, together with payments for rights of way, easements, franchises and pole rights.
4. **Building Construction.**
   Cost of buildings; car houses, stations, offices, store houses, power house, repair shops, wharves, coal sheds, etc., etc.; also furniture and fixtures for the same.
   To this account should also be charged the cost of land occupied by the buildings mentioned.
   Real estate (land and buildings thereon) not used by the road for actual operation must be charged to Real Estate Account.
5. **Track and Roadway Construction.**
   Includes the expense of grading, surfacing, ballasting, ditching and paving; the cost of rails, rail chairs, ties and stringers, tie rods, joint fastenings, track spikes, frogs and switches, supplementary wire, tie wires, channel pins, solder and miscellaneous track material; also the cost of distributing and laying the same, with the supplementary wire and its connections.
6. **Overhead Construction.**
   Cost of poles and setting; putting up trolley, feeder and guard wires, including cost of wire and all devices for overhead construction.
7. **Car Equipment.**
   Cost of cars built or purchased, including the cost of trucks, wheels, motors, upholstering, painting, lettering, varnishing, &c.
8. **Snow Plows and Sweepers.**
   Cost of snow plows and sweepers built and purchased, including the electrical equipment for the same.
9. **Power Station Equipment.**
   Cost of steam plant, engines, boilers, pumps, piping, shafting and belting, dynamos and switchboard equipment, together with installation of the same.
10. **Tools and Machinery.**
    Cost of tools and machinery for repair shops, car houses, &c. and expense of setting and placing in running order.
11. **Improvements and Betterments.**
    All expenditures which improve the *original plant*, and of which a portion should be charged to operating, and a portion to construction expenses.
12. **Real Estate.**
    All land and buildings thereon purchased as an investment and not used by the road for actual operation.

GENERAL OPERATING EXPENSES.

21. **Salaries of General Officers and Clerks.**
    In this account are included the salaries of the general officers; the heads of departments connected with the supervision and management of the general business of the road. Salaries of division superintendents and assistants may also be charged to this account.
    By general officers are meant officers in charge of departments, and whose jurisdiction extends over the entire road.
    This account embraces the salaries of all clerks in the general offices, clerks for heads of departments, and all clerks not hereinafter mentioned.
22. **Miscellaneous Expense General Offices.**
    The expense of heating and lighting the general offices; wages of porters, messengers, etc.; telephone service and all miscellaneous supplies and expenses of the general offices, including the cost of all stationery, books, paper, stamps, pens, pencils, etc.; also cost of all printing of blanks, circulars, statements, tickets, and the cost of advertising.
23. **Insurance.**
    Includes cost of insurance on property of the company, and against injuries to employes, and all expenses of collection.
24. **Legal Expense.**
    In this account are included the salaries, fees and expenses of attorneys, witness' fees and other court expenses.
25. **Injuries and Damages.**
    Expenses on account of persons injured, and property damaged, with payments of claims, are all chargeable to this account.
    Wages of persons while disabled, medical attendance and funeral expenses; also wages of claim agent and others connected with the claim department.
    Lawyers' fees and other court expenses *are not chargeable to this account;* nor are damages to property belonging to the company.
26. **Contingent Expense.**
    This account includes the miscellaneous expenses not otherwise provided for; traveling and other expenses of general officers and assistants, etc., etc.
27. **Park Properties.**
    Includes all running expenses of parks owned or leased by the company.

TRANSPORTATION EXPENSES.

28. **Car Service.**
    This account includes the wages of conductors, motormen, starters, aids, inspectors and switchmen; cost of punches, ticket registers, sign sticks, switch sticks and miscellaneous supplies for car service.
    The wages of the superintendent of time tables and chief of conductors, with such clerks as may be under them, should also be charged to this account.
29. **Car House Expense.**
    This account includes the wages of shed foremen, shifters, cleaners, oilers, wipers, laborers, inspectors and watchmen, except such as are employed on repairs of cars.
    The cost of fuel, and lighting the car houses and sheds, lanterns and oil for watchmen, tools used by workmen on cars,

(cleaning and oiling and other work, except repairs), are chargeable to this account.

30. **Lubricants and Waste for Cars.**
Oil, grease, tallow and other lubricants, with waste used upon car journals and motors, are included in this account.

31. **Supplies.**
This account includes such supplies as are constantly needed for the operation of the electric cars, but cannot be charged to repairs, such as lamps, fuses, carbon brushes, trolley cord, etc.

32. **Wrecking.**
Wages of those employed in getting derailed cars on the track, and removing obstructions and wrecks; tools used and all other expense incurred on the same account.
Expense of getting cars back to the car house, when broken down on the line, is also chargeable to this account.

33. **Operation of Power Houses.**
This account includes wages of engineers, firemen, coal shovelers, dynamo men, oilers, cleaners and others employed in the power houses, except when employed upon repairs.
Also the cost of water, water rates, or cost of pumping where the company furnishes its own water works; carbon brushes, fuses, lamps and other supplies necessary for the daily operation of the power houses, and not otherwise provided for; cost of heating and lighting power houses.
Repairs and renewals of engines, boilers, dynamos, switchboards and station fixtures *are not chargeable to this account.* Fuel and lubricants are also chargeable to separate accounts.

34. **Fuel.**
This account includes the cost of all fuel used in the power houses, with transportation charges on the same.

35. **Lubricants and Waste for Power Houses.**
Oils, greases, tallow and waste for use in the power houses, for engines, shafting, dynamos, pumps, etc.

36. **Water.**
Cost of water when taken from local water works companies.

37. **Hired Power.**
Cost of power when taken from other electric companies.

MAINTENANCE OF WAY AND BUILDINGS.

38. **Repairs of Roadway and Track.**
This account includes all expenditures on account of the roadbed and track, *except the cost of rails and ties used, and the cost of repairs and renewals of paving, and the supplementary wire.*
It includes tracks laid in buildings, yards, on turntables, wharves and over bridges; wages of roadmasters, track foremen, laborers, watchmen and others, while engaged in track repairs and renewals.
It includes cleaning, oiling and sanding track, repairs and renewals of drains under the track, repairs and renewals of planking over bridges, repairs and renewals of frogs and switches, joint fastenings, etc., etc. It also includes repairs of rails, and all work on rails, cutting and drilling, *except drilling for tie wires.* Also labor expended in taking up track.
The cost of tools, implements and all supplies used in connection with the track are included in this account.
The expense of removing snow and ice, with the cost of repairs on snow plows and sweepers, may be made a separate account if so desired, but comes under the head of Maintenance of Way.

40. **Renewals of Rails.**
This account includes the cost of new rails laid in the track, with the transportation charges on the same, less the value of old rails taken up.
The expense of loading, unloading, drilling, cutting, laying and repairing rails *is not included in this account.*

41. **Renewals of Ties.**
This account includes the cost of new ties laid in the track and the freight on the same.
The expense of loading, unloading and laying ties *is not included in this account.*

42. **Repairs and Renewals of Paving.**
This account embraces all expenditures on account of the paving.
It includes the cost of paving blocks and sand, and the cost of transportation of the same; the wages of pavers, laborers and others, engaged in repairs and renewals of paving; also the cost of tools and other supplies for the same work.
The expense of taking up and relaying paving, when necessitated by the repairs on the roadbed, the track and the supplementary wire *is not chargeable to this account*, but to the account for which expense was incurred.

43. **Repairs and Renewals of the Supplementary Wire.**
This account includes all expenditures on account of the supplementary wire and its connections.
It includes the cost of the wire, tie connections, channel pins, solder, and other supplies, also tools and implements used in connection with the work of repairing the supplementary wires; wages of solderers, laborers and others, engaged upon this work.
The expense of drilling rails for channel pins and tie wire rivets, is also chargeable to this account.
Expense on the supplementary wires, necessitated by the taking up of rails, ties, switches, frogs, etc., *are not chargeable to this account*, but to repairs of roadway and track.
Expense on the supplementary wires necessitated by the taking up or laying of paving should be charged to the account of paving.

44. **Repairs and Renewals of Buildings, Docks and Wharves.**
This account includes the cost of repairs and renewals of all buildings, docks and wharves, and of the stationary fixtures and furniture of the same, not otherwise provided for; car houses and sheds, store houses, car shops, repair shops, blacksmith and machine shops, power houses, coal sheds and bins, stations, etc., etc.
Repairs of pits in car houses and shops, cranes in power houses and coal sheds, etc., are embraced in this account.
Repairs of tracks in buildings and on wharves, *are not chargeable to this account.*

45. **Repairs and Renewals of Poles and Overhead Lines.**
The account includes the cost of repairs and renewals of poles and brackets, with trolley, span, guard and feed wires, with all appliances for suspension and insulation of the same.

MAINTENANCE OF EQUIPMENT.

46. **Repairs of Cars.**
This account includes the cost of all repairs on car bodies, painting, varnishing, upholstering, re-lettering cars and car signs; repairs and renewals of the trucks, brakes, brake shoes, axle boxes, springs, track brushes, snow scrapers, pilots, sand boxes, etc.; repairs and renewals of wheels and axles.
The cost of new cars taking the place of old to make the number good, are also chargeable to this account.
On roads using both motor and tow cars it is sometimes advisable to keep each kind separately.

47. **Repairs of Electrical Equipment.**
This includes the repairs of motors, their parts and connections, the labor of removing damaged parts and replacing same when repaired.
Armatures, fields, gears, pinions, controllers, switches, trolleys, lightning arresters, brush holders, cables, etc., all come under this head.
New motors or parts purchased or made and put in to replace those damaged or worn out must be charged to this account also.

49 **Repairs of Steam Plant.**
To this account should be charged all repairs and renewals of the steam plant in the power house, including the boilers, engines, pumps and shafting, repairs and renewals of belts, piping, steam fitting, etc.

50. **Repairs of Electrical Plant.**
Repairs and renewals of dynamos and their parts; armatures, fields, pulleys, commutators, oilers, bearings and boxes, brush holders, etc., are chargeable to this account; also labor removing and replacing damaged parts.
Repairs and renewals of the switchboard equipment are also charged to this account, such as repairs and renewals of station switches, rheostats, circuit breakers, ammeters, wiring and connections.

51. **Tools and Machinery.**
Repairs and renewals of tools and machinery, shafting, boilers, engines, etc., in the shops of the company; also cost of lubricants for the same.
Small tools (not shop fixtures) are chargeable to the account most benefited by them.

52. **Miscellaneous Expense.**
To this account should be charged all miscellaneous expense of maintenance and equipment, not otherwise provided for.

Report of the Committee on "City and Suburban Electric Railways."

BY E. C. FOSTER—Committee.

The subject that has been assigned to me for discussion, that of "City and Suburban Electric Railways," is decidedly a comprehensive one. Inasmuch as the interurban electric railways are comparatively few, it covers nearly the whole electric railway field. The latter class of roads is a growing one, however, and, as my work is in connection with lines of this kind, connecting Boston with the smaller cities surrounding it on the north, I shall assume that it is excusable in me to devote a considerable part of this paper to the consideration of the interurban roads.

It is difficult to make the distinction between city roads and suburban roads. The function of nearly all city roads is largely to convey the people from the residential districts, mainly in the suburbs, to the business sections, and likewise, from the latter to the former. In the improvements it has made in this class of transportation, lie the greatest benefits of the application of electricity to street car propulsion. The growth of our great cities has resulted in the appreciation of value of all real estate near the business sections, to a point where the only residence a working man can afford in these districts is a tenement house. These tenements are invariably crowded to a degree that is unhealthful. That the electric railway has done much for humanity in enabling the working population to leave these homes in the congested

districts, and procure more comfortable and respectable ones in the suburbs, goes without saying.

Next to this most important use of the electric railways comes their use in furnishing recreation for the masses of the people. Nothing accomplishes so much in the elevation of our population as frequent opportunity to cultivate acquaintance with nature. Optimism is the natural and healthy condition of the mind, and nothing encourages one to look on the bright side of life as does a ride or ramble through the country. The combination of fresh air and pretty scenery makes the only tonic that tones. The two necessary considerations in the accomplishment of the scheme of country air for the masses are, first, the public parks, and, second, the means of transportation to them. It is only within the past year that, in the state of Massachusetts, a State Public Park Commission has been created for the purpose of purchasing large tracts of land and opening them to the public, that they may enjoy the beauties of nature without trespassing upon private property. On a portion of the Blue Hills, only ten miles distant from the heart of the city of Boston, over 1,200 acres have been secured to be preserved forever for the benefit of the people. Also, in Arlington, a like distance in another direction, a large reservation is made; Middlesex Falls in another, and the Commission is now turning its attention to the shores of Revere Beach, immediately north of the city, one of the grandest beaches of this continent. It is needless to add that the street railway companies are doing their share in the matter of providing the necessary transportation. While their motives are not purely philanthropic, the results accomplished are of almost as substantial benefit as though the people only were considered. While this fact is very greatly appreciated, there seems to exist a growing feeling, on the part of some, that the street railway companies get everything and give nothing. Certainly the very evident benefits the people have secured, coupled with the fact that few companies have earned more than moderate dividends, and many none, should be enough to convince the most skeptical that the stockholder's experience is not always a profitable one.

However, I presume that it was not expected of me to devote this paper to a demonstration of the advantages accruing from the existence of electric railways, but rather to consider the question of the operation of roads, and the projection and construction of new lines. It seems almost useless for me to tell you, who know, certainly as well as, if not better than, I, how to operate existing roads, and how to determine what lines will pay, and under what conditions of fares and traffic. When I say, hereinafter, that such a thing should be so, even though it be without modification, you must understand that I offer such only as my opinion, formed from my own experience, and not necessarily as an established fact.

As a road is projected, and studied from a financial point of view, first, then constructed, and then operated, it may be well to consider these topics in this same order. The first point, covering the work preliminary to the construction, admits of nothing but rather general discussion. As it is not the purpose of this paper to consider roads built to yield their dividends in benefits to allied interests, as in developing real estate, it may be taken for granted that the question of primal importance, in the consideration of a proposed line, is its probable earning capacity. The stimulation to the growth of the country crossed may be considered, only in the reflex effect that such growth may have upon the business of the road. A line to pay should be one that makes itself a necessity to the people, in offering them the best facilities for transportation in the particular direction. Competing lines should be avoided, excepting where the volume of business is large enough to support both. Besides the assurance that the line is necessary to the people accommodated, it must be ascertained that the number of the latter is large enough to support the road on a paying basis, not only the first year, when the repairs are slight, but later, when reconstruction becomes necessary. I consider that there are very few cases where a company is warranted in investing its money in a line, on the strength alone of the future that may be expected from it. A road should be, at least, capable of earning its operating expenses from the start, and the evidence of a more prosperous time, later on, should be very strong, before it is constructed without immediate promise of good dividends. It is sometimes necessary for an established company to build on a location, merely to keep out competition. The only thing that warrants this is the knowledge that the opportunity exists for the proposed competing company to be self-supporting from the start, and ultimately a serious rival. Otherwise, it is economy to allow it to build the road, and buy it out at the foreclosure sale.

Track construction is a subject that has been so thoroughly discussed in all its details, that I shall not attempt to do more than express my opinion, in a general way, as to what forms are best suited for the various demands of the suburban roads. The kind of construction most desirable for a certain location depends, of course, entirely upon the particular conditions. For roads connecting towns, I think that it is often possible to secure an independent right of way for a very slight cost per mile, and very often for nothing; this might require special legislation. Progressive land owners realize that the one way to enhance the value of their real estate, is to put it within means of easy communication with the surrounding neighborhood, and especially the principal town. For this reason they are often willing to give the necessary land for an electric railway—without any undesirable conditions or restrictions—and oftentimes to contribute something toward the grading. If, in this way, the right of way can be obtained that is desirable as to route and grade, it offers many advantages that cannot be had on public highways. For such a right of way, the regular steam road form of construction would be employed. About a sixty pound T rail, 6 × 7 in. oak or chestnut ties, laid two feet centers, needle switches with lever throw, etc., would give a track that would allow a speed of forty miles an hour, making it necessary to slacken speed only for curves, and as much for switches as the overhead construction demanded, the track switches requiring no reduction of speed. Curves, in such a road, should be few, and of the longest possible radii.

Where it is decided to build on country roads, a location at the side of the road is, of course, preferable. Here T rail may be laid, and the track filled with gravel, covering the ties and leaving the heads of the rails entirely exposed.

In the streets of smaller towns, where permission can be obtained, it is also desirable to lay T rail, although there is always more or less trouble maintaining the paved brow that is usually required, and consequent difficulty in plowing snow from the track, due to the shears and diggers of the plow striking the partially displaced blocks.

In city streets, and others that are paved, the girder rail seems to be the only one suitable. In order to obtain the necessary depth for paving, this rail should be nine inches deep, and should weigh about ninety pounds per yard. This makes very expensive construction, but the expense is justifiable, when the conditions are considered. While such construction is necessary, where laid in streets paved from curb to curb, it is an open question in my mind as to what is best in macadam streets. There are many lines that are operated on fifteen or thirty minutes, or even on hourly intervals, where the business is hardly such as to warrant the use of track construction, costing from $20,000 to $30,000 per mile. The frequency of the service is an important factor in determining the most economical construction for use under particular conditions, and I think that the nine inch girder rail ceases to become a necessity, and becomes a luxury, when the number of cars run over it daily is reduced below a certain figure. Further, there are positive objections to the use of such rigid construction as this in dirty streets, as in macadam streets where the top dressing contains a greal deal besides stone. My experience has been that the rail becomes covered with dirt, and that the cars rattle and "chatter" badly in running over it, more than in running over a dirty rail of less rigidity. It may seem revolutionary to suggest it, but I think that, for certain places, it is at least worth while to consider relaying good tram rail, using some approved form of joint plate. I am not quite convinced in my own mind that there are conditions existing where this is warrantable, but the subject is certainly worthy of discussion and consideration.

Overhead line construction has kept pace in its improvements with those of the other branches of electric railway work, and the success that has been had with the lines built during the early periods of development, encourages one in the belief that modern lines may be depended upon to give little trouble.

Regarding equipment, my idea is that the longest car that can be operated successfully on four wheels, is the most desirable for the ordinary conditions. For long distance lines having heavy traffic, I would recommend thirty foot bodies, on double trucks, for box cars, and fifteen bench open bodies, on similar trucks. Where there is a sufficient demand, I should run a combination smoking and baggage car, as the trail car of a train of two.

In building a new road for short distance travel, I should give all curves the necessary radii for the use of seven foot wheel bases through them, and have trucks this standard. On these trucks, I should use twenty foot box cars and ten bench open cars, either class measuring about twenty-nine feet six inches over the buffers. As a supplement to the regular equipment of motor cars, I recommend trailers, and that they may be run economically, a power brake is necessary. To meet this demand, the air brake is being developed, and promises to fill the

requirements. For convenience in attaching trailers to motor cars, automatic couplers are necessary. There are several forms of latch couplings that can be made to do the work satisfactorily. An important thing in connection with the use of trailers is the adoption of, and adherence to, a standard, that all buffers and drawbars may be of one height, and other parts right for the proper operation of cars in trains.

For electrical equipment, it goes without saying that the modern multipolar, single reduction motors, with series parallel controllers, are the only ones that a road can afford to use. The performance of the various equipments, now manufactured by the different companies, has been so universally satisfactory, that I feel that a great deal has been accomplished in the past two years in the development of the car equipment.

I am a firm believer in the desirability of heating all cars in the North, thinking that it has a very important effect upon receipts. As much as I like the results obtained from electric heating, I hardly feel that we can depend upon this method. Our experience is that it takes from eight to twelve amperes to keep a twenty foot car comfortable, that is, 40 degs. above the outside temperature. This means that it requires about as much current per hour as to propel a car four miles. This would make seventy-two car miles of power per day of eighteen hours, chargeable against the heaters. When it is considered that this extra power is often demanded when power is needed for other purposes, as in snow storms, it may be seen that, aside from the question of cost of coal, the consideration of the necessary increased capacity of the power station and feeder system is an important one. Having put myself on record as opposed to electrically heated cars, it is probably expected of me that I present a method that is satisfactory. Unfortunately, though, this I am unable to do. For short trips, run from a car house, the hot water storage system may do. We still depend upon the stove, and "with all its faults we love it still," until we can find something that we consider an improvement upon it.

It is not improbable that before long a telephone will be considered a necessary part of the equipment of each car operated on suburban lines. It often happens that means of communication with the nearest car house, or with the starter, would save much delay, and even danger, in cases of cars disabled or thrown off their schedule time by other causes. Either a telephone in each car, with means of plugging in on convenient poles, or 'phones, arranged at the turn-outs, in boxes, may be used. As a substitute for this arrangement, or in connection with it, a system of signals between turn-outs may be desirable under certain conditions. By the use of lantern boxes containing incandescent lamps, and the necessary hand or automatic switches, a simple system of signals may be devised, by means of which cars running between turn-outs on single track lines will be protected from meeting other cars.

While these devices may be necessary in some cases, they will always be more or less burdens, in the complications they add. The signal system, especially, has one important objection. Regardless of the most carefully enforced rules to the contrary, men will learn to consider it as freeing them from the necessity of maintaining the same careful lookout for approaching cars, and in cases of failure of the signals accidents will be more likely to occur than they would without the signal system.

The adoption of a proper schedule of fares and transfers is a most important matter. Where lines are short enough to allow the use of one standard fare throughout, this question is a simple one, but where routes are longer, and it becomes necessary to collect higher fares, complication commences. When this latter condition is aggravated by systems of transfers, the complexity increases. My experience has been that, in general, it is best to divide such a line into sections, collecting a single fare in each, and registering all as the standard fares. These sections are arbitrary of course, but in our case are determined by town boundary lines. For instance, where we have a line running through several towns, we collect a single five cent fare in each town. In connection with this, I would say that there are instances where further restrictions need to be made. Cases have arisen where towns of large area have comparatively small centers of population, a long distance apart. Single fares have been established as being good anywhere within the limits of either town. A line is then built connecting the two towns, and instead of ten cents it is considered necessary to get fifteen cent fares. The question then arises as to how the required three sections can be arranged. According to established precedent, the five cent fare sections include each whole town, although the line in question did not exist when this understanding was originated. In this case, however, it becomes necessary to establish the third section as including that part of the line between the boundaries of the more thickly populated portions of the towns, and including the intervening open country in both towns. As an exception to this method of paying fares "on the installment plan" I would mention the case where there exists a very heavy through traffic on a line compared with which the local traffic is slight. In this case I consider it best to collect the whole fare at once, issuing to the through passengers conductors' private checks. These latter are held by the passenger as evidence that he has paid through fare, and surrendered to the conductor before the end of the trip.

The selection of the best rate of fares is a matter requiring the consideration of numerous conditions governing the particular case in question. It is safe to assume that the result to be worked for is the earning of the largest possible net revenue, considering, at the same time, the development of the business. Exactly the best way to accomplish this is the problem to solve. The expense of operating may be approximated reasonably close. It is more difficult, however, to determine the amount of traffic that different rates of fare may bring. It is well to study the classes of travel that may be expected, and fix such a basis of rates as will probably yield the largest margin of profit. After having done this, the basis thus determined may be increased by a considerable percentage, and this new basis adopted as one to use in opening the road. As every one knows, it is a simple matter to decrease fares, and, while I do not believe in starting out with high rates merely for the opportunity of obtaining the credit of cutting them at some future time, I do consider that it is necessary to have a margin of safety to avoid the possibility of being burdened with rates that are too low, and cannot possibly be raised. In this state, with the existence of a law making it illegal for railroad companies to withdraw transfer checks issued without permission from the railroad commissioners, it becomes more than ever necessary to very carefully consider all proposed changes, studying them especially as to their probable effect in the future, when the road has developed and taken in new territory. It is aggravating to see the opportunity for a new line, into a district that might naturally be expected to pay, by means of a rate of fare higher than the standard, and have the fact of a previously established rate, that can be construed over the line in question, standing in the way of the consummation of the scheme. I consider one and a fourth cents per mile a minimum rate for the basis of a system of fares, no fare to be less than five cents, and would advise the establishing of higher rates, up to two cents, as the particular conditions would seem to recommend.

In certain cases I think it advisable to sell round trip tickets. Our fare from Lynn to Boston is fifteen cents, but we sell two tickets for twenty-five cents. We think that the possession of this return ticket leads people to use our cars when they would otherwise patronize the steam roads. We have no other commutation excepting workingmen's tickets over certain routes, good only during the hours of six and seven morning and evening.

Transfers may be used within reasonable distances. The system must, of course, be carefully worked out, to avoid the possibility of abuse. In all of our efforts to be just to the public we cannot lose sight of the fact that the public is not just to us when it can avoid being, and that it behooves us to take the necessary precautions to protect ourselves, inasmuch as the popular moral code includes no provision for our protection. The existence of this unfortunate condition of affairs demands that we use care to prevent the abuse of the privilege we grant the public, the most common form of which abuse is the failure to observe the "not transferable" restriction.

Suburban roads work at a disadvantage compared with city roads, when the question of operating expense is considered. There are many reasons why a given number of cars can be operated for less money, within a small territory, than when spread over a large area. These reasons are obvious. In the former case a large number of cars may be cared for in one car house, thus allowing a minimum expense of maintenance. A small car house cannot afford the motor tables, traveling cranes, etc., that do so much to lessen the cost of motor and truck repair, nor can the work of the small house be divided among different men, giving each his specialty, as in a large house. In one of the largest car houses in the world, the Lenox Street house, of the West End Street Railway Company, of Boston, two men fill all grease cups, examine and replace brushes, and inspect other parts of the motors of from 120 to 150 cars, daily. The other work in this house is divided up among some twenty men, including carpenters and blacksmiths, so that the average is about six cars per man. This number of cars per man is often assigned, but probably the work is seldom so well done as in this house. Another important disadvantage under which the suburban road labors is that of the high cost of power. It

usually is dependent upon a number of small stations, due to the fact that it is impossible to cover the necessary territory from one station, and both the labor and coal consumption of small stations are necessarily greater per car mile than are those of large ones. The opportunities of making the expense in the first instance, that of car house work, compare favorably in the small house with the large are rather few. They lie in the dependence upon one capable man, circulating among the houses, directing the efforts of lower priced labor. Another idea that suggests itself is the equipping of one house with a complete outfit of labor saving appliances, and bringing all unusual repairs to this house. This is objectionable, however, in that it requires the moving of cars over long distances, at a time when they are least in condition; and, further, that it makes two gangs of men responsible for the care of the cars. Regarding the elimination of the difference in power costs, now existing in favor of the city road, the indications are that the time is coming when it will be no longer necessary for the country road to maintain its numerous steam plants. I refer to the probable introduction of the alternating system of long distance electrical transmission into railway work. Suppose the case where it becomes necessary to distribute power for railway purposes over large areas, as on many suburban roads where several power stations are now used. With this system, there need be but one main power station, which can be located at the point possessing the greatest advantages for cheap production of power. At various selected places rotary transformers may be placed, one for each section of road. These receive alternating current, over long distance lines, from the main station, and deliver it as direct current to the trolley wires, or possibly to such local feeders as may be necessary for the distribution throughout the particular section. These rotary transformers require only the same care as generators. Besides them, the only apparatus in the sub-station, needing attention, would be the circuit breakers. The latter would be arranged between the rotary transformers and the lines, in the same way that those in the present stations are. It will be seen, therefore, that one ordinary dynamo tender would be all the labor required in a sub-station. Further than this, the sub-station might often be in car houses, where one of the regular employes could care for the machinery, thus reducing the labor charge to a minimum. By this arrangement, power could be distributed to cars operating over areas of from twenty-five to fifty miles radius from one station, at cost slightly above that for distribution within the ordinary distances of present practice. I am told that, with such a system, using 6,000 volts, three phase currents, from a station located at the central point, we could supply power, by the use of three No. 0 B. & S. wires, to a road fifty miles in length, when fifty cars were being operated. The total efficiency of this transmission, neglecting the loss in the trolley wires, would be about 65 per cent. These fifty cars, on the fifty mile road, would give fifteen minutes headway, with a speed of eight miles per hour. With the higher speed, that would more probably fit the conditions of such a road, the number of cars would be reduced, allowing a proportionate decrease in the size of the wires, so long as the current allowance, twenty amperes per car, was sufficient. To accomplish these same results, with the present system of 500 volts would require 600 No. 0 B. & S. wires, the use of which would, of course, be impracticable.

While this system has many advantages which are sure to result in its extensive application, it has its attendant disadvantages which must be overcome. Most important of these is the difficulty of insulating the lines. Practice has been to use bare wire, simply because the covering is of no use with such voltages. The principal use of the insulation on the majority of overhead wires is a sentimental one. The public prefers the appearance of the covering to the bare wire. It is probable that it will be wise to recognize the existence of this preference, and cover the wires, merely to save comment. The most serious difficulty, however, lies in the fact that it seems to be absolutely necessary to keep the wires out of the trees. Geo. D. Johnson, superintendent of the Hartford Electric Light Company, writes that a twig short circuits their 5,700 volt mains, almost as readily as a wire.

It will be evident that the adoption of a long distance transmission system will admit of the use of any suitable water power that may be located too far away to be available under the direct method of transmission.

Although I have discussed no branch of my subject sufficiently in detail to treat it thoroughly, I feel that I have already taken more than my share of your time. In conclusion, I would say that I have very great faith in the future of the electric railway. It has demonstrated its ability to live through periods of adversity. The lesson in economy that the country in general has had has taught us a great deal with the rest. Roads that have paid expenses, during the past two years, will have nice margins of profits left from the receipts of the years to come, and those that have paid their dividends will pay larger ones, and add to their sinking funds. While a considerable part of the curtailment made necessary by reduced receipts, has been in the line of the sacrifice of repairs that should be made in prosperous times, there have been many unnecessary expenses brought to light and cut off. Things which we thought necessities proved to have been luxuries, when we learned how well we could do without them. I am a firm believer in the policy of putting everything into the best of condition and keeping it so, as being the one that yields the largest net revenue, present and future, but I realize now, better than I did two years ago, that in our zeal to have the best of everything, kept in the best of condition, we allow extravagances to creep in, with the necessary expenditures. The education in economy that we have gained will help us wonderfully in the future, and the combination of increased earnings and reduced expenditures will give an increase in the net revenue that will be substantial.

Report of the Committee on "Transfers on Street Railways."

By J. N. Beckley—Committee.

The carrying of a passenger from any part of a city, reached by the lines of a street railway, to any other part of such city, reached by the lines of the same railway, for a single fare, is, speaking broadly, a new thing in street railway operation. Ten years, even five years, ago the manager who had the temerity to advise his board of directors to establish a liberal transfer system would have, probably, been regarded as unfit for his position. To-day, the most successful companies have come to realize that in this matter of transfers, as well as in other matters, it pays to treat the riding public liberally.

One of the most important things to do, and to do promptly, is to educate the average man and woman to ride. That this is largely a matter of education every street railway manager knows. When a new line is opened, even through a thickly settled district, the people for some time continue to walk. Bad weather, the neeessity of haste or some other thing induces a person to ride once. The next time he rides with less inducement, especially if the cars are clean, the service prompt, and if he does not have to pay more than five cents to get to his destination. So the habit grows, and soon the rule is to ride, when, before, it was the exception. A liberal transfer system, properly guarded to prevent fraud, pays. This is, I think, now generally recognized. Local conditions and arrangements of lines must be considered in determining the regulations to be adopted. The rules intended to safeguard the company are important. Perhaps equally important is the making of rules broad enough to encourage riding.

If a transfer system is adopted, it is best not to hedge it in too much by narrow restrictions or to so complicate its details, as to involve labor and expend money unnecessarily. It is expedient also to appear to be making most liberal concessions to the public—especially as such concessions—presumptive or real—conduce to our own benefit. The punching "to and from"—the limit of privilege to use at absolute junctions as fixed spots—different forms, and even different colors for different issuing lines, may in most cases be avoided. If we secure a proper form of ticket, we can be protected in less complicated ways, and it is usually possible with careful arrangement to cover all requirements in one form. If series and consecutive numbers be employed, we can easily trace all issues by them instead of by old methods. If we use the series and consecutive numbers, we allot a certain quantity of tickets to each conductor and follow him by them, and should avoid minor details that interfere with or complicate the more important ones.

The ticket should be of liberal size to permit legible type and prevent crowded matter.

It should be bound in pads of 100, and the pad be so exactly arranged as to permit punching ten or more in one action of the punch. This feature permits canceling the month and day, and often the time, ten or more at once and accurately, and frequently several of the same destination. It is of great advantage to secure full "month," "days" and "time" space on each ticket—that can be accurately and quickly punched, and it forestalls the waste, expense and detail consequent upon daily dated tickets, while it gives equal protection without delay anywhere.

The subject matter ingeniously arranged can and should comprehend in one form all needed rules. "Good for this current trip—at point of change—on next car after time canceled—to destination

punched," illustrates this. "Subject to rules of company," covers several dozen words of the old form with equal rigidity. Special conditions may vary this, but in most cases it is restriction enough.

"A series number"—"conductor's number"—"run," of "car" number, or some such designation on each ticket will identify the issuer perfectly, and the consecutive number will trace the issue, hold it to sequence in use, and prevent tampering and fraud. We have some 200 conductors. Each has a stock of 25,000 tickets to begin with, renewed as used. One transfer department has 250 compartments on the wall of the room to hold these tickets (thus providing for increase in conductors), each of 25,000 capacity, so they are all systematically arranged in simple order, one compartment for the tickets of each conductor. The conductor turns in his unused transfers at the end of the day's work, and they are put in his compartment, and given out again to him on beginning work next day. A simple record book keeps this account; one double page for each conductor covers his transactions for the whole year, and shows at a glance each individual transfer account, for comparison or aggregating statistics.

Forenoon and afternoon are distinguished by light and black print in the destination blocks, and by the system we use we get month and day *one* punching each (but always preliminary, the conductor keeping these punched ahead in readiness), and *one* punch for time (even hour or ten minute interval) and *one* for destination. I need not explain that such a ticket supplants the expensive duplex form—for it is equally protective—nor enter upon any argument in favor of the absolute need of a short time limit. The day limit, A. M. or P. M. limit, or even the hour limit is of a by-gone day, too leaky to be considered, and very few companies now use it.

It is important, in my judgment, to arrange the form clearly, each section; name, rules, time, days, months, destination, series and consecutive number, to have a distinct and spacious position and be clearly defined by itself, not scattered about. It is also very important, in order to foster accuracy with rapidity, to so arrange the reading matter that the ticket shall be punched and read as punched, all one way, being held by thumb and finger of the left hand and punched with the right. Inverting and twisting the ticket not only takes time, delaying traffic, but increases inaccuracy. The ticket should be arranged in every detail so as to be within the mental grasp of the average conductor, and so as to make it easier for him to go right than to go wrong, easier to be quick than compelled to be slow. Regular horizontal and vertical lines soon fix themselves on the dullest intellect, but scattered details, hopping about a ticket, often puzzle the brighter ones.

In order that all punching may be done before tearing off the ticket from the stub, and that all possible advantage of the pad form and multiple punching can be secured, all sections to be punched should be arranged on the lower side and right hand end if possible.

The pad form saves counting the 100s, while the consecutive number counts the broken pads. The pad form is most convenient in handling in the office or on the cars, and saves time wherever used in giving out, in issuing or receiving or in taking stock. The use of the months is not important. If there be room for them there is no objection, as with the pad form they are no obstacle to quick service, as they can be punched in advance of use. Many companies omit them as the other restrictions practically give little opportunity for fraudulent use after thirty days. By beginning the consecutive number of each pad at 0, 100, 200, etc., we save complication in subtracting, as then the consecutive number on the upper remaining ticket instantly shows how many tickets have been removed.

The consecutive number is not only useful in counting, but compels proper use of the tickets. In conjunction with the timetable each ticket must show when turned in that it was issued in sequence of number and in sequence of time. No. 6,230, say, is issued at 9.30 A. M. Nos. 6,231 and 6,232 may not be returned at all, but if they are they must show issue in direct sequence of time. If not so, the series number tells us instantly who issued the ticket, and the man is spotted and the wrong exposed, for tickets cannot be abstracted and punched for future use as they will not fall within proper time limit and in proper sequence. We make conductors note on the daily car report the consecutive number of the transfer with which the day's work begins and the consecutive number with which it ends. At the close of each trip each conductor turns in the transfers taken in on such trip in a special trip envelope, dropping them in a box prepared for that peculiar purpose. This box is placed at our grand junction which all cars pass, but a number of such boxes could be used where different conditions obtain. We know at once who wrongly issued a transfer, and who received it and when it was done. A notice in our cars requires the passenger to ask for a transfer when fare is paid. This rule enables the conductor to issue transfers at his convenience, and distributes the labor of so doing instead of massing it at certain junctions, with confusion and delay.

Nor is it necessary to resort to tickets on a roll or in metal clasps or such devices for protection. The roll method necessitates single issues, singly punched, and loses the advantage of multiple punching, while it delays traffic and increases chances of error. The metal bound tickets add expense, but do not increase protection. Tickets may be just as easily abstracted in advance of proper use as in the pad form—so they may in the roll, for that matter. Real protection lies only in the system, not in the binding. Conductors cannot sell, trade or exchange transfers with series, consecutive numbers and timetable, without detection, and if the transfers be turned in on every trip detection is a very simple process, requiring no elaborate and costly inspection.

A special register for transfers, and so eliminating their cash value, doesn't help us. It confuses the conductor and paralyzes the spotter, and without a protected form of ticket, conductors can collect fares and ring them up on the register, and turn in each other's transfers to balance the account.

By putting the transfer business into the hands of the conductors, we cater to the convenience of passengers, and we obviate delays in traffic, consequent upon stopping cars to transfer. We save the large expense of transfer agents, and, in my judgment, do not increase leakage, for it is as easy for transfer agents to stand in with conductors to defraud the company, as it is for conductors to combine with each other. The numerous and continual frauds perpetrated upon transfer agents, by people who get transfers without having paid any fare, is too well understood to require discussion.

We have adopted a system of "faces identification" for moral effect, and especially for use at the noon hour, when abuse in transfers is most frequent. As soon as we have converted our stock of tickets to the new form, we shall put them into effect. They are, I understand, now in use in Minneapolis, St. Paul, New Haven, Binghamton and Scranton.

In conclusion, I need only add that our liberal system of transfer has proved a good investment, and that our form of ticket is efficient and protective. Simple, convenient and safe, yet systematic, distinct and business-like, it protects our interests, while it saves us all former waste and a vast amount of useless labor.

Report of the Committee on "Can the T Rail Be Satisfactorily Used on Paved Streets?"

BY STRATHEARN HENDRIE—Committee.

For reasons unnecessary to mention, your committee's report has been prepared with more haste than the subject deserves, and you will undoubtedly find it incomplete in many details. A vivid recollection, however, of the disappointment of your members at previous meetings, when papers have failed to materialize, has emboldened us to present this report in its incomplete state, as better than no report at all, and as continuing the discussion of a subject, in which so much interest was expressed at the last convention.

We would preface our report by the explanation that we have considered the word "satisfactorily," as applying to the point of view of the city and the driving public, as well as that of the company; and we will endeavor to show that the T rail is not only satisfactorily used in paved streets, but that it is the best rail for the purpose.

The tendency of the larger cities in this country—in fact we might say in all the cities of this country—during the past ten or twelve years has been towards smoother and better paved streets, and the general public, watching the progress of its city officials, has become in many places impatient of the action of the street railway people in maintaining the old forms of rail, which make a ridge on the smooth surface of a first class modern street in an American city. Our travelers have come home from England and the Continent extolling the grooved rail, and our city officials have in many cases forced either the English grooved rail or its American modification upon the railway companies. No street railway man hankers after the grooved head before he gets it, or enjoys it after he has put it in, and he therefore fights its introduction, demanding to be left alone, as he was, with his center bearing or five inch tram head. What we would show him—and through and beyond him his public—is that he can progress in the direction of their desires for a smooth street, and can give them something even more satisfactory to them than their favorite grooved rail.

For the street railway man, questions of price, joints, quick deliv-

T RAIL IN PAVED STREETS.

Place.	Company.	RAIL IN PAVED STREETS.				Construction.	PAVEMENT.		Filling.	REMARKS.
		Miles T.	Other rail.	Weight.	Height.		Inside.	Outside.		
Augusta, Ga.	Augusta Ry. Co.	.5	3.5	56 lb.	3½"	Ties 3 ft. centers, steel chairs	Brick	3 in. brick, then asphalt	None	Public and officials think it better than girder
Bay City, Mich.	Bay Cities Con. Ry. Co.	8	11	60 lb.	6"		Granite block	Same	Oak strip, gravel, etc.	City Engineer and B. of P. W. think it the only rail
Boston, Mass.	West End St. Ry. Co	24	215	35 to 100 lb.	1¾" to 9"	Largely 6 ft. rail on stringers and 9 in. on ties with tie plate	Brick	Same	Hardwood covered with coal tar	City officials and the public are not in favor of it
Columbus, O.	Columbus St. Ry. Co.	.5	54.5	60 lb.	6"	Ties 2 ft. centers, broken stone ballast	Asphalt with stone toothing	Same	None	No complaint; more will be laid
Denver, Colo.	Denver City Cable Ry. Co.	6			4"	Cable; yokes 4 ft. apart	Stone blocks, next rail, then asph.	Stone block	Oak strip beveled to fit	Makes good street
Denver, Colo.	Denver Cons. Tramway Co.	6.75		48 to 72 lb.	3⅞" & 6"	6 in. concrete under ties; concrete between ties				
Des Moines, Ia.	Des Moines City Ry. Co.	2	15.23	60 lb.		Spiked to ties	Brick	Same	Block cut or notched	Public and city officials like it
Duluth, Minn.	Duluth St. Ry. Co.	16	10		6"	Ties 2 ft. centers, oak stringers	Cedar block			All like it
Ft. Wayne, Ind.	Ft. Wayne Elec. Ry. Co.	8	7	60 lb.	6"	Ties 2 ft.; tie rods 10 ft.	Brick block, cobblestone	Same		Company now reconstructing entirely with "T" rail
Houston, Tex.	Houston City St. Ry. Co.	9	1	45 lb.	4¾"	Ties and chairs and stringers	Brick, gravel, cypress bois d'arc, rock	Same	Concrete	Gives satisfaction
Lincoln, Neb.	Lincoln St. Ry. Co.	15			5½"	Ties, 2 ft. centers	Brick, cedar	Same	Sand with brick	Have only two curves now, but intend to lay track
London, Ont.	The London St. Ry. Co.	1	11.5	56 lb.	4"	Cedar ties, gravel and ballast	Gravel	Macadam		Not favored. (Note—Pavement is not good)
Marinette, Wis.	Marinette Gas, E. Light & St. Ry. Co.	4		40 & 60 lb.	3½" & 6"		Wood block	Same	Wooden strip to fit	All well pleased now
Minneapolis, Minn.	Twin City Rapid Transit Co.	5	35	60 lb.	5¾"	On chairs and on ties	Cedar or granite	Same	Pine or oak strip	City engineers approve
New Haven, Conn.	Winchester Ave. R. R. Co.	14		52 to 72 lb.	4½" & 4¾"		Half block, half cobble	Same		Common Council will have nothing else
Norwalk, Conn.	The Norwalk St. Ry. Co.	3		60 lb.	6"	Three brace chairs to each rail	Blocks and cobbles	Blocks and macadam	Gravel	Gives satisfaction
Norwich, Conn.	Norwich St. Ry. Co.	1.2		48 lb.	4"	Chairs and stringers			Oak strip inside, pine strip outside	Not favored much
Port Huron, Mich.	The City Electric Ry. Co.	5		45 lb.		Cedar ties, pine stringers	Cedar block	Same		Gives satisfaction
Racine, Wis.	Belle City St. Ry. Co.	3	2.273		4⅜"		Brick			Public and officials like it
Salt Lake City, U. T.	Salt Lake City R. R. Co.	.227					Sandstone block	Same	Sand	Public and city officials well satisfied
Savannah, Ga.	City & Suburban Ry Co.	1	7	72 lb.	6"	Chairs or stringers				Not favored
Springfield, Ill.	Springfield Cons. Ry. Co.	22		40 & 60 lb.			Beveled brick or block			Gives satisfaction. Authorized by City Council
Springfield, Mass.	Springfield St. Ry. Co.	15		56 lb.	4" & 4½"	On stringers and on ties and chairs	Granite and cobble	Granite and macadam	Asphalt & brick	No complaint; evidently satisfactory
Waterbury, Conn.	Waterbury Traction Co.	8			6" & 7"	Spiked; ties 2 ft.	Belgian block for 7 in. rail; cobble for 6 in.	Belgian block	None	None better, when properly laid and paved to
Windsor, Ont.	Sandwich, Windsor & Amherstburg Ry.	3	1	56 lb.	4½"	Steel chairs; ties bedded in gravel, then inch board and block paving	Cedar block	Same	None	Preferred to girder rail
Wyandotte, Mich.	Wyandotte & Detroit River Ry	2		56 lb.	4¾"	On broken stone	Macadam	Same	None	No objections

ery, competition, coal pile, and construction combine to recommend the T rail. The old argument for the tram head—that the steel paving for the three inches is the cheapest in the end—no longer holds good in these days of good street pavements and rapid transit. Wagon traffic goes where it belongs—on the sides of the street. To those who can still use the clean headed, old center bearing rail, we can only say, "You lucky dogs;" to most of us it is lost forever. As a substitute for this, where old grants are being renewed or new ones made, the grooved headed rail has been in many places hastily, and, we believe, unadvisedly, required. While the suggestion of a T rail, for use in paved streets in cities, is startling to the average citizen, alderman or city engineer, and is in most cases impatiently rejected by them, yet we must recollect that the mention of a rail, such as steam roads use, calls up in their minds, the idea of four or five inches of steel standing up above the street and of dilapidated plank crossings with half drawn spikes, and we should go patiently to work to teach them, that as there is more than one way to supply motive power to a car, so there is more than one way of putting a rail in the street.

To aid you in this, we have prepared a list of twenty-six cities in which the T rail is used, with remarks thereon (to be found at the end of the table), kindly furnished this committee, by the railway companies, in answer to a list of questions sent out; and we might also say that there are over fifty other members of this Association, whose roads are reported in the railway publications, as being partly or wholly constructed of T rail, who declined or neglected to answer the inquiries of your committee. The general consensus of opinion of the twenty-six roads referred to, and of the officials of the cities in which they run, is that if you can once get down a hundred yards of T rail and make a decent job of the paving, neither the officials nor the citizens will permit you to use anything else in the future. The main thing is to make your paving job a neat and good one. In three of the other cities, where there is at present no T rail, but which are blessed with enlightened city officials, the T rail is about to be made a requirement on the companies.

Modern street railway construction and street paving imply a broken stone, concrete or other solid foundation, a high girder or T rail and a brick, asphalt or granite surface to the street in the larger cities, or cedar block, cobble or macadam in the smaller ones.

Asphalt or macadam can be paved as easily to a T rail as to any other. They should be laid flush, and room should be made for the flange by running a railroad freight car, or other car having a larger flange than the street car, over the track before it is opened for traffic. Bricks are now moulded by many paving brick manufacturers to fit girder and T rails, those for the latter allowing a space for the flange of the car wheel. Whether it is more expensive to chip the corners of granite or Medina blocks or to leave them intact a short distance from the head of the rail and fill the space thus made with asphalt, creosoted wood or concrete, is open to question, but, in either case a first class job can be made. The writer is familiar with two excellent pieces of fifty-six pound T rail construction on chairs, in one of which the pavement consists of six-inch cedar blocks, and in the other of small three or four inch cobble stones, both paved close to the rail with no filling.

It may be useful in your arguments with city officials in favor of a T rail as against a grooved girder, to insist that a T rail is a girder rail with a head differing less from that of the grooved girder than this does from the tram or center bearing head. Also the substitution, in this country, of the steel base and upright member of the girder for the wooden stringer, took place before the introduction of the grooved rail, and was due to entirely different causes, and certainly has not been brought about by any demand for smooth streets originating with the cities or citizens. Such substitution is equiva-

lent to that of steel for wood in buildings. The girder is an established fact; its grooved head, we hope, is merely a passing fancy. The grooved rail might easily be a big headed T out of which a piece corresponding to the groove has been planed. This can easily be shown by reference to cross sections. And we should bear in mind that if we hope to peacefully and with good feeling avoid the use of the grooved rail we must do so, not by objecting obstinately to what we know in our inmost minds to be reasonably objectionable, to be bad practice, to be obsolete, but by presenting to the public, and educating it up to it, a rail which shall, from its point of view, be as far ahead of the grooved rail as that is ahead of the tram or center bearing rail. And we should also bear in mind that the public will demand, and in the long run will secure, streets satisfactory to itself.

Your committee has not gone more fully into the details of construction from a street railway point of view because these must necessarily vary in different localities, but it suggests that the progress which has been made in girder rail construction in the past two or three years should not be lost sight of when we secure the T. Have it big enough and heavy enough.

As it may be of use to the members of the Association, your committee has attached to this report, in the form of an appendix, a list of some of the railways which have answered its queries, together with a synopsis of the answers, regretting that out of 178 letters sent out with stamped envelopes for reply, it received but eighty responses, and, as above stated, of the ninety-eight who failed to come to time more than fifty are using the T rail, but whether in paved streets or not is not known.

Special Paper on "Power Brakes vs. Hand Brakes."

BY E. J. WESSELS.

Hand brakes and friction brakes have not materially changed since the day they were first put in service. It is obvious that a brake only powerful enough to stop a small, slow moving, light weight car has outlived its usefulness when applied to cars weighing seven tons or more, propelled by an unseen force which has driven live stock from the field.

The modern brake, when placed alongside of the old time brake, bears the same relation to it that an arc light does to a kerosene lamp. Brakes of all kinds are useful, but the brake installed to-day should answer all the requirements of modern practice. By common consent, the two things regarded as most important in steam railroading are the wheel flange and brake. None of us would like to travel on the State Express if we had to depend upon hand brakes instead of the well known air brake.

It is not strange that car builders have not kept pace with present requirements in their braking apparatus. They have done well for the street railway fraternity, but heads and hands have been occupied in developing trucks, wheels and car bodies, and builders have not been able to do justice to the brake. The radical changes in car building, brought about by cable and motor cars, have kept builders busy. They could not devote their entire attention to improved brakes. We have no controversy with car builders on this question, and wish to suggest rather than criticise. If buyers demanded improved brakes, builders would conform. As such demand has not been made, the brake of to-day remains in appearance substantially what it was twenty years ago.

The evolution of the electric motor has been rapid and astonishing. Motor builders have had great odds to contend with, but have overcome them, and the leading types of machines combine efficiency with low cost and economy of operation. Motors have been standardized.

It will not be denied that hand brakes are inadequate. If power brakes could be furnished at the same first cost as hand brakes they would be universally adopted. The day is approaching when brakes will be considered as separate equipments, and will not be quoted in the lump sum named per car. There is no more reason for including brakes in the estimates than for including motors.

On roads free from grades, there is obviously not such imperative necessity for reliable brakes as there is on roads which have grades of from 5 to 14 per cent., or where travel is congested, and especially on suburban roads operated at high speeds.

Railway men are seeking the most improved appliances of all kinds. They have found it profitable to include many things in their rolling stock which formerly were not used. Thus, elegant cars have come into use, equipped with vestibules, plate glass, stained glass, Pintsch gas, upholstered seats, electric heaters, fine headlights and even call bells. These are radical departures from the old time cheerless cars which were generally not heated, and had smoking oil lamps, and floors littered with straw. Improvements pay. If they did not they would not be made. Formerly, it was difficult to work one's way to the door of a car, and when one got there, it was, at times, hard to get out. To-day, with improved facilities for ingress and egress, crowds are comfortably carried. This change in car construction involves additional expense. It is paid, without complaint, because the outlay is found to more than pay for itself in increased business. Then, too, the public demands improvements, and there is more disposition on the part of managers to give the public what it demands, if practicable.

It will not be maintained that the improvements are absolute necessities, nor can it be shown that they are in any sense "life saving." Ocean flyers in service have $20,000 oil paintings, ministering to the æsthetic taste of tourists, in their saloons. In the hour of collision it is far more important that passengers have a properly constructed life boat at their disposal than any creation of the painter's art. Each has its sphere, but the more important thing is the life boat. It is so in street railway practice. Cars should be artistic, but they should be equipped with brakes that will do their work quickly when danger impends.

On steam roads, hand brakes proved utterly inadequate. They were tested and found wanting. When the first air brake made its appearance it encountered great opposition. Where would steam railway practice be to-day if air brakes were eliminated? The battle of power brakes *vs.* hand brakes on steam roads was fought years ago, and air brakes remained in possession of the field. It is questionable if the need for power brakes is as great on steam roads as it is on surface roads, especially when trailers are run. Steam road stations are miles apart. It was comparatively easy for an engineer to whistle "down brakes," to cut off steam, and bring his train up standing. The inertia to be overcome was greater, but he had not the grades to contend with that exist on surface roads.

Electric cars in even out-of-the-way places ascend grades that no mogul engine has to confront. Of course, there is a corresponding down grade, and it is here that the difficulty arises, for surface cars ought to stop for passengers no matter how steep the grade or high the speed may be. Otherwise earnings decrease.

The braking power on an electric or cable car should be so positive as to permit of stopping in less than the car's length, if necessary. One has only to watch the men braking cars going down such grades as exist in Albany and Jamestown, N. Y., Easton and Allentown, Pa., and scores of places, to have a full appreciation of this point.

Recognizing the inadequacy of a single hand brake on grades, many roads have provided a duplicate inside equipment. This extra equipment is additionally expensive, not only in first cost, but especially in maintenance.

A motorman realizes how difficult it is to keep his car under control, hence he sets one brake before car starts down grade. He then depends upon his other brake. Manifestly, when one brake is set from start to finish, it means wear and tear of apparatus and short life for the shoes. Moreover, the speed of car is needlessly retarded and fewer car miles per day can be run, than would be made if he had a positive braking outfit at command.

In a good air brake the brake cylinder is constructed of iron, and contains a piston and piston rod, which is attached to brake levers under the car. The rear end of the brake cylinder is made airtight, and connected with the train pipe, so that when air is applied from the reservoir it forces out the piston in the cylinder and sets the brakes.

The power of the brake cylinder can be easily calculated, and is equal to the square inch area of the piston multiplied by the air pressure carried in the reservoir, hence—

Brake cylinder six inches in diameter and thirty pounds pressure gives 848 lbs. power at the brake cylinder.

Brake cylinder seven inches in diameter and thirty pounds pressure gives 1,154 lbs. power at the brake cylinder.

Brake cylinder seven inches diameter and thirty-two pounds pressure gives 1,231 lbs. power at the brake cylinder.

Brake cylinder eight inches diameter and thirty-five pounds pressure gives 1,759 lbs. power at the brake cylinder.

This may be increased by using larger diameters, or higher pressure, and by arrangement of brake levers any additional power may be obtained; at the same time it may be graded suitably to the weight and speed of car.

Friction (or continuous) brakes operated from the axle have been

used for years on cable systems, and the jar from them has caused constant complaint. On electric cars friction brakes, of course, can not be used. The braking force requisite to bring a car or train to a stop, should never exceed the weight of load resting upon the wheels to which brakes are applied. Any power applied in excess of this is wasteful and dangerous. The full power of a friction brake depends upon the load carried on axle, to which friction disks are attached. For example, with a grip car and passengers weighing 8,000 lbs., the weight being equally divided between two axles, leaves 4,000 lbs. carried by the axle with friction disks. With a car wheel of two and one-half times the diameter of friction drum, we gain that much leverage, which multiplied by 4,000 lbs. gives the direct pull power of friction brake of 10,000 lbs.

Nor is this all. The brake levers of street cars are, as a rule, adjusted to about four and one-half times leverage. If, then, we multiply the 10,000 lbs. pull of friction brake by this leverage, we have a strain of 45,000 lbs. upon brake beam and shoes. This is vastly more power than is ever required. When two or more cars are coupled together, it is impossible to regulate brake chains and brake gear, so that every shoe will press with equal force against the wheel. When, therefore, a gripman applies his friction brake, the entire 45,000 lbs. is carried by the beam and shoe that are adjusted nearest the wheels, and the remaining wheels revolve without noticeable check.

In a train of three four-wheeled cars with passengers, weighing 36,000 lbs., resting on twelve wheels, a brake power of, say, 2,900 lbs. applied to each wheel would make the most perfect stop. If the entire 45,000 lbs. power of friction brakes is applied to only two wheels of such train, there will be 38,000 lbs. more power exerted than necessary to stop wheels from revolving, and at the same time only one-sixth effectual braking power is obtained, as compared with a braking pressure distributed against every wheel under the train. Such harsh, rigid, excessive power of the friction brake, applied quickly by the momentum of the whole train, will wear out any kind of brake gear, no matter how good or how strongly made, and the constant jar adversely affects the life of cars. In cold, wet and stormy weather (with slippery tracks), when grip car is abandoned except by the gripman, the pull power of friction drum is greatly reduced, just at the time it is most needed to set brakes on trailers, which are always overcrowded at such time.

A twenty-eight foot closed electric car, weighing without passengers 20,000 lbs., and running at ten miles per hour, has over six times the energy to overcome when brakes are applied, that a horse car has, weighing one-fourth as much and traveling at less than one-half the speed. Moreover, when horses were employed there were ten feet extra length in which to stop car. This extra length is no longer available, since the advent of electric cars. Unless cars have proper brakes, high speeds are most dangerous.

Without entering the humane feature of braking, it cannot be denied that at best hand braking is a great task for even strong men. They report fresh in the morning and for a time muscles stand the strain; but after a few hours' handling of grip lever or controller handle, they find their strength decreasing. Realizing this, for the rest of the day they slow up earlier than strictly necessary, or (as often happens) they do not stop at all and let cars run past crossings, missing passengers, who do not always wait for the next car, but walk instead.

If, however, the men have ready for instant use an ally in the shape of power requiring but the touch of a handle to become available, they are placed in the best possible position to make as many stops in as short a distance as is necessary. Not being fagged out, they are better able to do their company more justice, and are more on the alert to prevent accidents.

In the distressing accident which occurred seven weeks ago in New Jersey, this point was particularly emphasized. We quote from the *New York Herald* of August 27, after having ascertained from the officials that the report is accurate. "When the crowded car began to go down the incline, the brakes would not respond promptly to the demand of motorman Gormley. Tight as he could wind up the chain he felt it slip repeatedly. He knew what this meant, and, with full strength, he set the brake as hard as he could. But his efforts were in vain, and the car gained greater headway every instant. It was beyond his control, and he realized that in a few seconds the car would strike the sharp "crab tree" curve. As it dashed down the steep mountain side tracks he turned and shouted to Conductor Bagley to put on the rear brake chain. Bagley was inside the car, and at Gorman's call every one suddenly realized the danger. The conductor was wedged between the passengers, but he fought his way to the rear platform and wound up the remaining chain of the single brake system from there. In an instant he saw that it, too, was of no use in the emergency, and turning he shouted, 'Jump for your lives! The car is running away and will strike a curve.' The car was rushing on to that fateful curve. Like a shot propelled by some awful power it went. Then it struck that curve. A section of one of the wheel flanges snapped off, and in an instant later the car left the rails. It ploughed its way across the track with scarcely any perceptible diminution of speed, was jerked sharply to the right, when the wheels struck the opposite rail and then capsized, landing squarely on its side with a crash which was heard a quarter of a mile away."

We need not pursue the account further, except to say that eighteen people were hurt, many of them badly, and one boy's arm had to be amputated. A $35,000 damage suit is pending against the Accident Insurance Company which wrote the risk on that road, and the same company has settled a number of cases out of court.

It is only fair to state that had that entire system been equipped with power brakes equal to such emergency, the chances are the car could have been stopped long before the danger point was reached without injury to limb or property.

It is not the purpose of this paper to make capital from such a sad occurrence; we are opposed to sensationalism, but it is proper to call attention to such calamity as a warning. What happened on that road has happened on others, and will again occur so long as implicit reliance is placed upon hand brakes, which cannot possibly do the work required of them at such a crisis. The first cost of equipping the entire line with power brakes would have been but a fraction of what the damages will cost.

It is unnecessary to multiply instances where hand brakes have shown radical defects. That practical men have been apt to think too lightly of the question of improved brakes is explainable by their having so many other important things to oversee. Then, too, the aim of a railway man is to incur as few obligations as possible and to operate with the utmost economy and earn dividends. But often seemingly cheap apparatus proves dearest in the end.

Probably 75 per cent. of the recorded accidents is chargeable to inefficient brakes. Statistics of this sort are hard to tabulate, and some records show even a higher percentage. While hand brakes often stop cars quickly, they do so by consuming excessive energy. This means waste and increased maintenance account. Then, too, it is impossible for a motorman to maintain his maximum strength for a long time. In active service he has to apply brakes between 250 and 400 times daily. He can only exert his maximum strength spasmodically and temporarily even when aided by the weight of his body. "A chain is no stronger than its weakest link."

The day is past when railway employes are considered merely automata. Not all men make good motormen or gripmen. These positions, like that of conductor, are ones of trust. The men, as a rule, are intelligent, and, during the recent financial depression, many recruits have been made who formerly filled much higher spheres. The strain of a day's work on these men is very severe.

When we consider how many chances people take in crossing tracks in front of moving cars, or in jumping on or off, despite printed warnings, this strain becomes more apparent. No matter how fast or slow cars go, people are always dodging them, with reckless disregard of danger. A motorman is not allowed to shout. He is required to keep silent. In the presence of danger he can only rely upon his gong or whistle and his arms. These alone are not adequate when drunken or deaf men are on the tracks.

The most painful thing which comes under a street railway man's notice is the killing or maiming, especially of children. When a little child, ignorant of danger, toddles to the track, and sees the car coming, it generally stops, hesitates, starts off and usually rushes in front of the car. The motorman, who has to depend upon a hand brake at such a time, seldom succeeds in stopping his car. It is not an unusual sight to see a little child taken from under the wheels.

Touching the legal aspect of the brake question, while it often happens that plaintiffs are non-suited on the ground of contributory negligence, to the railway man this frequently means outlay for legal talent. Even though his company or the underwriters are not called upon to pay damages in such cases, it is surely better to prevent accidents than to defend law suits, especially as prevention is cheaper.

It is a menace to life and property to have a high speed motor at work, without having suitable power to control it. Thus far, "reversing" has not proved a success, and, while theoretically one motor acts as a generator to drive the other (if there be two, which is not always the case), in practice this has proved a failure. The danger of relying

upon the same current which propels a car to stop it too, is only too apparent. If the current fails to work in one case, how can it be expected to work in another? The trolley may run off, or there may be a break in the line when current is needed for braking a car plunging down grade. "It's the unexpected that happens."

Hand brakes have no emergency stops. Air brakes have, and, if necessary, stops can be made so quickly as to apply brake shoes instantly to every wheel on one car or a train of cars in the most effectual manner. No hand brake can do this.

When hand brakes are used, it is necessary to have a separate brakeman for each trailer. When an air brake is used, these extra men are entirely dispensed with. On a train of a motor car and two trailers, if air brakes are used, only one motorman and one conductor are necessary. If hand brakes are used to control the same train, four men, instead of two, are necessary. This means a saving in wages of at least $21 a week, and will soon pay for an air brake equipment.

Moreover, when air brakes are used, there is no shuttle movement, jerking or bumping, and the shoes are applied evenly to all the wheels; whereas, in hand braking, it is impossible for different men on different cars to brake in harmony. One car will be braked hard, and another not so hard. Of course, no good results from such ununiform braking.

Air brakes are provided with reserve power stored in reservoirs, and, by having large enough capacity, the air pressure required for braking becomes practically inexhaustible. The air pump of a thoroughly good air brake is most economical in operation. It requires no power when the car is starting or when it climbs grades. As it takes ten times the power to start a car that it takes to keep it going, the advantage of this is obvious. A good air brake is so compact that very little room is required for it under the car body. It has no cumbersome or complicated machinery to get out of order. It works automatically. It needs much less attention than an electric motor gets. It is only necessary to keep the mechanism clean and in order, and to lubricate the pump regularly. No hinges or springs annoy inspectors or employes. A good air brake pump, the moment it has compressed sufficient air, cuts out and runs in free air with the axle. A good air brake entirely replaces a hand brake. The hand brake may be left on the car, and the air brake can be so attached as to leave the hand brake available should it be required. A good air brake requires no expert to operate it. It is so simple that a child can work it. This being so, a railway manager is not restricted to hiring men of a certain height or weight, for when work is done by compressed air instead of muscular strength, no Samson is required to work the handle.

In steam practice trunk lines maintain schools of instruction in which men are taught to handle air brakes, and only qualified engineers are trusted to operate them. A good air brake for surface roads is so constructed that, when used by men not schooled in its use, it does not get out of order. It is capable of being misused without proving defective. The physical labor involved in working the ordinary hand brake causes the other good qualities of the gripman or motorman to suffer. This has a direct bearing on accident account, wear and tear and repair accounts. The application is obvious. "A stitch in time saves nine."

A good air brake enables a man to make the best possible stops without noise, jar or injury to the apparatus. In hand braking much excess force is used. This means that rods and bars are strained when stopping the car, ane often the brake gear is in such shape that, when a quick stop is required, some part is sure to collapse.

One type of air brake equipment in service enables a gripman with but a small handle to work grip and brake either simultaneously or independently. When this type brake is used on the car, grip and brake levers are entirely removed, giving more space for passengers on platforms. Through its use, what formerly involved painfully hard work, is now accomplished with ease. This device is in successful operation on car 421 on the Third Avenue Railroad, New York.

We believe it is better to keep the motor controller and the brake handle separate, but if railway men demand a single handle to operate both it can be supplied just as was done in the air brake on Third Avenue, New York, car 421, which works grip and brake. We doubt, however, if a real necessity for a single handle exists.

Recently a new form of power brake has been announced, in which electricity is relied upon. The electric brake, while undoubtedly possessing some valuable features, has some which are a decided disadvantage. It is, of course, in its infancy, and its future will be watched with interest. We saw the paper read by Mr. Sperry on the 19th of last September before the American Institute of Electrical Engineers entitled "The Electric Brake in Practice." Mr. Sperry, unknown to himself, quotes our language verbatim, which was used as an editorial by one of the dailies and subsequently copied in the journals. It is to be regretted that, when using a part of our matter, the able electrician did not use other parts also.

He says that a locomotive engineer has his pressure gauges, which allow him to adjust the brake application to a nicety. A good air brake for surface roads is also supplied with a pressure gauge, but in practice no Westinghouse air brake engineer looks at a gauge, and they are more ornamental than necessary. He states that "with an electric brake the brake shoes are entirely dispensed with." Do the street railway men intend to to abolish brake shoes? Suppose, as may happen, the electric brake fails to work, what will become of the car or train? There is an apparent contradiction in the article on this point. In one place it states that the electric brake does away with brake shoes, and in another place it admits that it will be necessary to resort to hand brakes. How can hand brakes be used without shoes, and now can a car be held by an electric brake after the residual magnetism or (Foucault current) is dissipated? He says that the one grave fault of an air brake in railway service is that the maximum brake application does not exist as it should at the higher speeds. This is an error. The immense advantage of an air brake over an electric brake is the fact that power can be applied in varying degrees; great power, when needed, and almost imperceptible power, if only very slight retardation is wanted.

An air brake holds the wheels and keeps doing so. An electric brake, after first stop, depends wholly upon residual magnetism. This at its best is an uncertain factor. As we understand the paper, the residual magnetism in the electric brake is only available for something less than one-half minute after car has stopped. When this magnetism is consumed the electric brake possesses no more braking power whatever, until the car is again in motion. It is right here that the air brake shows its immense superiority, for it has the air reservoirs to draw upon when car has stopped, and, therefore, ample power is available for immediate and constant use. This failure in source of supply is a tremendously weak point in an electric brake. The paper states that "the current flowing after motion ceases, though small (mark this admission), is found exceedingly useful in holding the car from starting itself, even on quite a heavy grade, as only a small quantity of energy, added to the already great friction of quiescence, will prevent the car from starting." We fear that at such times the advocate of electric brakes would need something more reliable and constant to lean upon. The paper says "when an electric brake is used, it seems as though the car was running into an air cushion." This pays a well merited compliment to air brakes, for by them an air cushion stop is made possible. The paper adds "operating the brake in this manner, it will at once be seen that the system is one of the utmost certainty of operation, surer even than the hand brake, air or other power brakes." If the speaker had not been for some years in the electric motor business, he might not take such decided exception to this claim as he does, but since working with air pressures he has found them much more reliable and safer than electricity. The inventor referred to, makes fourteen claims of the advantages of his brake over other brake systems. As this paper is not written for advertising effects, we purposely refrain from naming any special make of air brake in contrasting the air brake with the electric.

1st. He speaks of the certainty of an electric brake in operating. So is a good air brake certain in operation.

2d. "The enormous power and under perfect control."

A good air brake has much more power, more constant power and is under better control. It will be noticed that the inventor omits all reference to electric brake power being constant. This lack of constant braking power is the objectionable and fatal defect of the electric brake. It will not be noticeable on a level, but it will be only too apparent on a grade. At the Institute meeting, before which the paper on electric brakes was read, one of the members stated he had been on a train in Connecticut, where two motor cars and three trailers were ascending a 9 per cent. grade. While doing so a fuse on the second motor car blew out, throwing all the work on the first motor car. This it was unable to do and hand brakes had to be immediately applied to prevent train from running away. The author of the paper was asked "what would you do at such a time with your electric brakes?" Mr. Sperry, in reply to the question said, that a case of this kind was rather unusual, but that he would have applied the electric brakes, which would have brought the train to a standstill, and by that time the hand brakes could be applied to prevent the car from running backward down the grade. How then can he claim that the brake dispenses with brake shoes, and if the electric brake had been used on the train in question to the exclusion of hand brakes and brake shoes, what would have become of the train and passengers?"

3d. "The absence of all power absorption at moneyed cost from the central station."

This may be true if brake shoes are not used, but remains to be proved in daily service. Shoes probably will continue to be used. A good air brake consumes very little power. You can test how little by watching the readings on a car operated at this time with an air brake, on the Atlanta Consolidated road.

4th. "Its high efficiency, being far superior to compressed air; amply proven in numberless instances where electricity has replaced air. (The air requires a direct application of energy, amounting to an immense aggregate power absorption during the day from the central station; the working parts of the air machinery are attached to the car axles and require a large quantity of energy, not only while compressing, but at other times as well)."

We are unaware of a single case where electricity has replaced air. We are informed on high authority that air compressors for driving rock drills and coal cutters so greatly outnumber electrical machinery for such purposes, that hundreds of air compressors are sold for every drill or cutter sold. The statement that an air brake requires a large quantity of energy, not only while compressing, but at other times as well, is wholly inaccurate and entirely incapable of proof. A good air pump requires no perceptible power after it cuts out.

5th. "Its extreme simplicity."

So is a good air brake very simple.

6th. "Observe saving in wheels, two or three fold."

A good air brake properly applied saves the wheels.

7th. "Saving of brake shoes."

We believe brake shoes will be retained, and would not care to ride on a car without them. Under certain conditions the paper admits hand brakes will be needed. How can hand brakes be applied without shoes?"

8th. "Very little wear of either wheel or magnet."

There is little wear to a good air brake, and lightning plays no pranks with an air brake, but is likely to do so with an electric brake.

9th. "No hissing to frighten horses on streets."

We have yet to hear of a case where a horse was frightened by an air brake.

10th. "The low E. M. F. at which it operates."

This is true of a good air brake. It is easy to test power consumption with a wattmeter, by running car with air pump, and then running car (under exactly similar conditions) with air pump detached; the slight power consumed will then appear.

11th. "The ease of its application and control."

Nothing surpasses a good air brake in these respects.

12th. "Conserving strength, prolonging the usefulness and life of the motormen."

This is open to question when one sees the despair of motormen when fuses melt and switches burn out. Gripman Williams on air brake car No. 421, of the Third Avenue Road, New York, (where 120 equipments are in daily operation) told the speaker, "This job is so soft, I expect some of you Wall Street fellows will come here to run cars since times are hard."

13th. "The smoothness of its operation."

Nothing can surpass the air-cushioning effect of a good air brake.

14th. "Cannot cause flat wheels."

A good air brake properly applied also prevents flattening of wheels.

We had no intention to refer at length to electric brakes, but have felt constrained to do so because the statements we have replied to appear in the printed Transactions of the American Institute of Electrical Engineers, and should not remain uncontradicted.

Lastly, it must be remembered that the magnetic clutch of this electric brake has to bear on the surface of a flat disk cast upon the car wheel. This can hardly be called "ease of application," for the brake can not be applied to the ordinary type of street car wheel. It requires a special casting to be made on one wheel on each axle. This, on a large system, means an additional outlay for wheels, as "extras are charged for."

We have purposely avoided tabulating the fatal accidents of the last twelve months, directly due to inadequate braking facilities. It, however, is timely to call attention to the charge of Judge Lippincott to the Grand Jury of Hudson County, N. J., last month. He devotes special attention to the subject of "killing by the trolley," which he characterized as being sometimes manslaughter. He said: "Deaths by accident have become very frequent. Personal injury, not resulting in death by accident, has become frequent. Now, from mere unavoidable accident, resulting in death or personal injury, no liability whatever arises, but the general rule of law is that where death or other personal injury results by reason of the omission on the part of another to discharge a legal duty there a criminal liability arises for manslaughter in the case of death, or for an assault and battery where death does not ensue. If neglect of a legal duty is the cause of death, the person guilty of such neglect is chargeable with manslaughter. If death does not result, but only other personal injury, then he is chargeable with assault and battery. The law imposes upon every one reasonable care in his acts toward another. There is a legal duty owing from one to the other, and a negligent omission of the performance of that duty, resulting in death or other bodily injury, is indictible." He proceeds: "There are many familiar illustrations of these principles of law; a motorman running his electric car along the streets carelessly, negligently, runs over another and kills him, it is manslaughter, although it was not his intention to injure him. A motorman running his car at a dangerous rate of speed along the streets, running over another by reason of his dangerous rate of speed, the death arising from this omission of duty to run at a reasonable rate of speed, he becomes guilty of manslaughter. If persons in charge of the running of steamboats, railroad trains. electric trolley cars, horse cars or other public conveyances, neglect the duty of using reasonable care, and death results therefrom, they are answerable for manslaughter, whether it be in the erection of buildings, the running of machinery, or any other employment."

It will be seen that the judge's charge covers the operating of motors. A jury will certainly class an air brake as being more than a reasonably safe appliance. It is certain that a plaintiff's attorney, in prosecuting a suit for damages, will call attention to the fact that it was possible for a company to have availed itself of an air brake which would have been reliable.

Recently, two verdicts were given against one traction company in New Jersey, one for $3,000, the other for $5,000, and there are other suits pending for over $500,000 damages in that place alone, on account of trolley car accidents. Thirty-eight deaths to date are charged against that one road since it adopted electricity.

On September 21, Motorman Michael Lewis was convicted of manslaughter in the Court of Special Sessions, at Newark, N. J. Lewis ran the motor car which killed four year old Martha Henry on August 4. On September 25, Judge Kirkpatrick sentenced Lewis for one year in the county penitentiary. The judge lectured him severely for carelessness, and said he felt it his duty to make an example of him. Lewis was crushed by the unexpected sentence. He expected only to be fined, and that his company would help him. On the same day Motorman Desmond was arrested in Brooklyn for nearly killing a six year old girl. His car cut off her right foot. He claimed he did not see her until she was directly in front of the car, and that it was impossible to stop it in time.

In Alliance, O., it is recorded that "the motorman, when he found his car going down hill at too great speed, immediately lost his nerve, and deserted his post." That car was equipped with a presumably good hand brake. This would not have occurred had a good air brake been available.

More than one motorman has lost his reason as the result of a fatal accident. Recently, a motorman committed suicide, owing to remorse for having run over a child. It may be said this was not his company's affair, but had this unfortunate man had a power brake at hand, he would not have killed the child and taken his own life. In a sense, we are our brothers' keepers. Would it not be well to place in every motorman's hands, apparatus which would render indictment by a grand jury out of the question?

There are some railway men who complacently tell us they have no accidents on their road. It may be that such fortunate individuals exist, but we have not found them. It is somewhat curious that after men made this statement, there were bad accidents on their roads.

The newspapers have been hounding the fraternity so much in Brooklyn and elsewhere, that trolley accidents have become household words, or a subject for jest.

There is no part of electric or cable railroading so important, as the ability to stop cars quickly and to keep them stopped. This is specially true where electric or cable cars cross steam roads at grade. At such times hand brakes show their inherent inadequacy.

We do not advocate the adoption of a scientific toy, but submit for your consideration the fact that you can procure at comparatively low cost, air brakes which are positive, simple, economical and highly efficient, and which have been tested in the crucible of daily operation.

In urging the adoption of air brakes, we are often told by railway men, "We haven't time for experiments. Let somebody else do the

experimenting, and then we will look into the thing." Had this position been taken by progressive men, would there be a single commercial electric motor in existence?

The experimental stage was passed long ago, and with 350,000 air brakes on locomotives, passenger and freight cars, it is untimely to talk about experimenting, for steam roads and surface roads have much in common. If a freight car loaded with pig iron needs an air brake, how much more is one needed to brake a car carrying living beings?

There are air brakes and air brakes. Of the merits of the different ones, buyers will do well to satisfy themselves before contracting.

The all important question is whether the first cost of a good air brake is too high, or not, in proportion to the advantages gained. No accountant can figure accurately how many dollars of damage claims will be avoided; nor how much revenue will be increased by the quicker schedules made possible with air brakes (for even seconds count); nor what the gain in labor account will be by not being restricted to hiring any particular height or weight of man; nor how much the life of the car body, truck and motor will be prolonged. There is a decided gain from whatever point we view the air brake, and with an air brake, an employe is armed at all points.

Will it not be worth your while to give this braking matter earnest attention? If but a few of this audience will determine to investigate the advantages of the air brake over all other forms of brakes, this paper will not have been prepared in vain. It was written, to suggest the value of good power brakes over hand brakes, in minutes snatched from busy days.

Report of the Committee on "Mail, Express and Freight Service on Street Railway Cars."

BY RICHARD MCCULLOCH—Committee.

In beginning a discussion of this service, it seems necessary to explain that the first word of the subject is spelled with an *i*, because a gentleman from the rural districts of Wisconsin proudly wrote, in answer to a circular asking for information regarding the carrying of mails, that "His road sometimes carried females too." He desired, however, that all information given should be regarded as confidential, so the name of this most fortunate road is withheld. That the street railroads of this country operate a heavy freight business has long been the opinion of the itinerant tinware peddler, the "umbrellas to mend men," the lady who takes in washing, and all the merchant princes of the tribes of Israel, notwithstanding the fact that a generation of sweet tempered conductors have talked themselves hoarse in endeavoring to explain matters differently.

The first feature, which strikes one in endeavoring to study a subject such as this, is the great difference existing between what are known as street railroads. We have city roads and suburban roads; we have summer resort roads; we have belt roads operated by different motive powers, some of them almost approaching steam railroads. There are large city systems, operating over many miles of track and running hundreds of cars, and there is one road down in North Carolina, from which the statement was received that: "This here road is owned, directed, managed, superintended and driven by Yours Truly." All these railroads haul different classes of passengers, bent on different errands, and are operated under different conditions. It is manifestly impossible, therefore, to lay down any fixed rule for mail, express or freight service—to say that it should be put into practice on street railroads, or that it should not be put into practice. This is a problem which must be solved for each railroad individually. In this paper it is intended merely to give a general discussion of the question without attempting to solve it.

In order to ascertain, as well as possible, how much has already been done, a circular asking for information in regard to mail, express and freight service was sent to every street railroad company in North America. 978 letters were sent out and 413 replies were received. These replies are tabulated below. As a great many railroads were not heard from, it cannot be assumed that the table is absolutely correct, but it is probable that most of the railroads having such a service answered the circular. Roads which are enumerated, as having express or freight services, are only those which have this service fully developed. The carrying of packages by conductors of passenger cars was not called express service, but is enumerated in a separate column. From some of the states, notably Pennsylvania, Rhode Island and Massachusetts, it was reported that the transportation of express and freight by street railroads was prohibited by state law, and many of the roads answered that their franchises allowed only the transportation of passengers.

The rate charged on express matter was usually five or ten cents per package, while the freight rates vary from four to ten cents per 100 lbs. The mail is usually carried either under a direct contract with the Government or under a sub-contract with a mail contractor. The income from the transportation of the mails varies according to the amount of mail, the number of trips per day, and the length of the haul, from $100 to $1,000 per annum.

TABLE OF MAIL, EXPRESS AND FREIGHT SERVICES IN NORTH AMERICA.

	Any Form of Such Service.	Under Contract with Express Co. or U. S. Government.	Haul Steam R. R. Freight Cars Over Street R. R. Tracks.	Operate Special Cars for this Service.	Carry Small Bundles on Passenger Cars for Pay.	Contemplate Such Service.	Distribute Matter Beyond Station.	Use Combination Express and Passenger Car.
Mail	62	58	...	5	.....	10	.....	.....
Express	35	8	.....	9	31	7	2	8
Freight	55	.....	6	37	.....	12	2	.....

MAIL SERVICE.

That the street railroads of this country are already alive to the possibilities of the mail service is shown by the table. Sixty-two street railroads are now carrying Uncle Sam's mail, while fifty-eight have Government contracts. Most of these railways are suburban roads or roads joining towns; but the postal authorities realizing the advantage of quick delivery, and collection, are now beginning to make arrangements with the large city systems for transportation of the mails from main post offices to branches and for distribution and collection throughout the city.

Various methods of utilizing street railways for this purpose have been proposed by different local post office authorities. In one large Western city, in which all the roads are controlled by one company, it was proposed to equip one car of each line with a mail receptacle. At stated times, the carriers along the route were to meet this car and drop into the receptacle all the mail collected by them, which was in turn to be taken from the receptacle as the car passed the main post-office. This plan, however, did not meet with the approval of the great fathers at Washington, and in consequence was abandoned by the local authorities. Any system of this kind would greatly expedite the collection of mails, but the weak point seems to be that no provision is made for their distribution.

The only method of handling a large mail service, in which it is necessary to collect and distribute along the route, and handle it satisfactorily both to the patrons of the road and the post office department, seems to be in the use of a separate car—an independent mail car in charge of a railway mail clerk. This system is already in use on street railroads in St. Louis, Brooklyn and several other places, and so far as we can learn is giving excellent satisfaction, both to the railway companies and post office authorities. The mail is quickly and promptly handled; the service is regular and certain; great and small quantities of mail may be collected and distributed with equal facility, the residents along the line are greatly accommodated, and no interruption or inconvenience to the passenger traffic need result.

As an example of such a service, it would probably be interesting to describe the operation of a United States mail car, which has been run by a street railway in St. Louis for some time. The St. Louis & Suburban Railway begins in the business part of the city and runs through the choicest residence and suburban settlements of the town of Florrissant, sixteen miles from the center of the city. After leaving the city limits, the line penetrates the beautiful Florrissant Valley, thickly dotted with pleasure resorts, country clubs, summer homes and suburban villas. The downtown portion of the road was formerly a cable, and the suburban part a narrow gauge steam line, but with the onward march of progress, the grip and the locomotive have gone to join the mule car, and the road is now electric throughout its entire length. The mail car makes three trips each day, two through to Florrissant and one as far as the city limits. The railroad company furnishes a conductor and motorman, while the post office department supplies the mail clerks. The car, which was built especially for this purpose, is equipped with its own motors, and is furnished with the necessary desks, cases, racks for mail bags, etc. At a schedule time it is run up in front of the post office and receives the mail put up in

pouches from a wagon there to meet it. The mail clerk receives a bag for each station outside the city limits, and for each carrier along the route a bag designated by his number. He also receives all mail which has come in too late for assortment, which is distributed on the car to the proper bags before reaching the first station. Letters are received, canceled and distributed on this car, just as in the ordinary steam railway mail car. The first stop is at a point about one and a half miles from the post office. At this point six carriers meet the car and each carrier receives from the mail clerk the pouch bearing his number. Another stop is made about two miles out, another two and a half, another three, and another four miles from the post office. Any mail for the suburbs is handed to the mail clerk by the carriers and dropped into the proper bag by him. After the city limits are passed, bags are exchanged at each station just as on a steam railroad. On the return trip the same system is followed until the city limits are reached. Within the city, the post office department has placed letter boxes at the principal corners along the line. Each carrier brings the mail collected in his district to the nearest box on the line of the railroad. Stops being made at each box, the mail clerk removes the mail, and assorts it before arriving at the next station. The letters thus canceled and assorted are delivered at the main post office, tied up in bundles ready for shipment. The mail car makes no stop for passengers, and for this reason can easily keep out of the way of the passenger cars. A light freight business is also done on the car. Provisions, light furniture, milk, trunks, etc., are carried and the charges collected by the conductor. The mail service has now been in operation three years. New features are constantly being added to it, and aside from the accommodation afforded the residents of the territory through which the road runs, it is a source of profit to the railroad company.

The system just described seems the best that has yet been devised for the handling of a large mail business. Where the mere carriage of the mails in pouches from the main post office to branches, or from depots to post offices, is undertaken and there is no attempt made at collection or distribution along the route, there can be no objection to carrying the mail sacks on the front platform, if their number is not too great; but passenger cars should not be stopped and held for mail collections, nor should valuable space within a passenger car be taken up with mail sacks.

The question as to whether or not mail service is called for depends almost entirely upon local conditions—the length of the road, the territory through which it runs, the proximity of depots and post offices to the line of the road, and many others. An advantage in estimating the advisability of inaugurating a mail service is that a certain fixed income may be assumed, which is not the case with any other service. It is usual in Government contracts to pay a a certain sum per 100 lbs. per mile, the weight being determined at stated intervals by weighing the mail. For this reason a certain fixed income is assured during the interval. A number of cases may be cited in which it would be well for the managers to look into the profits which might accrue from a mail service. Large city systems, covering various parts of the city and passing close to post offices and public buildings would afford great advantages in distributing and collecting the mails. Suburban roads, roads connecting towns, and roads running to depots in the outskirts of the city are other instances of openings for mail service.

An advantage, independent of any financial return, and one which is regarded by many as the one reason for street railways embarking in this service, lies in the prestige of Uncle Sam's name. This point was never so thoroughly illustrated as in the late labor troubles in Chicago. Rioters have no fear of the city police or of the state militia, both of whom are often in sympathy with them, but they regard with the greatest awe a company of regulars armed with Springfield rifles. Uncle Sam will tolerate no interference with the distribution of the mails, and no other point has been so thoroughly impressed upon the dangerous element in our communities during the last year. Some railway managers, on securing mail contracts, have proposed to paint upon each car "U. S. Mail," as an official announcement that their roads are under the protection of the U. S. Government. How effective will be the protection against blockades and riots, and how great a moral influence this will exert to prevent strikes and other stoppages, remains to be seen.

EXPRESS AND FREIGHT SERVICE.

The answers to the circulars showed that thirty-five roads are now engaged in the express business, while fifty-five are hauling freight. As a matter of fact, however, few roads through the country are doing a regular freight business, most of the so-called freight services partaking more of the nature of express. As operated upon street railways, the distinction between express and light freight service is so ill-defined that it is deemed best to consider both subjects together.

There are many points in the street railroad as now conducted, which make it almost an ideal agent for the transportation of packages and light freight. The great number of points reached by the cars, the absolute certainty with which they run, the thousand and one precautions taken against any stoppage of however short a duration, the rapidity with which distant points are reached, and many other causes combine to make the street railroad of to-day a common carrier of exceptional advantages, when only short distances are considered. Many conditions will suggest themselves to railway managers, in which an express or freight service may be made a paying institution. In the case of a town, in which the railway station is some distance from the business part of the town, there can be no quicker, safer and better plan of conveying express and freight to some distributing point in the heart of the town, than by the street railroad. Whether or not this will pay depends upon the amount of material, the competition, the distance, and the scope of the street railway franchise. A case often met with through the country is that of two towns connected by an electric railroad, one of which, having no steam railroad, is obliged to get all its supplies through the other town. The installation of a freight service of some kind would at once suggest itself in this case, and the profits would depend upon the size of the towns, the character and occupations of the inhabitants, the distance between the towns, etc.

The operation of an express service on large city systems has not been attempted to any great extent, but it has been contended by some enthusiasts on the subject, that a street car express service will eventually take the place of the many city deliveries and city express wagons now in use. As an example of a city road operating an express and freight service, involving collection and a house to house delivery, it would be interesting to cite the case of the Southern Railway, of St. Louis, which has been operating an express service on this plan for almost two years. The Southern Electric Railway begins in the heart of the city, and runs in a southerly direction for seven miles, following the general direction of the river, to Carondelet. The territory penetrated is thickly settled for almost the entire distance, and in no essential does the road differ from the ordinary city street railway. Three trips per day are made upon schedule time by the express car, which is entirely independent, being mounted upon motors of its own. At the downtown end is a receiving station where a clerk receives all express consigned to the company, and keeps all the books pertaining to the service. The especial feature of this service, however, is the collection and delivery. This is effected by means of wagons, two of which are kept at the downtown end of the road, and three of which meet the car on all trips at certain points along the line. On receiving notice by mail, telephone or otherwise, a wagon calls for a package, delivers it at the car, from which it is handed to the proper wagon, and delivered to the address marked on the package. A charge of ten cents per package is made for this delivery, and trunks are taken from houses to the Union Depot, checked, and the checks returned, for the sum of fifty cents. A corresponding charge, according to size, is made for the delivery of large boxes and bundles. A compliment to the efficiency of the service is paid by the large dry goods and clothing houses, who have ceased to run their delivery wagons into this part of the city, and now consign all of their bundles to the railroad company. Where formerly one delivery daily was made by the wagons, three are now made by the railway. An interesting feature of the service is that several large factories located in the southern part of the city consign all their freight to the electric express. The goods are put on the car, taken to the proper railroad stations, shipped, and the bill of lading returned to the consignor. Packages are received by the express car C. O. D., the charges collected, credited to the proper account, and settlements made at the end of each month. The railway company assumes all the responsibilities of a common carrier, holding itself liable for all loss and damages. This, however, is a contingency which seldom occurs. The service has now been in operation for about two years. It is well patronized both by the residents along the line and the large retail stores in the center of the city. It does not interfere with the regular running of the cars, and since its inauguration has never failed to pay.

Up to this point we have considered an express and freight service merely as a paying or non-paying institution, to be adopted in the one case and to be rejected in the other. There is another view which may be taken of the case, however, which is in many instances the most proper solution of the problem. This is to regard the establishment of this service merely as an auxiliary to the passenger traffic, to be operated whether or not it pays in order to gain increased passenger travel. The most notable instances of this sort are the roads which run from the hearts of our large cities out into the suburbs. It is manifestly to the interest of these roads to promote building and settle-

ment along their lines, and how can they better attract builders than by giving their patrons all the advantages of city life, not only in furnishing them with rapid transportation to and from the city, but in aiding them in receiving their provisions and supplies. This calls for some form of express service, and although the receipts from this source may not equal the expenses, the increased passenger receipts and the advertisement given the road must also be taken into account.

In all street railroad practice, the cardinal point of any service, whether mail, freight or express, must be that it does not interfere in the least with the passenger travel, and this point should always be kept in view in the arrangement of such a service. For this reason we would strongly advocate the use of separate cars, operated by separate motive power and by separate men. In roads between towns, or suburban roads operated on the same plan as a steam railroad, where stops are made only at certain stations, a combination car or a trailer might be used ; but in city roads the system of piling trunks and boxes in the passenger cars and on the front platform, and stopping for these to be put on and taken off, is not of the era of the electric railway. Another system more fitted to the mule and the bobtail is the custom, yet in vogue in some places, of receiving small packages for transportation and allowing the conductor to deliver them along the route, stopping the car and forcing the passengers to wait. If the addition of a package service renders necessary such a reduction in the efficiency of the passenger service, it is difficult to perceive the gain in accommodation. A passenger car should carry passengers. It should stop and start for passengers alone, and it should reach the end of the road in the shortest possible time.

If mail bags may be thrown on the front platform of a car, carried to their destination and delivered without causing any long stops, this is perhaps the best way of solving a mail service on a small scale; but in a freight or express service it is better that the work should be done with cars especially devoted to such service and by men especially trained for it. A single box car equipped with motors of its own will handle the light freight and express of quite a territory without any interference with the regular running of cars. A twenty-five foot car, equipped with double trucks, supplied with the most approved form of motors and controllers, and fitted up either as a mail car, express car or combination car, can now be obtained for $2,000 to $2,500. A smaller car, mounted on a single truck, can be obtained for less money. If heavy freight is to be hauled, it should be carried in motor and trailer cars built especially for this purpose.

If it is proposed to establish a freight or express service, estimates should be made of the amount of business which could be procured, of its reliability, and of the rates which could be charged, taking into account the existing competition. On the other side, the cost of operating such a service should be estimated, allowing liberally for the time the investment is in idleness on account of nothing to do. If a reasonable assurance cannot be obtained of a steady and regular traffic, it is best not to venture into it, for an unreliable trade is liable soon to develop into a losing one. There are cases, however, as has already been pointed out, when it would be good policy to operate such a service at a loss, merely to give accommodation to patrons; and it is possible that such a service, started for this purpose alone, might, in a growing community, develop into a paying one.

Before leaving the subject of express service, it might not be out of place to give a brief description of a novel form, soon to be introduced upon the Union Depot Railroad, of St. Louis, in which the freight is to consist of members of the genus *homo*, in a more or less disjointed state. This great railroad system, in its ramification, extends to almost all parts of the city, passing nearly all of the city institutions, including the Dispensary, the City Hospital, and several of the other hospitals, and at the desire of the city authorities it is now having built a hospital car. As designed, it is a twenty foot body, double truck car, having a double floor filled with asbestos to deaden sound. It is proposed to utilize it primarily in conveying patients from the Dispensary to the City and other hospitals. It can also be used in case of a great fire or calamity where there are many injured, and where the horse ambulances are not capable of handling the work. It is expected that other uses will develop for it after being put into service. The car is to be equipped with stretchers, folding chairs, a tank of water, apparatus for heating water by electricity, an emergency drug store, dressings, instruments, earth closets, and all necessary apparatus for taking care of the sick and injured. A surgeon is to be in charge of the car, and will accompany it on all its trips. The car is now being built, and the innovation will, no doubt, be watched with a great deal of interest. It is intended by the city authorities to make arrangements to run the car over all the electric tracks in the city, and this will enable them to reach almost any point within the city limits.

Information received from several of the states, as before stated, shows that in some places the transportation of freight or express over street railroad tracks is prohibited by state law or municipal ordinance, and it has been suggested that associations of managers of street railroads in those states be formed, for the purpose of securing favorable legislation. The enactment of these laws may be due to hostile steam railroad influence, or it may be due to a misconception of the nature of the services which street railroads would put in operation. Surely, a smooth running electric car, moving swiftly onward, would not prove such a nuisance as the great lumbering wagons which block the streets of our large cities. Where a freight or express service is needed, the accommodation to the public would be so great that many citizens might be enlisted on the side of the railroads to secure the proper legislation.

In closing, it would perhaps be well to note some of the principal points which it is hoped, have been brought out in this paper:

1. That a mail service involving collection and distribution is best handled on a separate car, operated on the same plan as a United States railway mail car.

2. That it is supposed that a great advantage, arising from the transportation of the mails, comes from the fact that the road is under the protection of the Government, and is thus secure from riots, strikes and blockades.

3. That the most promising opening for an express or freight service is a road running between two towns, or a city road running through well populated suburbs.

4. That the question whether or not such a service will pay is entirely a local question, and must be estimated for each road separately under existing conditions.

5. That there are cases when it would be advisable to operate such a service, independent of the profits, independent of the profits, in order to accommodate the patrons of the road and to induce building along the line of the road.

6. That such a service operated upon the ordinary street railroad must not be allowed to interfere in the least with the passenger traffic.

7. That in states having laws prohibiting this service, associations of railway managers should be formed to secure favorable legislation.

Five years ago such an institution as mail, freight or express service on street railroads would not have been thought possible. Such a service has always been considered as a prerogative of the steam railroad, and the fact that some street railroads have already gone into this business and that many others are engaging in investigating its merits, goes to show how eagerly the street railroad is encroaching on the domains of its elder brother. And it is not only in this respect that the electric railway is pushing the steam railroad. Belt lines, suburban lines, dummy lines, summer resort roads, mining roads and many others are rapidly being converted to the electric system. Everywhere we see instances of the screech of the locomotive being hushed by the busy hum of the trolley. We peer into the darkness of the future and we see great systems of railroads operated by power houses located in the neighboring coal fields; we see the great cities connected by electric lines, operated at marvelous speed, and perhaps at no distant date will some new "Empire State Express" or "999 Limited" be pointed out as the development of the electric street railroad.

Special Paper on "Brake Shoes."

BY POWELL EVANS.

The street railway is quite as old in this country and abroad as the steam railway proper. Owing to the immensely greater size of the latter, however, early in its existence the importance of even insignificant items of cost in construction and maintenance was made clear. As the various original steam roads became consolidated into the present great systems, economy required on every hand the adoption of standards wherever possible for each system. This principle then extended to the adoption of standards, applying not only internally to each system, but externally to all systems.

The necessity for effecting standards was the prime cause of existence of the Master Car Builders' Association, which includes representatives from about every steam railway company in the United States. This Association has collected most facts relating to the operation of all lines, and gradually reduced the greater number of details to standards. Among other net results at the present time are—the standard track gauge, coupler, wheel, and all such parts as

must necessarily be similar to permit cars from any one line to be operated on any other.

If standards have proven simpler and more economical in every way for steam roads, the fact should apply with equal force to street railway operation. Up to 1886, when electricity began its revolution of the latter industry, the horse railways were often conducted in a rather careless manner, without due regard for petty economies. Until the last year or two, since the introduction of electric motive power, the enormous change and growth of the business has taxed its managers to the uttermost to care for the vital necessities for keeping their respective roads in operation. Now, however, when the power station, track, overhead line, car and motors are quite as perfect as similar parts of the steam railway, it is full time that this Association should proceed to the adoption of standards for details.

Much has been done in this direction, but there is more still before you. We do not yet require the absolute steam railway standards, due to the interchange of cars over the various lines, but, with the growth of our suburban roads, it is not too much of a prophecy to predict this necessity in the near future.

It is not, and probably never will be, possible for all managers to agree on all points; but why should there be a difference of height of car floor above track, or diameter of wheel, on any two new or remodeled street railway lines? For our city and suburban service practically similar conditions exist all over the country, and like the steam railways we should have universal standards.

I believe in standards throughout; but now wish to call your special attention to the subject of the "shape" and "material" for brake shoes. Brakes are applied to the track as well as the wheel; but as the latter practice, with few exceptions, is the rule, what follows has special reference to it.

An extract from a letter by W. W. Whitcomb, president of the Composite Brake Shoe Company, of Boston, in the Street Railway Journal, of September, 1893, aptly emphasizes the need of reformation in this matter. He says:

"Giving attention more particularly to rolling stock, I have been struck by the fact that there is a great lack of uniformity or standard in the numerous repair parts, a state of affairs which the manager knows only too well. Take, for instance, brake shoes and their connection with the brake mechanism, a subject which has been for a long time under discussion among the master car builders of steam railways, and one which is now beginning to prove of equal interest to the managers of street railways. Having occasion some time ago to visit a large and widely known truck manufacturing concern, I was shown nearly one hundred different styles of brake shoes, many of them differing only in some small detail, yet enough to unfit them for any truck except the one for which they were designed; and the end is not yet with them. At another truck company's works the managers failed to recognize a drawing of one of their own shoes made some years before. These may be exceptional cases, yet are examples of this widely existing evil. Roads which use altogether but one style of truck are very few, and consequently for each individual style and make there has to be on hand a supply of shoes made expressly for it and fitting no other, thus multiplying styles at increased expense. This condition of things, annoying in the extreme to the buyer, ought not to exist, and a remedy for it should be adopted. That such a remedy can be found only in the adoption of some standard, suitable alike to all makes of trucks and their brake mechanism, will be readily admitted." His logic seems perfectly sound.

The steam railways have reduced the parts of their brake gear to a standard of shape—the beam, link, release spring, hanger, clevis and shoe. They have found designs good enough for all to use, and so good that no one road seems able to improve upon them.

Having decided upon these standards, they specify them when buying rolling stock, get them, and use them. Why should not our various truck manufacturing companies use a standard brake attachment; and if they can, why do we not decide upon one, and insist upon its use? As was stated above, the steam-railways some time ago settled the matter of "shapes," so this point does not appear in their recent discussions on brake shoes.

As regards "material" they are still undecided; but are unanimous on one fact, viz.; that the best thing for one road is best for all. Is this not true also among our roads? I will assume here that it is.

The Master Car Builders' Association has spent much time on this matter, and I will now read you in condensed form their last report of 1893.

After an introduction, Mr. Cloud, secretary of the association, goes on to say:

"In order to give some idea of the importance of this question from the standpoint of metal actually used in brake shoes per year, and entirely aside from the relative value of one metal or another in the service performed, some statistics have been collected from the various roads to show the annual consumption of metal for brake shoes on cars and engine tenders. While these statistics are not entirely accurate, they are nearly enough so for the present purpose. Some roads have reported the actual pounds of brake shoes procured in the calendar year 1892, while others have reported the number of shoes; by taking the average weight per shoe as 21 pounds and reducing all to weight, we find that roads which were represented in the association in 1892 owning 320,000 cars, procured in the year 1892, approximately, 32,000,000 lbs. of brake shoes for use on cars and engine tenders, or an average of 100 lbs. per eight wheel car represented per year.

If we extend this ratio to all the cars represented in the Association, or in round numbers to 1,100,000 cars, we will find that the annual requirements for brake shoes for cars and engine tenders owned by roads represented in the Association by representative members, is 55,000 tons. It may be said that approximately two-thirds of this metal is worn out in service and that the other one-third is returned as scrap, although this estimate of the average scrap weight is an estimate based on general knowledge, and not on any absolute statistics.

To show that the roads reporting are representative roads throughout the country, it may be said that the 320,000 cars reported on are owned by such roads as the Union Pacific, C. & N. W., C., B. & Q., Penna. Co., Penna. R. R., L. S. & M. S., B. & O. R. R., E. T. V. & G., N. & W., O. & M., Wil. & Weldon. N. Y., O. & W., and a number of smaller lines throughout the country.

It may also be added that of the total amount, 32,000,000 lbs. reported by the roads reporting, five-sixths of the total used was reported as cast iron, while approximately one-sixth was reported as Congdon, and a small number of the shoes of some different manufacture and under special names.

Most of the roads reporting as above also reported their consumption of driver brake shoes for the year, which were of different kinds, but which aggregated a total of 41,000 brake shoes, which average in weight about fifty pounds each, which would make 1,025 tons of driver brake shoes used by roads owing about one-fourth the cars represented in the Association.

Referring to the shop test made by the Chicago, Burlington & Quincy Railroad Company, and reported in the proceedings of 1891, it seems hardly desirable to repeat here the results of these tests, for while they had their particular value at the time, the report of 1892 says that "investigations have convinced the committee that accurate conclusions from the shop tests would not be warranted without road tests," and as the shop tests have been reported in detail and the principal conclusions can be had by reference to the report of 1891, these tests will not be further considered at the present time.

It is perhaps correct to state, that notwithstanding the use of wooden brake shoes in England until a comparatively recent date, the earliest valuable results of experiments on friction of metal brake shoes were presented by Capt. Douglas Galton to the Institution of Mechanical Engineers of Great Britain some fifteen years ago. The experiments were made with steel tired wheels, and the results showed very clearly the intricate character of the question of brake shoe friction under variable conditions of service in railroad trains. In support of this statement, the following table of co-efficients of friction at varying speeds with the cast iron brake blocks on steel tires is given from a paper read by Captain Galton before the Institution of Mechanical Engineers of Great Britain in April, 1879:

Number of Experiments from which the Mean is taken.	VELOCITY.		CO-EFFICIENT OF FRICTION.		
			Extremes Observed.		Means.
	Miles per hour.	Feet per second.	Maximum.	Minimum.	
12	60	88	.123	.058	.074
67	55	81	.136	.060	.111
55	50	73	.153	.050	.116
77	45	66	.179	.083	.127
70	40	59	.194	.088	.140
80	35	51	.197	.087	.142
94	30	44	.196	.098	.164
70	25	36½	.205	.108	.166
69	20	29	.240	.133	.192
78	15	22	.280	.131	.223
54	10	14⅔	.281	.161	.242
28	7½	11	.325	.123	.244
20	Under 5	Under 7	.340	.156	.273
.....	Just moving.	Just moving.	.....	.....	.330

It will be seen that the co-efficient of the friction is not only variable through a large range under the same speed, but that it varies very greatly with the speed under these conditions, increasing as the speed decreases.

It was also found that the co-efficient of friction decreased rapidly with the increase of time that the shoes were in action upon steel tired wheels when there was no reduction in the speed, as shown in the following table of co-efficients of friction as affected by time, also reported by Captain Galton from a smaller number of experiments:

SPEED.	Commencement of Experiment	CO-EFFICIENT OF FRICTION.			
Miles per Hour.		After 5 Seconds.	After 10 Seconds.	After 15 Seconds.	After 20 Seconds.
20	.182	.152	.133	.116	099
27	.171	.130	.119	.081	.072
37	.152	.096	.083	.069	.....
47	.132	.080	.070	.....	.....
60	.072	.063	.058	.....	.....

It must be remembered that all the experiments above reported by Captain Galton were made with cast iron brake blocks, on steel tired wheels, which is not a condition prevailing generally in the practice of this country, except on many passenger trains, but it becomes an important question to know whether similar variations are had with iron shoes on chilled cast iron wheels, especially as our service is such that shoes of the same kind are frequently used indiscriminately on both chilled and steel tired wheels.

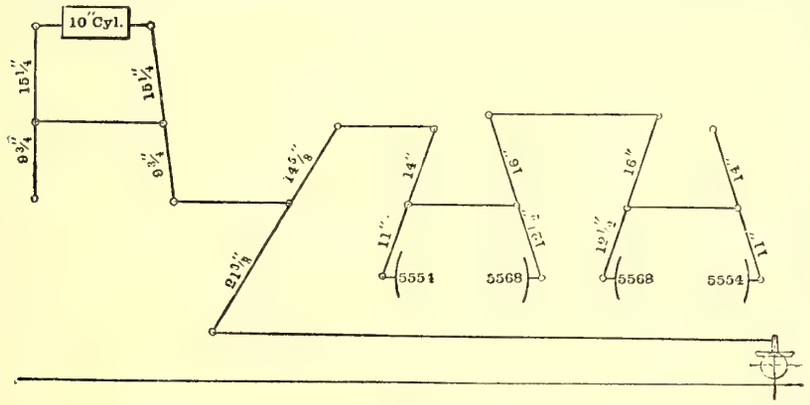


FIG. 1.

The most reliable results obtained experimentally by the use of different shoes on chilled wheels and with different brake arrangements at the present time in hand, are those obtained by the Pennsylvania Railroad Company (which furnishes the information) in various tests conducted during the past two years, which tests had different objects in view, as follows:

First.—A comparison of retarding power with one brake shoe per wheel and with two shoes per wheel with the same aggregate pressure applied to the wheel in each case.

Second.—A comparison of retarding power with long and short shoes with one brake shoe per wheel in each case.

Third.—A comparison of retarding power with uniform pressures by the use of cast iron, composite and three different grades of cast steel shoes.

Fourth.—A comparison of the durability of these cast iron, composite and steel shoes in continued service; also, incidentally, the relative wear of the wheels under these different shoes.

Considering these in the order above mentioned:

First.—Figs. 1 and 2 show the brake rigging on one four wheel truck in these tests, Fig. 2 showing the ordinary method used with one brake shoe per wheel, and Fig. 1 showing two brake shoes per wheel, which is standard on the car used for these tests.

The tests were made on a uniform grade of about eighty feet per mile, with three cars, two of which were passenger cars and the other a dynamometer car placed between the two. The three cars together weighed about 130,000 lbs. The run was made by gravity, and the start by releasing the hand brakes on the forward passenger car and on which alone the air brake was used to stop the three cars by opening the conductor's valve. The train of three cars was allowed to run a distance of one mile by gravity with the brakes released, and the time was taken by stop watches at the start and at the end of one mile to check the uniformity of the speed attained in the different tests. On passing the one mile post the air brakes were applied, as already explained, to the forward car only, with the other two cars pushing, and the time and distance required to make the stop were taken and the speed was recorded by the dynamometer car. The sliding of the wheels was noted by an observer at each end of the car which was braked. The condition of the rails was dry during the trials, but the wind, which was light, was in different directions and of different velocities on different days.

Statement No. 1 gives the details of the trials made to compare the use of one brake shoe per wheel with two brake shoes per wheel, all using long shoes. The sliding of the wheels was somewhat more with two shoes per wheel, but it was mostly on the last pair of wheels. It will be noted that there is practically the same efficiency in these two methods of braking.

Second.—The experiments as between long and short shoes were made in the same manner as described above, and the shoes of different lengths show about the same results, as per statement No. 2.

In the two sets of tests (given in the report) it was noticed that the riding of the cars during the stop was much better with two brake shoes per wheel than with one brake shoe per wheel, due apparently to the fact that the application of the second brake beam to each pair of wheels partly counteracted the tilting of the trucks caused by the outside suspended beams when only one pair of shoes is used per wheel in this manner.

Third.—The experiments on retarding power with uniform pressures by the use of cast iron, steel and composite shoes with one brake shoe per wheel were made in the same manner as described above, for the first tests, and the details of the various runs in these experiments are given in tables 1, 2, 3, 4 and 5 herewith, in which three different grades of steel shoes were tried, and in which the different grades are designated by the letters "D," "M" and "Z."

The composite shoes consisted of cast iron with a small percentage of wrought iron in the rubbing surfaces extending through the shoes, the percentage of wrought iron being somewhat less than 7 per cent. of the whole surface.

For a more accurate comparison, each of the runs included in tables 1, 2, 3, 4 and 5 has been reduced to actual retardation in pounds by the brakes during the stop, and the results are given in table "A" in the original report.

I omit statements 1 and 2 in the report, as they give in too much detail, relating purely to the high speeds and pressures of steam railway practice, the results broadly summed up just above. Tables 1 to 5 of the report are also omitted, as they are summed up later on; and table A, as it is included in table B immediately following.

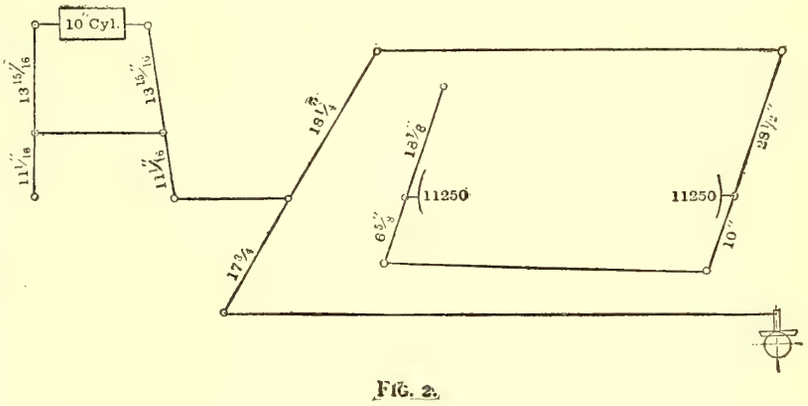


FIG. 2.

In calculating this retardation the weight of the train and the weight of the wheels, together with the speed, having been taken into consideration, and the total energy of motion calculated by adding the rotative energy of the wheels to the energy of the train as a whole, and after allowing for the effect of the grade and the effect of the ordinary resistance of the train without the brakes applied, the actual figures of the retardation of the brake shoe against the wheels as an average during the whole distance of the stop have been calculated and presented in table "A." (Included in table B.)

Table "B" presents selected runs for the purpose of making comparisons between runs in which the pressure in the brake cylinder varies between close limits of $39\frac{5}{8}$ minimum and 42 lbs. per square inch maximum. In this table "B" the figures have all been reduced on theoretical basis to 40 lbs. pressure to the square inch, thus giving a

number of cases which can be very accurately compared with one another. At the bottom of the table the averages are given with each kind of shoe, and the percentage for comparisons.

TABLE "B."

BRAKE RESISTANCES.

No. of Run.	Cast Iron Shoes. Pounds of Resistance.	No. of Run.	Composite Shoes. Pounds of Resistance.	No. of Run.	Steel Shoes "Z." Pounds of Resistance.	No. of Run.	Steel Shoes "M." Pounds of Resistance.	No. of Run.	Steel Shoes "D." Pounds of Resistance.
121	2308.40	71	2212.80	99	1698.00	18	2059.60	150	1946.80
122	2334 80	73	2236.00	96	1721.20	15	2059.60	156	1977.60
124	2403.20	75	2307.60	100	1738.40	17	2079 60	155	2008.00
123	2412.80	74	2310.00	97	1743.60	16	2108.80	149	2012 80
128	2454 40	185	2322 40	48	1767.60	.....	.....	158	2020.00
127	2462.40	187	2349.60	50	1810.40	.....	.....	35	2045.20
8	2470.80	189	2350.40	51	1836.40	.....	.....	159	2092.80
125	2479.60	184	2362.80	95	1867.20	.....	.....	34	2095.20
126	2489.60	188	2364.00	.....	.....	.....	.....	30	2135.60
9	2577.60	193	2370.40	.....	.....	.....	.....	29	2159.60
.....	.....	191	2372 80	.....	.....	.....	.....	.....	.....
.....	.....	186	2405.20	.....	.....	.....	.....	.....	.....
.....	.....	192	2410 40	.....	.....	.....	.....	.....	.....
.....	.....	182	2414.40	.....	.....	.....	.....	.....	.....
.....	.....	190	2449.20	.....	.....	.....	.....	.....	.....
.....	.....	183	2453.20	.....	.....	.....	.....	.....	.....
	Average.		Average		Average		Average		Average
	2439.36		2355.70		1772 85		2076.90		2049.36
	Per Cent		Per Cent		Per Cent		Per Cent		Per Cent
	100		96.58		72 68		85.15		84.02

Table "C" presents a comparison of the actual distances for four tests with each kind of shoe, in which the air pressure and the speeds were almost exactly alike. It also includes a percentage comparison of the average of the four runs with each kind of shoe.

TABLE "C."

COMPARISON OF FOUR RUNS UNDER THE SAME CONDITIONS.

DISTANCE RUN AFTER BRAKING.

No. of Run.	Cast-Iron Shoe Feet Run	No. of Run.	Composite Shoe Feet Run.	No. of Run.	Steel Shoe "Z." Feet Run	No. of Run	Steel Shoe "M" Feet Run	No. of Run.	Steel Shoe "D" Feet Run
8	1806	192	1887	49	3087	15	2471	157	2162
7	1893	184	1927	50	3904	17	2575	150	2866
9	1805	68	1941	51	3829	16	2708	29	2307
6	1834	65	1865	101	3425	18	2720	34	2594
	Average, 1834		Average, 1905		Average, 3561		Average, 2618		Average, 2482
	Per Ct. Av 100.00		Per Ct. Av. 103.87		Per Ct. Av 194.16		Per Ct. Av 142 69		Per Ct. Av 135.33

Two tests were made to compare the durability of the cast iron, composite and the three different grades of steel shoes in continued service, and incidentally the wear of the wheels was also noted.

The car on which the tests were made required sixteen shoes, which were made up as follows in the first test:

4 Cast iron shoes.
4 Composite shoes.
4 Steel shoes "Z."
2 " " "D."
2 " " "M."

Grouping the two grades of steel "M" and "D" together as from one foundry, the total wear of the four shoes of each manufacture was as follows, while the car ran:

KIND OF SHOES.	WEAR.	
	Actual Pounds.	Percentage Comparison.
4 Cast-iron	23.530	100
4 Composite	11.394	48.4
4 "Z" Steel	2.337	9.9
2 "D" " } 2 "M" " }	1.680	7.1

A second test was made to determine the durability of the shoes, and, if possible, to get a better record as to the relative wear of the wheels, and the following table gives the results, including also a statement of the relative distances run after the application of the brakes, taken from the former tests reported.

Three sets of cast iron shoes were practically worn out during these tests, and one set of composite shoes, while the steel shoes were not much worn. So far as the wear of the wheels is concerned, the results were somewhat contradictory, and inasmuch as a large portion of the wear of the wheels is from the rail, it would be unsafe to ascribe all the difference to the shoes.

COMPARATIVE WEAR OF CAST IRON, COMPOSITE AND STEEL BRAKE SHOES.

KIND OF SHOE.	WEAR OF				Relative Distance Run after Application of Brakes. Taken from other tests.	REMARKS.
	SHOES.		WHEELS.			
	Pounds	Per Cent.	Reduction in Circumference in Inches.	Per Cent.		
Cast Iron.....	94.690	100.00	2.812	100.00	100.00	12 Shoes worn out.
Composite.....	37.635	39.75	2.343	103.87	103.87	4 Shoes worn out.
Steel "D".....	5.708	12.06	1.156	135.33	135.33	2 Shoes slightly worn.
Steel "M and D"	10.220	10.79	2.437	139.04	139.04	4 Shoes slightly worn.
Steel "M".....	4.532	9.57	2.281	142.69	142.69	2 Shoes slightly worn.
Steel "Z".....	8.194	8.65	2.969	194.16	194.16	4 Shoes slightly worn."

A discussion follows which Mr. Rhodes initiates by saying:

"The report says that the composite shoe consisted of cast iron with a small percentage of wrought iron in the rubbing surfaces extending through the shoes, the percentage of wrought iron being somewhat less than 7 per cent. of the whole surface. On our line we use a composite shoe, and have for a number of years, on account of the saving which we find by using that shoe, but it has in the neighborhood of 40 per cent. of wrought iron. I can readily see that a test made of a shoe with only 7 per cent. of wrought iron might give entirely different results.

Mr. Marden: We have made, on our road, quite a number of experiments as to different metals for brake shoes, and we find that on steel tired wheels we cannot run with as good results with the same kind of metal as we can on chilled wheels. In fact, we are using, today, nothing but chilled brake shoes on steel tired wheels. On cast iron wheels we are using a composite shoe, and we are also using what is known as a Congdon shoe.

Mr. Lewis: One table states that the consumption of cast iron shoes is 22,530 lbs., while that of steel shoes is from 1,680 to 2,337 lbs. In other words, you have used nearly twenty times as much cast iron in the same service as you have of steel. It is assumed, of course, while the mileage is not given, that the mileage given by the different kinds of shoes mentioned in the report was the same. Now, the difference in the cost between the steel, composite or cast iron is not above a ratio of two to three, while you notice that in the wear the ratio is as one to twenty. Now, I have never considered that a steel shoe was objectionable for a driving brake shoe, and I never have known them to injure the tires, and if they wear twenty times as long as a composite or cast iron shoe, I think it would be advantageous for us to use them.

Mr. Waitt: In connection with what Mr. Lewis has said, there is another feature that comes in for consideration—the matter of the length of time that the shoes of various manufactures will wear is offset considerably by the amount of shoe resistance or holding power of the various metals. I notice two tables which show that there is a material difference in the resistance between cast iron and steel, the steel in the tests running an average of only 2,049 as against 2,439, or only 84 per cent. of the holding power of cast iron. It seems to me that this should be taken into consideration, and that we should not base a decision as to what is the best metal for brake shoes entirely upon the wear. And then, of course, will come in the consideration as to the effect on the wheels. It has been said by some—I am not prepared to say how true it is—that there is nothing gained by changing metal for brake shoes, that just so surely as you get a brake shoe that wears longer you are taking the life out of the tire—out of the steel tire, if it is a steel tired wheel, or out of the tread of the wheel, in the same proportion, or nearly so, as what you gain in the wear of the shoe.

Mr. Sanderson: We made some trials (I think it was four years ago) with some heavy shifting engines, putting cast iron shoes on one side of the engine, and steel shoes on the other. We found that the steel shoes outwore six and one-half sets of cast iron shoes. We have been using cast steel shoes since then on the driving wheels on all our larger engines on heavy mountain service where much sand is used, and we find that the steel shoe cuts down the tires about as fast as they

wear on the rails. I was looking up the record the other day, and found there was an engine that had been on the road two years, on heavy mountain service, and did not require returning yet. That is the Ross cast steel shoe. I would like to ask, in regard to this report, whether there were any release springs on these brake beams. The power seems to be calculated on the pressure in the cylinder. Now, we made some little rough tests the other day with a hand dynamometer, and found that it took over 800 lbs., with some forms of release springs, to pull the shoe up to the wheel. We could not make any calculations as to the co-efficients of friction and resistance.

Mr. Cloud: The report did not give any information on that subject. The standard, however, uses a release spring, and I presume it was used in this car. But how much it took to overcome it, I have no idea.

Mr. Lewis: In regard to the effect of different metals on the steel tire or on the wheel, we know that the Ross-Meehan shoe is designed to wear the part of the wheel that is not in contact with the rail nearly as fast as the wheel wears where it is in contact with the rail. The fact is that we never have seen a shoe constructed in that way that has worn the wheel as fast as the rail will wear it.

Mr. Harrison: We have been conducting experiments on the Baltimore & Ohio road for some time to try to find out the most economical brake shoe for our service. We have had experience with the wooden brake shoe and the wrought iron shoe and the cast iron shoe, and when we try to take the wear of the wheel and the wear of the rail the conditions are so entirely different that it is almost impossible to get any result at all. We were changing our cars, running them first one place and then another, until the only thing that we could do was to take them on to some local train. We have not arrived at any conclusion yet as to what the best metal would be. Soft metal has given very good results, and some experiments reported were very satisfactory.

Mr. Mackensie: I move that a committee be appointed by the chair to report at our next annual convention upon the advisability of making an extensive brake shoe test. I want to say now that in order to do this it will be necessary for that committee to have different kinds of wheels under the cars and different kinds of brake beams, and I think that that should be embodied in the motion. We can make a test of a brake shoe and also of a brake beam at the same time, and I believe that there are lots of lines running through the country who would be glad to furnish cars with different kinds of wheels in order to make these tests."

This ends the report as far as concerns us. I have it here in full detail for any one wishing to see it. The following extracts from letters from two wheel manufacturers and one brake shoe manufacturer, will show their views on the question of friction between wheels and shoes.

Charles V. Slocum, of the New York Car Wheel Works, of Buffalo, N. Y., says: The best mechanics acknowledge that two metals of extreme hardness coming together with resistance, as in the case of of wheel and brake shoe, do not adhere, but will eventually heat and burn.

As you are probably aware, the treads of cast iron wheels have the hardest surface which is possible for the manufacturers to provide, and this hardness is absolutely necessary for the service required. This surface cannot be touched by a tool to any extent. It is harder than hard steel, and when brake shoes of the same material are used, or shoes of considerable hardness, friction results instead of wear, with a consequent burning of the treads of wheels, in many instances shortening the life of the latter and putting the railroad company to a great deal of expense in replacement of wheels or in having them refitted; hence it becomes a question of wheels versus brake shoes.

In other words, will railroad companies prefer to buy the harder and more expensive brake shoes for the purpose of economizing in the consumption of the same, or will they prefer to buy softer brake shoes, as, for instance, the ordinary soft casting worth from one and a quarter to two and a half cents per pound, according to the qualities purchased, with a total investment per shoe of twenty to fifty cents, or will they prefer to economize in car wheels, which cost from $3 to $65 each, according to style, size and kind?

These shoes are very readily replaced with very little expense. No car wheel can be replaced to any advantage without taking out the truck, pressing off the wheel, pressing another on, replacing it in the truck and replacing the truck under the car. The expense of replacing one wheel has been variously estimated at from $2 in steam railroad service up to $10 in street railroad service, where the motor has also to be removed and the gear taken from the axle.

This, it can be seen, is comparatively expensive and does not include the cost of the wheel itself burned by the hard brake shoe, nor the cost of the new wheel to take the place of the burned one. Including these two items, a conservative estimate of the cost of replacing a brake burned wheel under a motor car would be $20, and where a company is not well equipped with facilities for doing the work, the expense would be far greater.

The cost of replacing a brake shoe might possibly be $1, including the cost of the old and new soft casting and all the labor involved.

Street car wheels are ordinarily guaranteed ro run from 25,000 to 35,000 miles in service under ordinary conditions, and will often make double these figures in actual mileage if not actually prevented. Hence it is a question which every master mechanic must decide, as to whether the wheels shall be assisted in giving good service by the use of soft brake shoes, or whether they shall be hindered, and in many cases actually prevented from giving satisfactory results by using friction, instead of resistance, in the stoppage of cars.

The Philadelphia Car Wheel Company, of Philadelphia, Pa., writes: It is a well known fact that when two metals are very hard and are brought together, they do not adhere, but will heat and burn.

Cast iron wheels are chilled on the tread, and are made as hard as it is possible to make them, and if the brake shoe is made and chilled in the same manner, instead of adhesion and wear on the brake shoe we have friction between the two surfaces, which results in the burning of the tread of the wheel, which unfits it for future service.

The difference between replacing new wheels and new brake shoes is so very great that there is no question but that a brake shoe made softer than the wheel is far more preferable and economical than when made with a chilled face, and we, of course, would commend the use, in every case, of a brake shoe made from ordinary iron.

In this connection we would like to call your attention to the flange of motor wheels. A great deal of the wear on wheels has been on the flange, and if this is not made of sufficient thickness it will chip and break long before the chill is worn from the tread, and much of the rail now in use has been made with a groove too narrow to take in more than a seven-eighths flange, and this is entirely too small for a motor wheel.

W. W. Whitcomb, of the Composite Brake Shoe Company, states: From observation and discussion in railroad clubs by the steam railway mechanics, I have become strongly of the opinion that a chilled brake shoe should never be used in street railway service, and with but few exceptions they are being condemned and thrown out. They may give more service, but it is usually at the expense of the wheel and a constant risk of accident and disaster to the traveling public. In the electric service, for instance, where considerable speed is attained and frequent and sudden stops necessary, a chilled shoe should be prohibited, in my opinion.

In connection with the first two above citations, it is well to note that with us there is not much danger of burning the wheels, but the remarks on wear do apply, and with force. I now wish to give you some figures which will show the cost of this brake shoe business to us, and therefore its importance.

In round numbers there are on all lines of street railways in the United States 50,000 cars, including the steam and electric motors, cable grip cars, trail and horse cars. These should not properly be lumped, as they include varying factors of weight and speed, varying the brake services required—but for the result in view, using low averages, this lump figure will be sufficiently accurate.

Assuming an average mileage of seventy-five miles per day for all cars, including an allowance made for cars used in rush hours only and others under repair, the total result would be 3,750,000 car miles per day. Taking the average life of brake shoes at 5,000 car miles, and an average of five shoes per car, there is a daily consumption of 3,750 brake shoes, and an annual consumption of 1,358,750 shoes. At an average weight of twenty-one pounds each, new, the total weight is 28,745,750 lbs; at two cents per pound, amounting to $574,875. I will deduct from these amounts an average weight, per shoe, of nine pounds when worn out, amounting to 12,318,750 lbs. of scrap, at one-third cent per pound, equal to $41,062, leaving a net balance of $533,813. This represents what we pay annually for metal actually ground to dust braking our cars. To this we must add the cost of labor in changing the shoes. Allowing thirty minutes per shoe for replacement and adjustment of rods, etc., and $2 per ten hours per day for labor, this total amount charge would be $136,875. Adding this last figure to the net cost of metal gives us the total annual charge of $670,688 for brake shoes, equal to about $13.70 per average car, from which you can roughly estimate the cost of this item for your respective roads.

It is self-evident that if you select a metal which will give you a greater car mileage than 5,000 miles; or a shape which will permit you to use more of your twenty-one pounds of new shoe than twelve pounds for braking, and, therefore, less than nine pounds for scrap; or if your shape is readily adjustable on cars, and your men become familiar with their replacement and save time—if you do any one of these, a saving results, and if you do two or all, the saving is so much the more increased.

Now, the first step towards an advance in economical operation is to turn to your accounts and records and locate any leaks. Can you all do this?

I will hazard the statement that you cannot. Wm. Wharton, Jr., & Company, Incorporated, of Philadelphia, in preparing this paper, sent out 300 circular letters and sets of questions for returns—with stamped and addressed envelopes enclosed—to as many representative street railways in the United States. The questions asked are given below:

MATERIAL.

1. Do you keep records of wear of shoes and wheels?
2. What are your averages?
   (*a*) Weight of cars?
   (*b*) Mileage of wheels before worn out?
   (*c*) " " various shoes before worn out?
   (*d*) Stops?
   (*e*) Gradients?
3. What material has given you the most satisfactory results for brake shoes?
   (*a*) In braking qualities for wheels?
   (*b*) In economy of shoes themselves?
   (*c*) In " " wear on wheels?
4. What materials have you used for brake shoes, and how proportioned in amount to each other?
   (*a*) Soft iron?
   (*b*) Hard or chilled iron?
   (*c*) Wood?
   (*d*) Steel?
   (*e*) Wrought iron?
   (*f*) Combination of any of above?
   (*g*) Any other materials not above included?

SHAPE.

5. How many different styles do you use;
   (*a*) Makes of trucks?
   (*b*) Patterns of shoes with separate hangers?
   (*c*) " " " without separate hangers?
6. Would you advocate a standard shoe, without separate hanger, to fit all trucks; and do you think such a standard possible?
7. Or, would you advocate a standard shoe, interchangeable for right and left, fitting into hangers with a standard shoe face, the hangers made for special adjustment to various trucks?

No.	MATERIALS. Weight of cars.	Mileage of Wheels.	Mileage of shoes.	Stops per Mile.	Gradients.	SHAPE. No. of Truck patterns.	Shoe patterns. No hangers.	Shoe patterns. Separate hangers.	Stand. Shoe wanted.	Stand. Shoe hanger wanted.	REMARKS.
1-7	No	Re-	cords	at	all.						
8	12 to 22,000...	Abt. 225,000....	Abt. 75,000	... .	As high as 10% and plenty of them.	4 Brill.....	.....	1.....	.....	Yes.....	Shoes wear down to ¼ in. thickness or less before giving out.
9	.....	.....	.....	....	.....	.....	.....	.....	.....	Present practice.	Shoe inter. and fit stand. hanger.
10	.....	.....	.....	.....	.....	1.....	.....	.....	.....	.....	Shoes from Bemis Co. only.
11	....	.....	.....	.....	6% heaviest	1.....	.....	.....	.....	.....	....
12	.....	.....	.....	.....	.....	5 or 6.....	.....	.....	.....	Yes	Use shoes as made by truck manufacturers.
13	.....	.....	....	.....	.....	3.....	6.....	.....	Not pos'ble	Yes	60 per cent. chilled iron, 20 per cent. soft, Lappin.
14	Abt. 12,000 ..	25,000 to 30,000..	.....	....	.....	3.....	.....	.....	Yes	.....	Chilled iron in shoes.
15	15,000.....	35,000.....	3,000.....	.. ..	Not over 7%..	2.	.....	.....	.....	.....	Hard iron shoe to brake on tread only.
16	4 to 6½ Tons	20,000 to 60,000..	4 to 7,000.....	Abt. 10 per m	2½ to 5½ % ..	2.....	.....	3.....	Not pos'ble	Yes	60 per cent. soft I., C. I. with wood, also with steel plugs.
17	12,000.....	55,244.....	4,864.....	5 per m.....	3 to 6%.....	1.....	.....	1.....	.....	.....	Medium C. I.
18	{Cab. 7,500.. {E. 14,500...	} 40,000.....	7,000.....	8 per m.....	Level.....	1.....	.....	1.....	.....	Yes ..... {	Congdon shoe (cast steel plugs in C. I.).
19	6 to 8,000.....	Abt. 40,000.....	Abt. 12,000.....	.....	0 to 12%.....	2 Brill	.....	.....	.....	Yes	Soft iron and wood, "Ill-fitting hangers."
20	4 to 5 Tons..	.....	.....	.....	Highest 2%...	2.....	.....	.....	.....	Yes	Ordinary C. I. shoe.
21	Abt. 6½ Tons	30,000 to 32,000..	.....	.....	.....	2.....	.....	.....	.....	.....	Chilled iron shoes—2 patterns.
22	.....	.....	.....	Very frequent.	One of 10% ...	2.....	1.....	2.....	.....	Yes..... ...	Soft iron with wood plugs.
23	.....	.....	.....	.....	8 to 9% in places.....	2.....	.....	.....	.....	Yes.....	Soft iron shoe.
24	7 to 8 Tons...	One year	9,000.....	Very frequent.	6%.....	4.....	2.....	1.....	.....	Yes.....	Have used soft I. and hard I. and iron and wood plugs.
25	12 to 15,000...	30,000 to 40,000..	5 to 7,000.....	Not frequent	About level	6.....	3.....	3.....	.....	Yes.....	Have used soft I. and hard I. with wrought plugs, and wood.
26	5 Tons.....	Not worn out but flat in 5 years.....	6,000.....	5 to mile.....	0 to 9%.....	4.....	.....	.....	.....	Most emphatically	Same as 25 above. Note letter about skidding of wheels.
27	4 to 6,000.....	One year	2 to 8,000	Every 300 ft.	0 to 6½%.....	4.....	2.....	2.....	.....	Yes.....	
28	{Cab. 7,000.. {E. 16,000...	33,000..... 27,000.....	....	As usual in cities.	Abt. 2½%....	1 each railway....	.....	Loop hanger bolted to brake bar..	.....	Durable, but hard to keep good fit	See his note. Prefers hard iron. Thinks soft I. wears wheels faster than hard I. Impossible for one shoe to suit all railway men.
29	11,000.....	45,389.....	.....	.....	5% heaviest..	2.....	.....	1.....	.....	Yes.....	Congdon shoes.
30	20,000.....	30,000.....	4,500.	.....	....	4.....	.....	1.....	.....	Yes...	C. I. with wrot. I. plugs.
31	5½ Tons.....	20,000 to 24,000..	10 to 14,000.....	Every 500 ft.	Not over 2%..	1.....	.....	1.....	.....	Yes.....	McGuire type shoe, chilled iron wheels.
32	10,000.....	Abt. 36,000.....	1,500.....	20 per mile...	4 to 11%.....	1.....	1.....	.....	.....	Yes.....	Hard C. I.—4 steel segments, 3 in. apart.
33	{Mo. 16,000.. {Trail 6,000..	}	.....	.....	3 to 7%.....	1..... ..	.. ..	All.....	....	Yes..... {	Soft C. I. and same with wro't plugs.
34	8 to 9 Tons	4,000 to 30,000 ..	Comp. 20,000 C. I. 8 to 10,000..	Usual in cities....	..... Max. 3%.....	2.....	1.....	1.....	.....	Yes.....	Note on wheels.
35	8 Tons.....	35,000.....	4,5000.....	7 to mile.....	7%.....	3.....	.....	2.....	Yes.....	Yes.....	Soft C. I. and comp. shoe. Soft C. I., hard C. I., C. I. with wood plugs. Wood.

Note.—The originals used in preparation of this sheet were present for reference.

REMARKS.

Of the thirty-five answering replies, seven sent no information whatever (1-7); seven stated that they had no records of shoes or wheels, but gave such information as memory supplied probably (8-14); thirteen gave records of shoes and wheels—"limited," "not accurate," etc. (15-26); two had records of wear of wheels, not of shoes (27-29), and six had records of shoes and wheels (30-35). A tabulated list of replies in the order above indicated is given on this page.

The small number of these answers, first, and the smaller number giving accurate information, second, does not speak well for the interest the members of this Association show in such matters, or the records kept by them. As a whole the replies are very contradictory.

You will note the wide difference in material in use. It is not possible that this difference can exist and all be right.

Who are in error? In my opinion a standard shape of shoe proper could be put in practical and immediate use. Out of twenty-four circular replies on this point twenty-two favored such a plan. The principal objection made to it is, that the hangers wear and will not hold shoes tightly for any length of time. Is this not largely due to faulty design, as the Master Car Builders' Association standard for some years has consisted of a separate shoe and hanger? I am using the word hanger as meaning the clevis in steady railway practice.

The Graham Equipment Company also uses this standard on its trucks, and in a recent letter on the subject states: "We have no trouble with hangers wearing out. We find they hold the shoes tight, and so far in our experience of three years we have not yet found a case of the hanger or shoe rattling loose." The Atlantic Avenue Railway Company uses the Master Car Builders' standard, varying the hanger attachment to fit their trucks. The Electric Traction Company, of Philadelphia, the Baltimore City Passenger Railway Company and many other lines using the McGuire Truck Company's shoe, or designs similar to the Master Car Builders' standard, vary the hanger to fit different trucks. You will find samples of all the above mentioned shoes among those now on exhibition here. I strongly advocate the adoption of the Master Car Builders' standard by this Association, the hangers made to fit our various trucks. In time we may hope to reach a standard hanger, when the brake beam and attachment are made from one design, which could easily be accomplished.

This standard shoe weighs less than any combined shoe and hanger, and most of the metal in it is available for actual wear—leaving the smallest possible percentage of residue for the scrap pile. You will note the great weight of useless metal required for attachment solely, which many of the combined shoes and among those exhibited contain.

This standard further requires but one pattern for right and left shoes for all trucks, and car house men become familiar with it and accustomed to its fitting.

Without further attention to shape, I will proceed to some consideration of material. From conclusions based on the foregoing Master Car Builders' report and letters immediately following it, there appear to be three main conditions involved in the "best material," viz., that it should be economical in wear itself, economical as regards wear on wheels and should have a good co-efficient of friction. Different men will vary in opinion as to the relative importance of these three conditions.

It seems to be generally conceded that neither chilled iron nor steel are advisable, as they have not a sufficiently firm hold on the wheels and wear them too much.

Soft cast iron, on the other hand, is satisfactory on both these points, but wears out too fast. Various combinations of soft and medium hard cast iron, with wrought iron, chilled iron or wooden segments inserted in the frictional face—from 20 per cent. to 40 per cent. of the face—have given the best results in all these respects in street railway service so far. The Lappin and Baltimore Car Wheel Company's shoes represent the soft and chilled segment type; the Composite Brake Shoe Company's shoe the iron and wood segment type, and the Wharton Company's shoe the wrought and cast iron type. Still another type is the Wharton wood shoe, in which the frictional surface consists of oak cut across the grain. The Pennsylvania Railway Company uses a medium hard or soft, as you please, cast iron mixture for its shoes; but it is well to remember that the pressure of the shoe against the wheel, and the circumferential velocity of the wheel, is much greater in steam railway practice than in ours, and the former could not use at all with safety material which might do our work.

A chilled iron shoe would burn their wheels, and a wooden shoe would be set on fire. Another point of difference in conditions of the two practices is the normal freedom from dirt and grit on the steam track, and the necessary presence of both on all tracks laid in city streets. The grit undoubtedly increases the frictional co-efficient between the wheel and the shoe on street cars, but also tends to increase the grinding of both.

A. Whitney & Sons, wheel manufacturers of Philadelphia, have designed a shoe having open cuts across the frictional face, to permit this grit to fall out. As the area of the frictional face must necessarily be as great as in others of continuous surface, they practically apply a number of small shoes instead of one large one, and the total amount of grit retained by the former type is probably equal to that retained by the latter, so I cannot see any actual difference in result in this respect between the two. The grit is always with us, and must be considered an ineradicable factor in our problem. In connection with the area of frictional surface, the best practice seems to be for the shoe to be not less than twelve inches long, and to rub on both the tread and flange of the wheel.

Regarding this question of material, I have collected the available information, but am free to confess my inability to suggest final conclusions. We must think and work over the matter for a time.

The object of this paper is to call your attention to the value of standard design in the practical business of squeezing dividends out of the operation of your roads; to show you that steam railways have standard shapes for brake shoes and attachments, and that we should and could have our own; to inform you that our roads, as a whole, are inconsistent in their selection of material for brake shoes; and to lay before you for further consideration the facts known regarding the merits of various materials for this purpose.

Too much stress cannot be put on the value of good records in this and other details. The results will more than repay the trouble and bookkeeping costs.

I now beg to suggest the appointment of a committee to investigate the subject during the coming year, to make experiments, if deemed advisable, and to report at the next convention. A sum of money should, in my opinion, be appropriated by the Association for their use. The Master Car Builders' Association is now having a series of experiments made at the works of the Westinghouse Air Brake Company, on brake shoe material.

Report of the Committee on "The Best Method of Treating Accidents."

BY P. M. DYER—Committee.

Among the subjects coming to the attention of the general manager none is more replete with perplexity and difficulties than the disposition of personal injury claims. Expense of operation can be approximated; cost of construction estimated by the engineer or architect, but when and where accidents will happen, and what they will cost the company, can never be predicted. By the aid of modern inventions the cost of operation has been lessened; but this gain is threatened by the additional expense incident to the increased number of accidents on street railroads operated in the crowded thoroughfares of our large cities.

It is my purpose to explain to you in what manner the North and West Chicago Street Railway Companies attend to personal injury cases, commencing with the accident and following the theme to the final disposition of the claim. These two corporations carried 167,000,000 passengers during the year ending December 31, 1893, and upon the claim department devolves the duty of investigating all accidents and the making of settlements, or preparation of the defence, in all claims that spring from this great traffic. One claim department does this work for both roads.

The working force consists of a medical staff and a sufficient number of investigators, all under the direction of the chief adjuster, who reports to the general counsel of the two companies. For the purpose of this article the work of the claim department may be divided into three periods, each separate and distinct from the others, as follows: First, investigation; second, negotiation; third, litigation.

First, as to investigation. The work of this period begins immediately after the accident and continues until there has been secured a full and accurate account of the accident, with reliable information as to the nature and extent of the injuries to person. Employes have been instructed to notify the claim department of the occurrence of an accident on car or train, giving circumstances of the same, nature of injuries to and residence of the injured, and as far as possible to secure the names of the witnesses. When this has been accomplished and the injured one has been placed in the charge of a physician or the police, the car or train may continue its journey. In the meantime a representative of the claim department will proceed with all possible dispatch to the scene of the accident. If the injured person has not yet been removed, he must see that conveyance is provided to the hospital or to the home.

These companies usually bear the expense of temporary medical care and transportation, without regard to liability, believing such attention is appreciated by the injured and the community at large. In all cases of personal injuries, it is the duty of the medical staff to secure the privilege of an examination; the physician making the same to avoid any assumption of responsibility for the treatment, but to fully ascertain the nature and extent of the injuries, and to obtain, if possible, a concurrence in his report by the attending physician.

All employes witn ssing accidents are required to make written statements of the circumstances of the same on printed forms provided for that purpose, attaching the names and places of residence of all witnesses. This report must be completed and given to the foreman before the employe finishes his day's duties. These reports are forwarded to the claim department without delay, and when received, circular letters containing printed interrogatories are sent to each witness. If the seriousness of the accident demands it, interviews are had with the witnesses. That the claim department may be kept fully advised from time to time as to the condition of persons injured on these roads, they are occasionally visited during the period of recovery by the investigators assigned to those cases. In Chicago, all hearings before the coroner are had immediately after the accident, and the verdict of the coroner's jury is usually rendered on the day following the death. It is the policy of these companies to secure the presence of their witnesses at the hearing before the coroner, and obtain stenographic minutes of the proceedings. Thus, in a comparatively short time, the claim department will have collected much information as to the condition of the injured, and the circumstances of the accident. We may now consider the work of the first period completed.

The reports relating to an accident could now be filed away, perhaps forever, if it were not for the industry of some claim lawyer or other hustler who persuades the injured to make a demand on the company for compensation. The making of a claim leads us to a consideration of the second period, that of negotiation. Demand being made for compensation, it becomes the duty of the chief adjuster to place before the general manager or general counsel all facts within his knowledge bearing on the claim, for a decision as to liability, and the naming of the maximum sum to be paid, if a settlement is deemed advisable, the claimant being promptly informed of the decision. As to the negotiations preceding a settlement, I need say but little. They are usually conducted by the chief adjuster on the part of the company. If not successful the period of negotiation will end, usually to be followed by litigation, the third and last.

After the commencement of suit all witnesses are again located by the claim department, and thereafter located at stated intervals until the time of the trial, and if possible additional witnesses are found to strengthen the defense. Success in defending suits arising from personal injuries, largely depends on the character of the work done during the period of investigation. The officers of these companies believe in the thorough investigation of all accidents, if possible the settlement on a reasonable basis of all valid claims, in vigorously contesting fraudulent demands, and that prompt settlements are for the best interests of their companies.

In conclusion, I will say that the time is at hand when all railroad corporations must be prepared to resist claims in a large percentage of their accidents. To promptly prepare to do this is the part of wisdom, when considered from a financial standpoint, usually the determining consideration in corporate management.

Report of the Committee on "The T Rail Track Construction of the Terre Haute Electric Railway."

By Russell B. Harrison.—Committee.

It gives me pleasure to respond to the request and invitation of the American Street Railway Association, extended last year at the Milwaukee convention, to make a report at the Atlanta convention, on "The T Rail Track Construction of the Terre Haute Electric Railway." This is not alone from the fact that it is very gratifying to have so influential a body as the American Street Railway Association thus recognize the pioneer and successful work of the Terre Haute road in the important field of track construction. But more especially from the standpoint that having given several years' study to street railway track construction—not following as others lead—but working on the problem with new and original ideas, I believe the presentation of the results that have been secured will not only prove of great value and interest to the members of the Association in showing how T rail track construction may be successfully laid in paved streets, with the hearty approval of the public, and will give the members a standard to follow that will enable them to save thousands of dollars in expensive experience and in costly experiments. If but a small part of my expectations in this respect shall be immediately realized, the seed will be sown and will produce a great harvest, bringing ample reward for our efforts and work on the problem.

The present standard of "all steel" T rail track construction of the Terre Haute Electric Railway, not only has no equal in this country, but is so far in advance of anything yet attempted in the way of street railway track construction, that I feel a brief outline of our work on the problem, prior to reaching the present standard, will not only not be out of place, but will prove of real interest. I am aware, gentlemen, that these are strong words to be used in connection with our present track construction, and that my opinion may not be immediately shared by many members of the Association, but I am confident that all members making an actual inspection of the track, will share my opinion as to its smoothness, solidity, durability, permanency and general merits, and the great advantages and public popularity of the smoothly finished asphalt and brick paving laid in connection with it.

Terre Haute is an anomaly among the cities of this country, on the subject of street railway track construction. It is the only city that would not permit girder or groved rail in its streets, and would make as great a fuss now on the subject, as the average city would do, if an attempt were made to lay T rail track. This will seem a strange condition, but to the company it is a very pleasant one, making its relation with the city on the subject harmonious, and permitting the road to secure, with popular approval, the best and most durable form of rail, at the least cost. This feeling—the approval by the public of a T rail did not exist at the start, but was brought about gradually, assisted by the greatest of all teachers—experience. It would not be in existence to-day if the management of the road had not at all times realized that public opinion and the approval of the public, were valuable assets to a street railway company, and worth every earnest effort to hold and maintain. Our motto has been, not how cheaply, but how well we could construct our tracks in the streets. The public have appreciated our efforts and sustained us loyally.

There has been in the past too much attention paid to motors, generators, cars, power-houses etc., and too little to the foundation for successful and economical operation—a perfect track. The development of electricity as a motive power for street railway service, was very rapid, and it is only natural that the inexperienced should be misled in their hurry to change power and have an electric road that would make them very rich in a year or two. Is it any wonder then that many roads should find after a year or two of experience that the track was too light for the cars and motors, and the cars and motors were too heavy for the track, and that both were worn out and required rebuilding, at time when the great panic had reduced traffic to its lowest point. Light and abused track and worn out cars and motors, coupled with reduced traffic, have brought to too many roads the unwelcome guest—the receiver.

It seems strange that street railway track construction should drift so far away, in theory and practice, from steam railway track construction. One had but to study the wonderful display showing the development of track construction, in the Transportation Building, at the World's Fair to acquire a liberal education on the subject. The Terre Haute road has indeed had a fortunate experience. Its management early realized, that successful track construction should approach as far as possible, and not deviate from, further than necessary, the best steam railway track construction. So to-day the Terre Haute road is an all T railroad, and every block of track in paved streets of so durable a character that it will last for years, with a minimum of repairs.

Terre Haute, although a small town at the close of the great civil war, was very enterprising and determined to have a street railway. A company was incorporated for this purpose in 1866, with ample capital, and commenced to lay track early the following year. It is an interesting fact in connection with the present low price of steel, that the side bearing, flat iron rails purchased by the company in 1867, cost $108 per ton. These rails were used about twenty years and then, thirty-eight pound girder rails were substituted. The franchise of the company does not contain any requirements as to the style, character or weight of the rails. While there has been no expression from the public on the subject, the management feared that the general and popular prejudice against the use of T rails in the streets would appear in Terre Haute. They, therefore, hesitated about so radical a change, but appreciating the good results that would come from the use of such a rail, they decided to place a trial order. No publication was made of the fact that it intended to use T rail. The first T rail laid by the company was on South 3d Street, in the fall of 1890. This rail was laid preparatory to changing the motive power from horse to electricity. The old girder rail on 3d Street was taken up, new ties distributed, and when everything was ready the T rail was distributed in a matter-of-fact way, as if it was the only rail that could be used, and a force of men put to work in laying them. The Mayor of the city came around

shortly, reports having reached him, as to the company laying a steam railway track, and when he saw the reports were true, said with some excitement, "What are you doing here, putting a steam road in our streets?" The superintendent, who was on the spot, was equal to the emergency, and replied pleasantly, but earnestly, that the track was being built for an electric railway. The mayor replied that that could not be the case, as the rails were steam road rails. The superintendent then informed him, that these T rails were the only rail adapted for the successful operation of electric railways, and while it appeared to be the steam road rail, it was in reality very much lighter (the section being forty pound T) than a steam road rail. Further explanations satisfied the Mayor, and convinced him as to the merits of the T rail. In a short time he not only became interested, but enthusiastic, and brought councilmen to see the rail, and explained to them its advantages for electric street railway service. They in turn brought prominent citizens and others to look at it, and thus by tact and good management the T rail was introduced.

A description of the laying of this first T rail track will prove of interest. It was a forty pound T rail, laid on oak ties, 5 × 7 × 7, with three feet space from center to center. The rails were laid without proper regard to having the end of the rail rest on a tie. Planks, 2× 6×12, were laid on both sides of the rail. On the inside, the planks were nailed to the ties, and on the outside blocks were nailed to the ties to raise the plank to a level with the rail, to provide vehicles an easy crossing. Ordinary flat splice bars were used with the rails. The rails were bonded with three-eighths inch, galvanized bond wire, with a single bond to the joint. They, in turn, were wired and soldered to a supplementary wire, of one-quarter inch, galvanized, stranded iron wire, each alternate joint being soldered and wired from both rails of the track. In the single track, the supplementary wire was in the center of the track, and in the double track between the tracks. The track was covered in with good gravel.

One year's experience demonstrated that planking was unnecessary; that gravel, which is found in great abundance under and about Terre Haute, made—with a little clay that is found above it—a superior substitute for the plank, and protected the rails better, in enabling vehicles to pass along, and to cross the track easily and without injury. This substitute only required occasional attention in filling up low spots to maintain a level roadway. In two years, the planks were badly decayed and warped up at the end, and as the track was thoroughly overhauled at that time, the planking was taken up, and gravel substituted.

At the end of two years' service of the track, it was found, in making repairs, that the galvanized iron, supplementary ground wire was rusted out and gone for various distances, making a return circuit an impossibility, and as we had only the rails to depend upon, which, in themselves, for this purpose, are not sufficient, this trouble not only reduced the efficiency of the circuit, but caused frequent burnouts of the armatures and fields. It grew to such an extent that it was found necessary to rebond this track, and it was decided, at the same time, to dig up and repair the entire track, and increase the number of ties by one-third, and, at the same time, give careful attention to having the ties under and properly supporting the rail joints. Tinned, No. 00 copper wire was substituted for iron as the bond and supplementary wire. Good gravel, with a little clay, was substituted for the plank along the rail, and the substitute has given very much better service than the planks have ever done. This section of the road, as rebuilt, is in daily use now, and giving good service.

The era of street paving did not set in, in Terre Haute, until 1892. This was not because Terre Haute lacked in enterprise and progressiveness, but was because the town was situated on a high bluff, fronting the Wabash River, and had, with the gravel subsoil, good drainage and good streets. When it was decided to pave Wabash Avenue and Main Street with brick for fifteen blocks, it became necessary for the company to take up its girder rail. Our experience, thus far, with T rail, had been so satisfactory that it was decided to continue its use on the following method:

Rail.—About this time the Illinois Steel Company brought out its sixty pound Shanghai T rail, and as this was five and three-quarters inches high, permitting paving without chairs and direct spiking of the rail to the ties, it was very promptly adopted and ordered.

Ties.—Carefully selected oak ties 5 × 7 × 7 were used.

Foundation.—After excavating for the track, the ground was rolled by a heavy fourteen ton steam road roller. Then six inches of broken stone was placed in position as a bed, and rolled by the fourteen ton steam road roller.

Track.—Then the ties and rails were placed in position and raised to grade by tamping screened broken stone underneath, spaces between ties were filled with broken stone and rammed to position.

Bonding.—Single bonds were used of seven-sixteenths inch, galvanized iron wire, and a supplementary wire of No. 00 tinned copper wire.

Paving.—On top of the broken stone, screened sharp sand was placed, and with one-inch hose this sand was washed into the interstices of the stone. After drying, the sand was brought up to an even surface by a fresh deposit, and it was then smoothed to even surface and the desired thickness by a mould board. Then vitrified bricks were placed in position, leaving them somewhat higher than the rail. They were driven into the cushion of sand by means of hand rammers, with a square piece of boiler plate placed on top of them, to force all to the proper level. The sand cushion permitted the bricks to crown evenly from center towards each rail to afford proper drainage. A special brick with one corner cut off with sloping angle to give space for flange of wheel to run in, was laid next to the rail. These bricks were not the shape of the special nose brick now used, and only set against the lower edge of inside of head of rail. The space between the brick and web of rail was filled with grouting. Bricks of regular size were laid between. After the bricks had been rammed and rolled to proper position, a grout of best screened sharp sand and Portland cement with water, made to such flowing consistency as to percolate all the crevices, was poured over them, and by brooms pushed into the openings. When thus wet, the bricks were solidly united and they cannot be separated, except with great difficulty. A finishing coat of sand was thrown over the entire surface, and traffic kept off for one week. After thoroughly setting, the sand was swept off and the street opened for traffic. The street between the tracks and curbstone, as well as between the tracks, is one solid mass of concrete and brick from center of street to curb, and will sustain great pressure. Since this track was laid, our experience with it has demonstrated that it could have been improved in one particular, viz., the sand and broken stone should have been united with cement into regular concrete. For we have found since the paving was completed that the use of the water on the sand did not wash it thoroughly into interstices of the broken stone. In time the sand dried and settled down into the spaces, and while the ties and the paving immediately over them have remained firm and solid, the paving between the ties has settled slightly, without breaking or disturbing the concrete holding them together. This track laid in Wabash Avenue, the principal street of the city, has had two years' severe service, and has been thoroughly tested in every particular, and thus practically demonstrated its great success and merit. Vehicles, carriages and wagons can pass along the rail, and turn in or out at will, without jar or wrenching. It can be crossed at right angles, or at any angle with equal ease and comfort. A coutinuous traffic over it has caused no perceptible wear, and the cars glide over it without oscillation, as smoothly as when first laid.

Our next experience with T rail construction was in a street paved with asphalt, where a half mile was laid in the fall of 1892, and a mile more in the spring of 1893.

While asphalt presented some new problems, the T rail, ties, joint plates, bonding and supplementary wire were the same as on Wabash Avenue, the foundation was improved by making it of concrete, six inches below the ties. This broken stone concrete was also placed between the ties, and up to a point to allow space for four inches of asphalt packed into position.

The asphalt was brought up to and in contact with the rail on the outside for the entire distance of half a mile. On the inside of the rail for the first half mile the vitrified brick used on Wabash Avenue, with corner cut off on a sloping angle, was used to give flange space, and between the two ends of the brick asphalt was used in the regular way. On the last mile the merits of the Haydenville blocks having been brought to our "attention" it was decided to use them both inside and outside of the rail, and while it makes a smoother finish to the rail than the brick or asphalt, our experience proves that these blocks do not have the wearing qualities of the brick. This track and asphalt paving are beautiful in finish, and of unusual strength and smoothness. It is a genuine pleasure for passengers to ride over this track, for there is no motion perceptibie except the forward motion.

Our next experience with T rail construction was during the year 1893, in several streets paved with brick. The rail was sixty pound Shanghai, and rail plates, bond wire and supplementary wire were the same as in the street laid in asphalt. The foundation was six inches broken stone concrete below these ties, and about five and a half inches additional concrete between the ties. It also covered slightly the top of the ties. The foundation for this brick track was further improved by

pouring a thin wash of sand and cement over the top of the foundation before placing the sand cushion thereon. This gave the foundation, track, ties and concrete a solid union. The brick paving was laid in a manner similar to that on Main Street. Instead of angle cut brick for flange space Haydenville blocks were placed on the inside of the rails, one and a half inches distance therefrom. The lower part of the space between the Haydenville block and rail was filled with sand concrete, rammed down tight. On top of this an inch of tar was placed. The hollow spaces in the Haydenville Block were filled with sand concrete before placing in position, and the space in the center of the track between blocks was laid with vitrified brick in the regular way. This track is perfect in strength, smoothness and durability. A year's experience with the Haydenville blocks on these business streets show that the glazed upper service wears too rapidly, and their use has been entirely discontinued.

While this track, just described, was in every way superior, I gave further study to where additional improvements could be made, caus ing the following changes: 1st, to use a heavier rail with wider head; 2d, to substitute metal ties for wood; 3d, to secure greater rigidity and evenness in rail ends; 4th, a firm and permanent hold on the rails without the use of nuts and bolts; 5th, in paving, a better brick and of such shape as would provide better flange room and contact with the web of the rail. These changes brought us to an all steel T rail track.

Rail.—When the Illinois Steel Company, brought out the seventy-two pound Shanghai T rail which was an improvement both in weight, strength and in the width of the head of the rail over sixty Shanghai T of same make it was immediately adopted as the Company's stand ard and was used in our latest and best T rail track construction. The Shanghai rails of this company's make are so well know that a description is hardly necessary, but as this paper will be read by some who have not seen sections of them, I will give the dimensions of the seventy-two pound rail. The rail is six inches high, the base is five inches wide, the top or head is two and three eighths inches in width. The web from where the turns begin is three and one half inches. The long web permits the rail to rest on the ties and brings the top of rail to proper level for paving with brick, asphalt or granite blocks. In this track the rails are laid broken jointed. The seventy-two pound rail has a wider head which gives better contact, and wider bearing service for the wheels. The edges of the wheels do not nick or chip out as with the lighter rails with narrower heads.

Experience with the narrow head rails demonstrates that by wear an outer flange is formed on the wheel and that this outer flange is very destructive to the life of special work and the wheel. The wider rail head is also better for gravel or macadamized streets as it gives no opportunity for the stones lying adjacent to the rail to nick the outer edge of the tread of the wheel.

Foundation.—The foundation of a track is to a larger degree than any other part responsible for its wearing qualities, and this fact has not been lost sight of in our work. Good rails, ties and joints cannot alone make a track or properly sustain it so as to keep it level and give good wearing qualities; therefore under the all steel track it was determined to place a heavy foundation of the best material. After the necessary excavation the ground was rolled with a heavy fourteen ton steam road roller. Then eight inches of broken stone concrete was placed in position and allowed to set. Then the rails, ties and joints were distributed and connected together and when the track is completed it is brought to the required grade or level by putting blocks under the rails at intervals to bring track to proper grade. Then four inches of broken stone concrete is tamped under the ties and under the rails, after the tamping process is completed the inequalities of the surface are filed with concrete and the whole leveled up with concrete over the top of the ties and pounded to a level surface with a wooden rammer and allowed to set.

Ties.—The ties are steel and double corrugated and heavily coated with tar while hot, and being made, and are two inches high, seven inches wide and seven feet long for straight line work, and were laid fifteen inches between centers. For special work the ties vary in length as the necessities require, up to twenty feet or more. The metal of the tie is one-half inch thick. These ties were manufactured by the Daniels Steel Tie Company, of Youngstown, O. The rails rest on and are fastened to the ties by clamps with off-sets to fit the base of rail. These clamps are secured and adjusted to the top of the tie by special made bolts with oval shoulder and is inserted from bottom of tie with the head below and the nut on top, which permits a powerful box wrench being used to draw the nuts on bolts to a permanent position.

In using these steel ties in connection with the Wheeler rail joint a mechanical difficulty arose, but was overcome in the following way, after some study: The Wheeler joint has a thickness of three inches below the rail base, and in laying track with broken rail joints a straight tie would not answer. At first we thought it would be necessary to use a wooden tie under rail joints, but by devising a special tie, we were able to have them all of metal. The special steel tie for use under joints was adjusted to the necessary levels, by bending it down in the center three inches by an easy off-set. In laying the track these special ties were easily placed in position and gave perfect satisfaction. The clamps and bolts were the same as on straight line work.

Joints.—A great deal of attention was given to the subject of securing a good rail joint for this all steel track, and after examining many devices selected the Wheeler rail joint made at Marion, Ind., as it did away with the bolts and nuts, and embodied the best of all mechanical principles—that of the wedge.• These joints at that time had not been made for Shanghai rails or for steel ties, but I overcame these difficulties by designing a new joint to be used with these rails and ties, and secured in this new pattern more bearing surface on the tie, by having the bottom of the joint made to fit the corrugations of the tie. The joint consists of two parts, one of which is keyed on to the other. The larger or heavier part used on the outside of rail has two lugs, that fit in the angle joint holes nearest the ends of rails. After it is placed in position,the lighter part is keyed on with a large maul and it holds the rails rigid. Then the tie is placed under joint and is fastened to it in the regular way, with the exception that the clamps have longer off-sets, the holes in the ties for the bolts are also wider apart, on account of the width of the base of the joint. The joint has corrugations on each side at right angles to the rail, which gives it great strength. The joint is made of the best malleable iron and weighs thirty-two pounds complete.

Bond and Supplementary Wire.—Iron wire, having proved unserviceable and unsatisfactory, the heaviest copper wire was used in connection with this steel track. Double bonds of No. 0000 copper wire were used at each rail joint, one in the upper and one in the lower part of the web of rail. These bonds were soldered and connected to the No. 00 tinned copper supplementary wire, that has been adopted as standard.

Paving.—When the foundation is completed and the track set in it, as just described, nothing remains but the paving to complete the track and street for use. The all steel track was laid on 9th Street, a business street leading from Wabash Avenue or Main Street to the Union Depot, and brick was, therefore, selected for the paving material. This brick pavement was laid as previously described, and needs no further description.

As the use of Haydenville block has been abandoned and the angle, nose-cut brick did not touch the web of the rail, I designed a special shaped brick that has many advantages, combined with the same wearing qualities as the brick on each side of the tracks, as sample pattern of brick which I have with me will give a clear understanding as to its shape.

Drainage.—In the earlier laid track in paved streets, rapid and proper drainage of the tracks was not provided for. The paving was crowned to the center of the track and followed the slope of the streets, but when the lowest point in the street was reached, no provision was made to carry the water quickly to the sewer. In this new track, proper provision is made to get rid of the water from rain, snow and street sprinkling, quickly and effectively. In the center of each track, at the lowest point in the grade of each street, an eight-inch sewer pipe was laid to the sewer. Over the top or opening of this pipe, in the center of the street, is placed a small catch basin surmounted by a special made iron grating. The water flowing down the track and along the side of the rails, is thus rapidly removed and a simple and effective drainage secured.

Injury to track by vehicles and heavy teaming.—On our track, which is standard gauge, four feet eight and a half inches wide, heavily loaded vehicles cannot drive along it and get the benefit of the smooth metallic surface as in the case with girder rails. This condition is a great improvement, and makes a saving in many ways.

First. It saves an immense amount of money in repairing the injury and wrenching to track, and rapid wear and tear thereto caused by vehicles, and particularly heavily loaded wagons turning in and out and driving along the track.

Second. It permits a quicker and more frequent car service—which all street railway men know means time and money by giving the cars a clear track.

These are great advantages and will be best appreciated by the

managers of the lines in large cities. They can also bear testimony to the large savings effected in the wear and tear.

To further prevent heavy teaming along the flange spaces of our track, and at the same time make the wear and tear on the street paving, which we are required to maintain, a minimum, the following ordinance was passed by our City Council, October 4, 1892 :

"An Ordinance Regulating Heavy Hauling Over and Through the Improved Streets of the City of Terre Haute.

"Be it ordained by the Common Council of the City of Terre Haute, that it shall be unlawful for any person to drive or cause to be driven or permit his or her servant to drive upon any street or alley paved with wood, stone, brick or asphalt, any wagon or other vehicle having upon it weight which, together with the weight of the wagon or vehicle, shall exceed four thousand pounds (4,000) and less than seven thousand pounds (7,000) unless the tires upon such wagon or vehicle shall be at least three inches in width; nor shall any such wagon or vehicle having upon it a weight which, together with the weight of the wagon or vehicle, shall exceed seven thousand pounds (7,000) be so driven in or upon any such paved street or alley, unless the tires on such wagon or vehicle shall be at least three and one-half inches (3 1-2) in width.

"Section 2. Any person who shall violate any of the provisions of this ordinance shall, upon conviction therefor be fined, and forfeit and pay not less than five dollars ($5.00), nor more than fifty dollars ($50.00).

"Section 3. This ordinance shall take effect and be in full force and effect on and after December 1, 1892."

Before tests were made, the trackway was carefully calibrated as regards time for traveler to go from top to bottom and the intermediate points, resulting in knowing the time to one-hundredth of a second. The tests were conducted across the bus bars of the switchboard of the Camden Horse Railroad Company, Camden, N. J. Average voltage, 515 volts.

Before throwing a fuse in circuit, a water rheostat was set, using a Weston ammeter for this purpose, so that the current desired would flow through the fuse, when the circuit was completed by the traveler on the trackway.

The different size fuse wires were subject to the following limitations: The time of the traveler running full length on the trackway 1.5 seconds; the current ranging from 20 to 130 amperes in ten ampere steps.

The smaller fuse wires would fuse with the minimum current of twenty amperes, and in all instances inside of the 1.5 second limit. Consequently, the curves show a wide range, but in the larger size wires, a greater current was required to fuse the wires in the 1.5 second limitation; consequently, the curves given for the larger fuse wires show less and less range as the fuse wires increase in size.

In order to strike an average, the tests were repeated, under similar conditions as regards current and gauge wire, with a three inch horizontal fuse, a six inch vertical fuse, both of which were connected to a standard form of fuse block, also a four and a half inch fuse, the average in length of the three inch and the six inch, was employed connected in a specially constructed fuse block which absolutely pre-

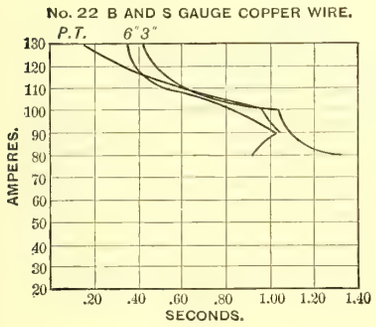


FIG. 1.

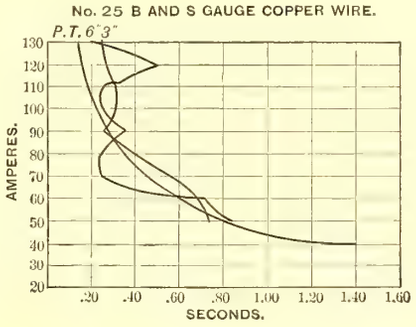


FIG. 2.

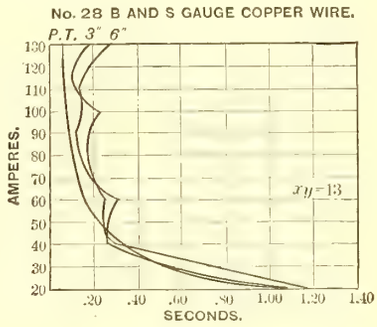


FIG. 3.

vented any arcing of the terminals. In other words, the fusing of the fuse wire could not burn the terminals to which it was attached.

The results with a few of the fuse wires are recorded graphically in the accompanying charts and give, therefore, the time required in fractions of a second for the circuit to be opened under identically similar conditions as regards current and gauge of wire for a three inch, a six inch unprotected and a four and a half inch protected terminal fuse.

The curves as given in chart No. 3 for No. 28 B. & S. copper wire, illustrates excellently the erratic character of the fusing of wires under conditions as observed in the practice of to-day.

The time required to open a protected terminal fuse wire becomes less and less as current increases and grows less regularly, showing that a regular law is followed. The curve is an hyperbola having its asymptotes for its axes, and the equation for it is $xy=13$ for No. 28 copper. Whereas, the two unprotected terminal fuses are uncertain and show in a very pronounced manner wherein the terminals contribute to this end, the conclusion one is forced to draw is that a fuse wire in practice, when it fuses, does not do as it was intended to, open the circuit, but establishes a condition, though the time may be limited, wherein the terminals act as a magazine to furnish the gas through which the circuit is continued. The curves throughout do not show any superiority of the six inch fuse over the three inch. Looking at the results in comparison, as given by the Board of Fire Underwriters, which is attached to this paper, the very point they should have observed, to wit, the continuance of the arc through but a short period of time, at the expense of the terminals, and the possibility of the vicious gas thus generated, coming in contact with other circuits and establishing other and more serious conditions, such as short circuits and possible fires.

Not to be misunderstood, while the tests as are herein recorded show no superiority of the six inch unprotected terminal fuse wire over the three inch unprotected terminal fuse wire, the six inch fuse wire is unquestionably safer when conditions are more extreme, such as, for instance, when a short circuit occurs.

The determining factor in this matter of fuses is: What are the conditions required to protect against absolute short circuits across the bus bars of a large power station, 500 volt switchboard? Tests are

In closing this report, gentlemen, I wish to thank you for your attention, and at the same time express the hope that it will prove, as it was intended, a good guide to you in securing that very necessary condition for successful and economical operation—*perfect track.*

Before closing I wish to call your attention to the fact that through the kindness of The Paige Iron Works Company, I am enabled to show you in the Exhibition Hall a sample of our special track work made of seventy-two pound Shanghai steel rail and laid on the Daniels steel ties, as we lay it, also samples of Wheeler rail joints, attached and unattached to rails. Also a crude sample of our brick paving. This sample is not as correctly or as smoothly laid as we lay it in Terre Haute, but as I did not reach Atlanta in time to supervise the laying, it would be unreasonable to expect unskilled hands, without guidance, to lay it as our experienced employes do.

Special Paper on "Destructive Arcing of 500 Volt Fuses."

BY W. E. HARRINGTON.

The destructive effects of the arc accompanying the opening of 500 volt circuits with switches, lightning arresters and fuses, has led the writer to inquire into this phenomenon, particularly in reference to fuse practice. A series of carefully conducted tests were made to find the relation between the fusing currents of different size copper wires, ranging from No. 30 to No. 21, B. & S. gauge, the time required to open the circuit, and to what extent the arc contributed to the time required.

An inclined trackway was constructed, having two copper tracks upon which a traveler, consisting of a block of hard wood having copper plates in contact with the tracks, could run, the circuit from rail to rail of the track being completed through an electro-magnet on top of the traveler. Parallel with, and alongside of, the track was a raised board, on which a paper was attached. An impress was made on paper by a lever on the traveler, when released by electro-magnet, owing to stoppage of current.

conducted showing how fuses act under conditions that are predetermined, certain currents which are made to flow, etc., but you never see anything published or advice given in this matter of fuses for the condition which really occurs the most frequently, that is, absolute short circuits. The Board of Fire Underwriters' report, herewith attached, give the different length fuse blocks required for 10 amperes, 20, 30, 40, and so on.

Now the requirements and limitations as prescribed in the Board of Fire Underwriters' report are true and perfectly safe when the fuse "blows" under the conditions as outlined in the tests, as made by the committee appointed to make such tests.

But on an absolute short circuit across bus bars, as above stated, a 10 ampere fuse block constructed as specified, will, instead of protecting one when most in need of such protection, burn up in the most vicious way, and will open magnetic cut-outs in a power station requiring currents up to a 1,000 amperes, to open. Understand, the fuse does not itself do this, but the arc established at the expense of the terminals is the immediate and sole cause, and the circuit must be opened elsewhere. As stated, the magnetic cut-outs, above referred to, open the circuit.

This matter of arbitrarily adopting a series of fixed dimensions and connections, under which fuses are to be used, is absurd.

The conclusions one is forced to draw from the above tests and the general literature upon the subject of fuses, are as follows:

First. The proper and only fuse block to be used is one having protected terminals.

Second. That fuse blocks should be furnished so that the terminals would not be burned under conditions approaching an absolute short circuit across the bus bars of a 500 volt power station.

Third. That magnetic cut-outs are immeasurably preferable under all circumstances.

APPENDIX.

REPORT OF UNDERWRITERS' INTERNATIONAL ELECTRIC ASSOCIATION.

The following data give the maximum length between terminals at which arcing occurs, the minimum lengths at which no arcing was observed and the safe lengths on 500-volt circuits for fuses, whose melting points are identical with the various current strengths designated.

Amperes.	Maximum length at which arcing occurred.	Maximum length at which no arc was observed.	Safe lengths.
10	¼ inch	½ inch	1 inch
20	½ "	¾ "	2 "
30	2 "	2 "	2¾ "
40	2 "	2¼ "	3⅜ "
50	2¼ "	2½ "	3½ "
60	3 "	3¼ "	3¾ "
70	3 "	3¼ "	4 "
80	3¼ "	3½ "	4⅛ "
90	3½ "	3⅜ "	4⅜ "
100	3¾ "	4 "	4½ "

Special Paper on "The Use of the Booster on Electric Railway Circuits."

By J. H. Vail and S. H. Wynkoop.

The question of investment in copper is one which has always been a bugbear to the street railway manager, and is to-day the most serious problem confronting the operating company, inasmuch as it tends to restrict the extension of long distance lines for serving suburban traffic. Since the cost of copper for a given service increases directly as the square of the distance, the necessary investment becomes prohibitory when the line extends more than three or four miles from the station.

Railway generators and motors are becoming more satisfactory; we are still allowed, in the absence of a conduit system inspiring confidence, to suspend our trolley wires overhead; and in some cities the authorities will look the other way while we string cables as large as hawsers from pole to pole, in pairs, in dozens, and—if poles could be found to stand the strain—probably in scores.

Even then we are not happy. The power house site is usually chosen, so far as circumstances will permit, with reference to convenient coal delivery and the distribution of traffic. In the heart of the city crowded streets render slow speed imperative; in the suburbs, where a clear track invites to rapid transit, the pressure is low—usually abominably so. In fact, the writers have in mind a city not far from the metropolis, where two motor cars are run upon a single car's time; and they have witnessed the *fading out* of the electric headlights as the two cars started out together. The reduced voltage was in this case self-evident; and the net horse power secured to move the cars was *probably less than half the proportionate amount originally generated* in the station. The loss in transmission does not require further demonstration.

Accurate tests show that the commercial efficiency of the street railway motor at normal voltage is 78 per cent., while at two-thirds of the normal it is only fifty-two per cent. We all undoubtedly recognize the fact that the resultant effects of too little copper show up to the non expert traveling public in slow speed and dimming of lamps; but to the railway company the results *are actual losses*—decreased traffic and increased coal bill; which is the direct opposite of what we desire. In other words, instead of aiming at the greatest receipts for the least expenditure, we are actually getting least receipts for greatest expenditure.

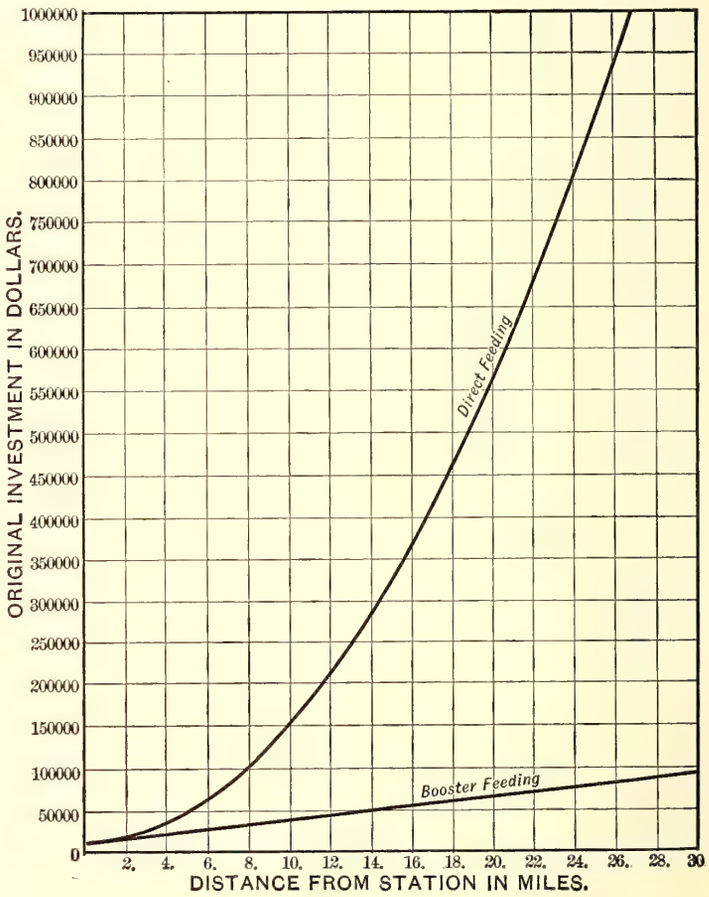


DIAGRAM I.

INITIAL COST OF STEAM AND GENERATING PLANT, COPPER AND SPECIAL APPARATUS FOR DELIVERING 200 AMPERES AT 500 VOLTS.

The usual remedy suggested is: Use more copper. Very good. But if the owners of the road are already groaning under the weight of the copper mine that has been saddled upon them, together with the cash invested therein; if they live in constant fear that they will be forced to place all feed wires in large cities underground, what then?

Leaving out of this discussion improvement in generating station, car equipment and track, we must look for higher economy to the alteration of our methods of electrical distribution, adopting such as will prove, after careful comparison, to be of least first cost, of reasonably high commercial efficiency, of interchangeability on different divisions of the system, and of practically automatic action.

We are in need of a marked advance over present practice in this direction, and must devise some method of distribution that shall give better and more economical service over a large area, and which shall at the same time enable us to reach out from the power station to distances at present inaccessible.

The alternating current system, which has done so much to develop the distribution of electricity for lighting by incandescence, has not yet reached that stage of eminent perfection in motive power service which will warrant us in admitting its value for railway work at the present time.

Another method which might be suggested is one which contemplates the use of motor generators located at intervals along the line and actuated by high tension currents. Such a system must be automatic under all conditions of load and short circuits, working with cool bearings and not requiring careful attendance. This scheme also requires practical development.

The well known booster system, invented by Mr. W. S. Barstow, and applied by him with great success to the feeders of constant potential electric lighting plants covering large areas, is worthy of our careful investigation, as it promises to offer a practical aid to the economic solution of what may be called the medium long distance electric railway problem.

With direct feeding we can overcome the loss in transmitting energy only by incurring the heavy cost of copper as a first investment. With the booster system, we overcome the loss in transmission by incurring the cost of operation of a machine which shall automatically raise the initial voltage above that of the bus bars by an amount which may exactly equal the drop in potential on the feeder at that instant.

When using this machine, we calculate our feeder for ampere capacity only, and constantly maintain the pressure at the service end of the feeder equal to the pressure at the bus bars, irrespective of the length of the feeder or the load.

In any given instance, the cost of a direct feeder increases as the square of the distance, while the cost of the booster feeder is directly proportional to the number of miles. These characteristics of the latter system result in a reduction of first cost of from 25 to 75 per cent., as compared with the first cost of the ordinary direct feeding methods of our present practice; and it thereby becomes possible for numerous electric street railway companies to extend their lines into suburban localities, from ten to twenty miles distant from the power station, at the same time retaining the investment within reasonable limits.

In order to present these in a manner easily comprehensible, we can readily establish equations for the two systems to be compared; and then, by assuming certain accepted values, plot the results. Let

C_1 = Current delivered to trolley wire.
V = Voltage at generator.
V_1 = Voltage at trolley wire.
V_2 = Voltage of booster.
Eg = Efficiency of generating apparatus.
Eb = Efficiency of booster.
E' = Operating expenses for direct feeding—coal, oil, water, waste, engineers, firemen, and interest on so much of the steam generating and transmission plant as is due to the feeder under consideration.
E'' = Operating expenses for booster feeding—details as before.
M = Length of feeder in miles.
m = Circular millage of feeder.
$ = Initial cost of as much of the steam generating and transmission plant, as is due to the feeder under consideration.
I = Per cent. interest on investment.
D = Per cent. depreciation on investment.
s = Cost of steam plant per H. P.
g = Cost of generating plant per K. W.
b = Cost of booster per K. W. output.
k = Cost of insulated wire per pound.
p = Cost of placing 544 ft. No. 0000 wire, including insulators, pins, cross arms, sundry hardware and labor—5 per cent. allowance for sag.
z = Cost of supplying one horse power per year, in quanties of over 100 H. P.

Then for direct feeding

$$\$ = \frac{\frac{C_1 V_1}{746} + \frac{C_1 (V-V_1)}{746}}{Eg} s + \left\{ \frac{C_1 V_1}{1000} + \frac{C_1 (V-V_1)}{1000} \right\} g + \frac{2315.488 M^2 C_1}{V-V_1} k + \frac{.5664 M^2 C_1}{V-V_1} p \qquad (I.)$$

And for booster feeding

$$\$ = \frac{\frac{C_1 V_1}{746} + \frac{C_1 (V-V_1)}{746} + \frac{\frac{C_1 V_2}{746}}{Eb}}{Eg} s + \left\{ \frac{C_1 V_1}{1000} + \frac{C_1 (V-V_1)}{1000} + \frac{\frac{C_1 V_2}{1000}}{Eb} \right\} g + \frac{C_1 V_2}{1000} b + .019318 m M k + \frac{m M}{211600} p \qquad (II.)$$

Substitute the following values in Eq. I.:

C = 200
V = 500
V = 550
S = 45
Eg = .95
g = 25
K = .13
p = 75

We have

$$\$ = 9735 + 1374 M^2 \qquad (III.)$$

Substitute the same values in Eq. II assuming 211600 as the value of m, taking Eb—.90, and finding an expression for V2 in terms of M, we get

$$\$ = 8732 + 2857 M \qquad (IV.)$$

In order to graphically represent the relation between initial investments in the two methods of feeding under discussion, Eq. I. and II. have been solved for varying values of M from 1 to 30, and the results plotted on Diagram I. An inspection of this diagram shows at once the immense superiority of the booster system over the direct feeding in cases where the first cost is the essential feature. It will be noted that the curves have been carried out for the entire thirty miles,

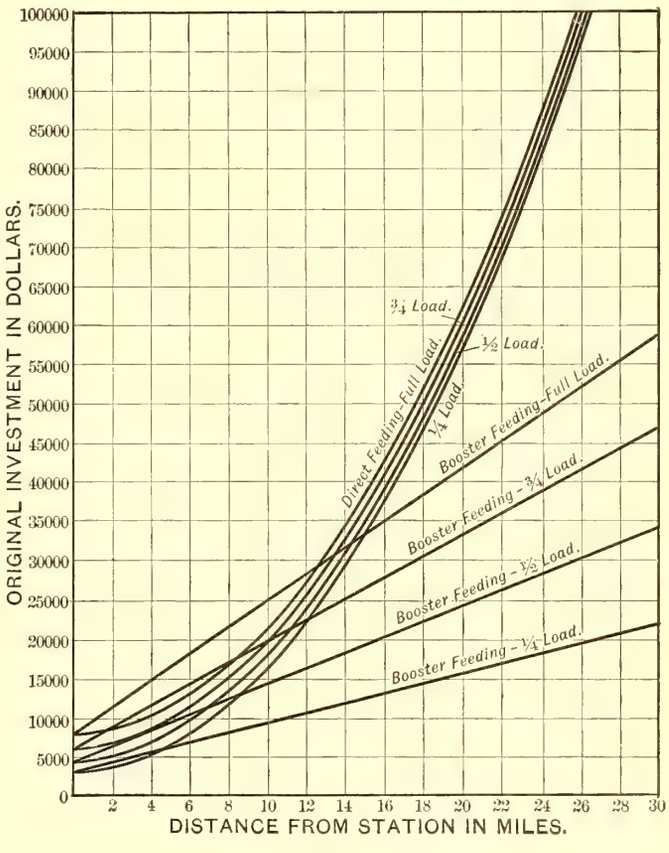


DIAGRAM II.

OPERATING EXPENSES OF PLANT DELIVERING 200 AMPERES AT 500 VOLTS, INCLUDING COAL, OIL, WASTE, WATER, LABOR; AND INTEREST AND DEPRECIATION ON THE INVESTMENT.

without regard to the practical voltage limit in direct current machines, or the point at which the cost of operating an independent station becomes less than operating from the main station.

Diagram I. shows that for distances greater than one and one half miles it will cost less to instal a booster system than to place copper and machinery in the usual manner for feeding direct. In cases where the motive power is water, costing little or nothing per horse power, these curves give at once the relative economy of the two methods; but ordinarily on the account of the consumption of coal, the loss in the line (represented in the new method by the power required to

operate the booster) becomes an important factor in the discussion; and it is necessary to establish equations for the operating expenses, taking into account the fixed charges of interest and depreciations on the investment, as well as the cost of furnishing the required power.

The following equations will enable us to determine these values for different distances:

Direct feeding:

$$E' = \frac{\frac{C_1 V_1}{746} + \frac{C_1 (V - V_1)}{746}}{Eg} z + \$ (I + D) \qquad (V.)$$

$$E'' = \frac{\frac{C_1 V_1}{746} + \frac{C_1 (V - V_1)}{746} + \frac{\frac{C_1 V_2}{746}}{Eb}}{Eg} z + \$ (I + D) \qquad (VI.)$$

Making the same substitutions in Eq. V and VI as were made in I and II, placing $(I + D) = .10$, and remembering that \$ varies according to the method and distance under discussion, we get

$$E' = 155\, z + \frac{\$}{10} \qquad (VII.)$$

$$E'' = (139 + 36\, M)\, z + \frac{\$}{10} \qquad (VIII.)$$

Diagram II. represents these equations plotted for varying values of M, being taken at 40.

The intersection of the upper curve with the upper straight line is the point at which the booster system costs as much to operate as does the direct system. This distance we find to be twelve and one-half miles. For shorter distances, direct feeding is more economical, while for longer distances the booster system has an absolute advantage. Now, the assumption upon which Eq. V. and VI. were solved, is a feeder constantly loaded to its maximum capacity. The absurdity of this assumption is apparent when one considers the actual conditions which obtain in railway work; the average load on the feeder during the entire year will be more nearly one-third or one-quarter of the maximum. We have therefore established and plotted equations similar to V. and VI., for ¾, ½ and ¼ load, and the resultant curves are shown on Diagram II., in order to afford ready means of comparison.

A careful study of these diagrams demonstrates in what the economy of the booster system consists. While the method we have outlined may seem like robbing Peter to pay Paul, it must be remembered that in direct feeding there is a large amount of capital invested in the pole line, accruing interest day and night, in storm and sunshine, irrespective of the traffic on the line; while with booster feeding, the interest on copper investment is nominal, the power required to drive the booster itself being proportional to the load on the line. Thus we can readily understand why, under the conditions given, with an average load of one-quarter the maximum, the booster system is absolutely more economical than the direct feeding system for distances over four and one-half miles.

The equations here laid down will serve to answer any questions that may arise as to relative first cost or operating expense. It has been impossible to represent results derived under varying conditions without multiplying the diagrams indefinitely. All calculations have been based upon the most recent methods of rail bonding and track feeding; and the assumption that the resistance of the return circuit is equal to that of the outgoing circuit is therefore perfectly safe.

It may occur to some that the installation of a special high voltage generator to supply the feeder in question would be a simpler method of reducing the copper; but a cognizance of the enormous variations in drop under extreme changes in load, on a long feeder calculated for ampere capacity only, leads at once to the discarding of such a scheme until such time as manufacturers can furnish efficient generators over-compounded from 50 to 150 per cent.

The adaptability of the booster to railway work of all kinds is wonderful. A few specific instances are noted, in the confident belief that the suggestions thus thrown out will impel each and every electric railway manager to personally investigate this system, with a view to ascertaining exactly how far it would prove of advantage when applied to his particular road.

Ordinarily in calculating copper for distribution, we are obliged to allow for special features influencing traffic, such as ball grounds, race tracks, picnic groves, etc. As there is seldom any necessity for bunching cars at all these points simultaneously, and as the various features are usually scattered, it follows that at all times one or more of the feeders is lying comparatively idle. Under the plan suggested, the copper is figured for average conditions, and a booster, placed in the station, is arranged to be thrown immediately upon any feeder which may become burdened with an excessive load.

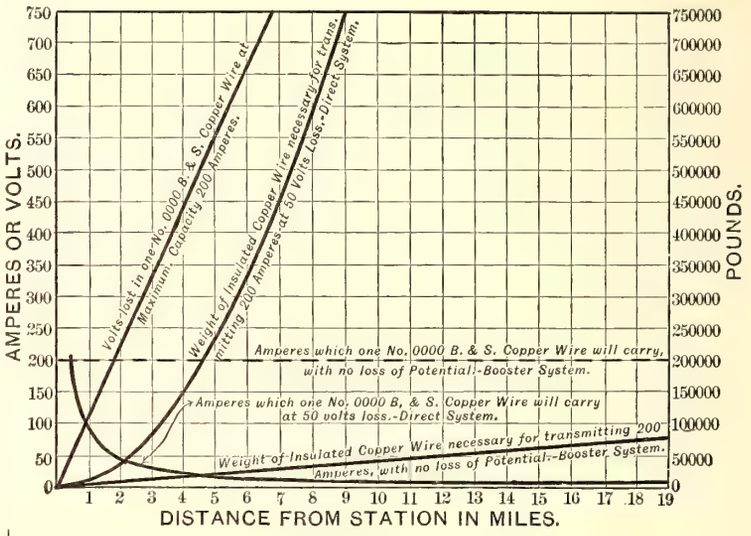


DIAGRAM III.

COMPARISON BETWEEN DIRECT AND BOOSTER FEEDING FOR RAILWAYS. RESISTANCE OF RETURN CIRCUIT (RAILS) = RESISTANCE OF FEEDER. ALLOWANCE FOR WEIGHT OF INSULATION = 15%. ALLOWANCE FOR SAG = 5%. SHOWING THE INVESTMENT SAVED IN WEIGHT OF COPPER BY MEANS OF THE BOOSTER SYSTEM.

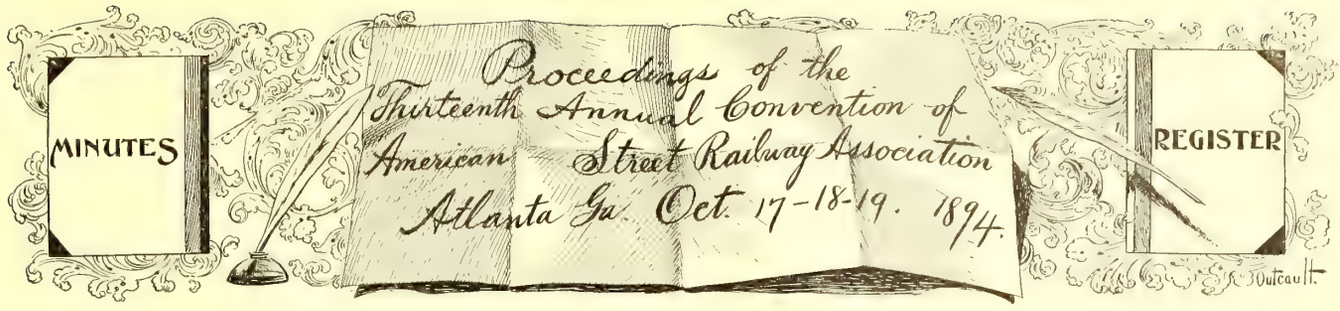
Another feature of this system, which makes for economy, becomes prominent on long suburban lines forced to run an infrequent schedule late at night. On such a road the booster may be shut down and cut out of circuit entirely when the load on the long distance feeder drops to, say, one-quarter of the maximum, depending upon the amount of copper in the line.

If this suburban line extends to a park or pavilion which is open only during the summer months, the advantage of the booster over direct feeding is enormous, since the investment on a booster lying idle is a small fractional part of the interest on the idle copper of a direct feeder.

On many roads already in operation the copper in the line has proven entirely insufficient, and the erection of additional feeders is contemplated. Would it not be worth while to consider the installation of a booster at one-tenth the cost of the extra copper, provided calculations showed the economy of operating the two systems to be equal?

In the progress of electric railways, as in the growth of cities, development frequently fails to follow the lines predicted for it. It therefore, happens that many a road to-day is worrying along, the victim of misplaced judgment—and copper. In many instances the adoption of a booster and a redistribution of the present copper, will remedy the evil in the most economical manner.

In large cities such as Boston, Brooklyn and Philadelphia the tons of copper could in this way be largely reduced, with a gain at the same time in uniformity of pressure.





The Thirteenth Annual Meeting of the American Street Railway Association was held in Machinery Hall, Piedmont Park, Atlanta, Ga., Oct. 17–19, 1894.

President Henry C. Payne, of Milwaukee, Wis., called the meeting to order and introduced Hon. W J. Northen, Governor of Georgia, who said :

"*Mr. President and Gentlemen of the Convention.*—Just before I retired last night, I was caught over the telephone by the president of the Atlanta Street Railway, who requested me to meet you at this hour and speak some words of welcome for the state to the officers and members of this Convention. I attempted to excuse myself by saying that much important business in my office demanded my attention, and I could not spare the time. He replied that no business in my office could be more important to this state than the organization you represent and I must lay aside all business and come. I reminded him that I had only ten more days of service and I could not do less than utilize every moment if I cleared my table for the incoming of my successor. He replied that the state could wait in its minor interests while it gave due consideration to the higher claims of this Convention upon its general interests and future development. It did not avail with him that I had already anticipated his interest and written you words of welcome, now being circulated through the Convention. He insisted that I must give personal recognition of your presence and your work.

I am here, therefore, more, it would seem, by the command than the invitation of the president of the Atlanta Street Railway Company to bid you welcome to the state and to the South. The people of Atlanta have learned that when Joel Hurt touches the button " we must do the rest." (Applause.)

Now that I am here, Mr. President, speaking for my state and my section, I give you glad greeting. I apprehend that many of you have never before visited the state and possibly not the South. We are glad to have you here, that you may know for yourselves the attractive advantages of the South.

This ideal, balmy day is fully representative of our delightful, health giving climate. Many of you, I dare say, expected to find us living in the tropics It may surprise you to know that the hottest day I have experienced in five years, I found last June in Toronto, Can., and the next highest temperature, last August in Nebraska. I had the honor, upon that last occasion, to make an address to a large assemblage of people, with the thermometer 107 degs. on the outside, and 205 degs. under my vest, when the temperature for my estate, on that day, was only 90 degs. In colder climates than ours, this is nature's compensation for the growth and development of crops. The heat, in short summers, must be intensified; whereas, with us it is greatly diminished because of greater length of time for utilization.

We are glad to have you, personally, know about the variety, abundance and richness of our agricultural products, our mineral, timber and industrial resources.

We give you especial welcome upon these special grounds so that, impressed, as you will necessarily be, by the preparations in progress for the coming Cotton States & International Exposition, you will not only advertise abroad its possibilities and its attractions, but you will return next year and bring with you your friends to look upon its splendid magnificence and share the benefits to come from its exhibits.

We receive you gladly into our state because we want you to know our people better—warm hearted, hospitable, genial, cultured, progressive and true, the equals of any among the civilized nations of the earth.

Again, we are glad to have you visit us that you may know the financial and business conditions of the South. Did you know that, during the recent financial distress that came upon our common country, we had fewer bank and business failures at the South than in any other section of the Union? Did you know that the South owes less money than any other division of states? The average land mortgage indebtedness for fourteen states at the South is only $33,000,000, while the same indebtedness for fourteen states at the North amounts to $334,000,000. The average annual interest for these states at the South on this mortgage indebtedness is $2,600,000; for the corresponding states at the North is $21,900,000. The average per capita of this indebtedness for the South is $25, while for the North it is $129. I do not desire to make odious comparisons, but it is due us of the South to say that the State of Kansas has under mortgage 26,000,000 acres of land—more than the five Southern states counted together, Alabama, Arkansas, Georgia, Kentucky and North Carolina.

Knowing these conditions, we are glad to have you visit our section, with a view to the further development of your interests at the South. Electric street railways have made wonderful progress in this section. We now have at the South 1,611 miles completed and projected, calling for an investment of $71,080,000 to equip them. This has all been done, too, within the last six years.

We welcome you because you are an organization of thorough business men, come to consider the business conditions about you for the advancement of the common good.

More than all, we give you greeting because we believe you to be the strongest factor for the advancement of the business interest and the civilization of the times that has given spirit to our progress for the last quarter of a century.

Standing, then, in this distinguished presence, in view of the conditions you find here, and the intelligence and purposes you bring with you, speaking for Georgia and the entire South, I give you most cordial greeting and glad welcome to our state and among our people. (Prolonged applause.)

President Payne responded to the governor's greeting as follows:

Speaking for myself, and feeling that I voice the sentiments of every member of the Association, I beg to return cordial thanks to the Governor of Georgia for the hospitable manner in which he has welcomed us to this fair city of the South.

I am sure that we shall all carry away with us warmest feelings of friendliness for the city of Atlanta. We have all anticipated our visit to this city with genuine pleasure, and I am sure that we will look back upon our Convention here as one of the most pleasant we have ever held or could ever hope to hold. Atlanta is a proverbially hospitable city. We already feel the generous greeting in every handshake. We are glad to be here.

The street railway business is so closely identified with the best interests of every city, that it is no wonder that a body like this is made to feel at home in the active, thriving cities of the land. Once more I voice the sentiments of every man here, and return thanks to the Governor of Georgia for his friendly greeting here to-day. (Applause.)

Letters of regret at their inability to be present were read from past presidents, Chas. B. Holmes, and Henry M. Watson.

The first order of business was the reading of the minutes, and on motion they were approved as printed.

The president read his address as follows.

Address of the President.

Gentlemen of the Association:—For your partiality in electing me to the office of president of the Association, I desire to return my most heartfelt thanks.

It is hardly necessary for me to say that, since our last meeting, the street railway business has suffered, in common with all other enterprises, owing to the financial stringency and business depression which has prevailed in all parts of the country. These conditions, however, have not been without lasting benefit to the interests which we represent; I think we have all studied more thoroughly to bring about economies in operation, to limit the construction of new lines into unproductive territory, and in every way to bring our business to a more healthy basis; so that, from that point of view, there is compensation for the depression through which we have passed. I presume it is the common experience of all that we are on the up grade, and I confidently anticipate a slow, but gradual, return to normal business conditions. The resources and characteristics of the American people are such that they cannot long continue in a state of either mental or financial depression.

During the transition period from animal to electric power on the tramways of our country, it was but natural that the proceedings of the annual meetings of the Association should be largely taken up with the consideration of the application of electricity to transportation purposes Now that we may fairly consider such application as an accomplished fact, I think our attention should to a greater degree be turned to a

comparison of views regarding the practical operation of our several roads. The substitution of electricity for animal power has elevated the business to a higher plane. Street railways have become as essential to the prosperity of our metropolitan cities as the steam railways to the country at large.

Having had practical experience in the management of both these methods of transportation, I can fairly say that the duties of the manager of a street railway equipped for rapid transit are more vexatious than and require quite as much ability, intelligence and application as those of one in charge of a steam railway. The steam railway manager makes his time tables, publishes them, and the people are expected to, and do suit their convenience to the same. Not so with us. We are expected to make our time tables to conform to the convenience of each individual separate passenger who desires to be transported, and a car is expected to be at each and every corner at the identical moment when the passenger is ready to be carried.

Again, the steam railway manager has to encounter legislatures and legislation but once in two years, or at the most once in each year, and that during a short period in the winter only; while the life of the street railway manager is made unhappy, to say the least, by the legislative bodies in cities, which are practically in continuous session.

The American capitalist is quick to discover promising fields for the investment of capital, and I think it is safe to say that never in the history of our country has there been a more rapid development than has come from the application of electricity to transportation purposes. In the anxiety to secure franchises and to reconstruct street railways, very excessive valuations have been placed upon, and paid for the right to operate by electricity in our large cities. This has led the representatives of the people to believe that there is a present value attached to franchises far beyond that which the facts will sustain. Consequently, these conditions have led to a fruitful field for the legislator, as well as for the assessor, from whose tender solicitude for the welfare of the people, the street railways, whose prosperity contributes so much to the general good, have suffered. The interest, as well as the inclination of most managers tends toward giving as liberal and good a service to the public as the patronage will justify.

Transfers and to what extent they should be granted, commutation and its effect upon earnings, and the relative earnings of cars operated on long and short headway, furnish fruitful topics for discussion and comparison of views. These, and many other practical subjects which will occur to you, I think should receive our attention, and I believe their consideration will be not only of great interest, but of material advantage to us all.

Your Executive Committee have set apart one morning for executive session, at which time I trust we shall have full and free exchange of views bearing upon matters to which I have referred, and many others affecting the practical operation of our roads.

The question of insurance has become a perplexing one. In many instances the larger systems find it very difficult to obtain insurance in sufficient amounts to cover their risks, and I think the common experience is that rates have increased to such an extent as to be so burdensome as to justify us in considering the propriety of organizing a mutual insurance association.

I cannot close without referring to the great loss which we have suffered from the removal by death since our last meeting of two of our most prominent and active members.

Mr. William Richardson, of Brooklyn, N. Y., had been identified with the Association since its organization. All will recall the great interest which he took in our deliberations, and I am sure that we all feel a sense of personal sorrow that we shall no more have his wise counsel. His life's work, so far as business activities were concerned, was completed, and he was looking forward to that quiet and peaceful ending of his days to which a long and active life had entitled him.

Mr. William J. Stephenson, of Washington, D. C., first vice-president of the Association, was, to my mind, an almost perfect type of an aggressive, forcible, intelligent business man. He had been for a considerable time engaged in maturing plans for the introduction of the underground trolley system upon his road. To this end he had succeeded in obtaining the necessary legislation from Congress, and his plans were very far matured toward the actual commencement of the work of reconstruction. We cannot but regret that he has not lived to consummate the plans which he had so ably matured. Mr. Stephenson was looking forward with the greatest interest to this meeting, and I am sure that I reflect the sentiment of every member in expressing my sorrow and regret at his untimely taking off.

The report of the Executive Committee was read as follows:

Report of the Executive Committee.

Atlanta, Ga., October 17, 1894.

To the American Street Railway Association:

Gentlemen.—Your Executive Committee respectfully submits the following report:

MEMBERSHIP.

The hard times affect the street railway business as surely as they do any other. The fare is so small—only a nickel—that one of the unthinking public is surprised when he learns for the first time that business depression affects the receipts of a street railway company The fact is, there is no more accurate test or measure of the state of the business of the country than the varying income of a street railway company, showing with absolute accuracy the state of business activity or depression in the community. Business in general during the last year has been bad, and the street railway business in particular has suffered, several of the member companies having gone into receivers' hands, while consolidation still continues to be the trend of the times.

While the year has been a hard one, the business outlook is encouraging, and we look forward with confidence to a successful year's business.

At the opening of the meeting in the City of Milwaukee, there were 197 member companies.

At that meeting, and during the year, the following companies have joined:

Camden, N. J.—Camden, Gloucester & Woodbury Railway Co.
Charleston, S. C.—Enterprise Railroad Co.
Columbia, S. C.—Columbia Elec. St. Ry., Light & Power Co.
Helena, Mont.—Helena Rapid Transit Railroad.
Macon, Ga.—Macon & Indian Spring Electric Street Railway Co.
Mobile, Ala.—Mobile Electric Light & Railway Co.
Nashville, Tenn.—Nashville Traction Co.
New Britain, Conn.—Central Railway & Electric Co.
Newburgh, N. Y.—Newburgh Electric Railway Co.
New Orleans, La.—New Orleans Traction Co., Limited.
Paterson, N. J.—Paterson, Passaic & Rutherford Electric Railway Co.
Poughkeepsie, N. Y.—Poughkeepsie City & Wappinger's Falls Electric Railway Co.
Rockland, Me.—Rockland, Thomaston & Camden St. Railroad Co.
Tampa, Fla.—Tampa Electric Light & Street Railroad Co.

The following changes in the names of members have taken place:

Brooklyn, N. Y.—Brooklyn, Queens County & Suburban Railroad Co., in place of Broadway Railroad Co.
Carbondale, Pa.—Lackawanna Valley Rapid Transit Co., in place of Carbondale Traction Co.
Kansas City, Mo.—Kansas City Cable Railway Co., Consolidated, in place of Kansas City Cable Railway Co.
Nashville, Tenn.—Nashville St. Ry., in place of United Electric Ry.
New York, N. Y.—Metropolitan Street Railway Co., in place of Houston, West Street & Pavonia Ferry Railroad Co.
Norwalk, Conn.—Norwalk Street Railway Co., in place of Norwalk Horse Railroad Co.
Washington, D. C.—Belt Railway Co., in place of Capitol, North O Street & South Washington Railway Co.

The following changes of names of companies, by substitution and consolidation, the new companies succeding the old, having taken place:

Jersey City, N. J.—Consolidated Traction Co., in place of the Jersey City & Bergen Railroad Co , and the New Jersey Traction Co., of Newark, N. J.
Lawrence, Mass.—Lowell, Lawrence & Haverhill Street Railway Co., in place of Haverhill & Groveland Street Railway Co., and Merrimack Valley Street Railway Co., of Lawrence, Mass.
San Francisco, Cal.—Market Street Railway Co., in place of City Railroad Co., and Ferries & Cliff House Railway Co.
St. Louis, Mo.—Union Depot Railroad Co., in place of the Benton-Bellefontaine Railway Co.

The following companies have withdrawn; several of them having gone into the hands of receivers, or leased to other companies, and nearly all of them being very weak financially:

Alexandria, Va.—Washington, Alexandria & Mt. Vernon Railway Co.
Amsterdam, N. Y.—Amsterdam Street Railway Co.
Birmingham, Conn.—Derby Street Railway Co.
Cincinnati, O.—Mt. Auburn Cable Railway Co.
Dover, N. H.—Consolidated Light & Power Co.
Erie, N. Y.—Erie Electric Motor Co.
Findlay, O.—Findlay Street Railway Co.
Lancaster, Pa.—Lancaster Street Railway Co.
Lyons, Ia.—Clinton & Lyons Horse Railroad Co.
Nashua, N. H.—Nashua Street Railway Co.
New York, N. Y.—North & East River Railroad Co.
Peoria, Ill.—Fort Clark Horse Railway Co.
Raleigh, N. C.—Raleigh Street Railway Co.
Yonkers, N. Y.—Yonkers Railroad Co.

As a result of the foregoing changes, the membership now numbers 187 companies.

Your Executive Committee held a meeting in Atlanta, January 24, 1894, and the minutes tell their own story, as follows:

MINUTES OF SPECIAL MEETING OF THE EXECUTIVE COMMITTEE:

Minutes of special meeting of the Executive Committee, held in room 108 of the Kimball House, Atlanta, Ga., Wednesday, January 24, 1894, at 3 o'clock, P. M. There were present the president, Mr. Henry C. Payne, and Messrs. William J. Stephenson, Lewis Perrine, Jr., Thomas H. McLean, W. Y. Soper, E. S. Goodrich and the secretary, Mr. W. J. Richardson. Letters from Messrs. D. F. Longstreet, James R. Chapman and Edward Whittaker were read, stating their inability to be present, and regretting their absence.

The minutes of the special meeting, held October 20, 1895, were read and approved.

The secretary announced the fact that the special report, which was to have been presented at the Milwaukee meeting on "A Standard Form of Street Railway Accounts," would be prepared by H. I. Bettis, of Atlanta. Letters in reply to a circular letter sent December 1, 1893, to all the member companies requesting suggestions as to subjects on which reports might be prepared, were read.

On motion of Mr. Stephenson the following subject was selected: "The Best Method of Treating Accidents and Complaints."

On motion of Mr. Perrine the following subject was chosen: "Street Car Wheels and Axles."

On motion of Mr. Stephenson it was decided that a discussion should be had on the subject: "Transfers and Commutations," and that C. K. Durbin, general superintendent of the Denver Tramway Company, be requested to open the discussion.

The secretary announced that a special paper would be presented by M. F. Burke, superintendent of the Terre Haute Street Railway Company, on the following subject: "The T Rail Construction of the Terre Haute Street Railway Company."

At the suggestion by letter of John B. McClary, seperintendent of the Birmingham Railway & Electric Company, Mr. Perrine moved that Thursday morning, October 18, be set apart for an executive session of the Association, and that delegates be requested to come prepared to discuss freely and without reserve any subject relative to the operation or conduct of the street railway business in general, and of their own roads in particular. Carried.

Mr. Stephenson moved that committees be requested to prepare papers that will not take more than twenty minutes to read. Carried.

The question of the employment of a statistical secretary was considered. On motion, the further consideration of the question was postponed until after the next meeting of the Association.

Mr. Perrine introduced the subject of 'Street Railway Mutual Fire Insurance." On motion of Mr. Stephenson, the subject of "Street Railway Fire Insurance" was referred to a special committee, consisting of Mr. Perrine and the secretary, to report at the next meeting of the Association.

The subject of a "A Street Railway Institute" was considered. It was the judgment of the Committee that in consideration of the financial condition of the country, the subject be laid on the table.

On motion of Mr. Stephenson, the "Aragon," was selected as the headquarters of the Association.

It was moved that if suitable and proper arrangements can be made, that Machinery Hall, on the Exposition Grounds be selected for the place of meeting, and the exposition of street railway supplies. Carried

The president stated that representatives of the street railway and traction companies, of Chattanooga, Tenn., were desirous of having those in attendance at the Atlanta Convention, including ladies, visit Chattanooga on Friday, October 19; and that Lookout Inn, on Lookout Mountain, with 400 rooms, would be kept open until after the Convention, in order to accommodate the Association.

It was the judgment of the Executive and the Local Committees that the invitation of our Chattanooga friends should be accepted, and that the Association set apart Friday for the visit. On motion, adjourned.

SPECIAL REPORTS AND PAPERS.

The special reports and papers that have been prepared cover a wide range of subjects, and express the latest thought and practice in the business.

EXPOSITION.

The exposition of street railway supplies will be found of unusual interest, the products there displayed being the latest expression as to the needs of a street railway, especially if the motive power be electricity.

STREET RAILWAY LAW.

Judicial decisions and opinions have been issued during the year, and constitute parts of volumes X and XI of "Street Railway Law," as follows:

1893.

November—George Rouser *vs.* North Park Street Railway Co.
December—W. L. Allen *vs.* Birmingham Railway & Electric Co.

1894.

January—John C. Bleil *vs.* Detroit Street Railway Co.
February—George A. Jennings *vs.* Tacoma Railway & Motor Co.
March—Otto J. Lang *vs.* Houston, West Street & Pavonia Ferry Railroad Co.
April—Catherine King *vs.* Second Avenue Railroad Co.
May—James E. Johnson, *et. al.*, *vs.* Reading City Passenger Railroad Co.
June—James E. Morgan *vs.* Jersey City & Bergen Railroad Co.
July—Mary Flanagan *vs.* People's Passenger Railway Co.
August—Lena T. Cleveland *vs.* Bangor Street Railway Co.
September—State of Minnesota *vs.* Frank S. Hoskins and Dow S. Smith.
October—Youngstown Street Railway Co. *vs.* Elmer Haverstick and 115 others.

AMERICAN STREET RAILWAY DECISIONS.

The second volume of the work started some years since, entitled "American Street Railway Decisions," has been printed, and is now in the binder's hands, and will be issued to subscribers during November.

The editors have copy in hand to push the work to a speedy conclusion, and they promise to bring the matter down to date as rapidly as possible, consistent with accuracy. Companies that have not already subscribed for the work are reminded to send in their subscriptions. The price is $5 a volume, net, delivered.

PROPOSED AMENDMENTS.

Two proposed amendments, one to the Constitution, the other to the By-Laws, are herewith submitted, and, though it would not be binding in any sense, we should be pleased if a vote were taken at this meeting, without debate, that we might ascertain whether the judgment of the Association is in accord with that of your Committee on both subjects.

The proposed amendment to the Constitution is to provide for the admission of individuals, and companies, not street railways, as associate members, under certain conditions; such character of membership having been found conducive to the general welfare of kindred associations.

The proposed amendment to the By-Laws has in view morning sessions only; providing for less exhaustive meetings; for more opportunity for social enjoyment, as well as for opportunity to examine the display at the Exposition, which has become so important a feature of our annual meetings.

CONSTITUTION.

Members.

Article III. of the Constitution shall be amended, so as to read as follows:

Section I. There shall be two classes of members—active and associate.

Section II. Active members shall be American street railway companies, or lessees, or individual owners of street railways; and each member shall be entitled to one vote by a delegation presenting proper credentials.

Section III. Associate members shall be individuals or firms, or companies not embraced in section II., who shall have been recommended by an active member. Associate members shall not be entitled to vote.

BY-LAWS.

Article VII. shall be amended by the substitution of the word "Tuesday" for "Wednesday," and by the addition of the following words to the first sentence, namely; "and shall continue four days."

THE TECHNICAL PRESS.

It is with unfeigned pride that we regard the journals devoted to the street railway business. We desire as a committee, to acknowledge the services of their owners to this Association, in their earnest endeavors to increase the membership; and hereby express our appreciation of their efforts to make their publications the peers of any other trade papers in the land. The souvenir editions for fine character of typography, high grade of illustrations and thoughtful care in composition evidence the desire of their proprietors to set the best that is procurable before their readers. We heartily wish them all possible success in their earnest endeavors to excel. While we do not desire to make any particular distinction in our reference to the technical papers, we feel called upon to express our thanks to Mr. C. B Fairchild, editor of the STREET RAILWAY JOURNAL, for his personal efforts in the interest of the Association, in his contact with the street railway men of the country, and for the benefit conferred upon the fraternity in the production of the book entitled "Street Railways."

OBITUARY.

William Richardson departed this life December 31, 1893, in the seventy-first year of his age. He was for many years the president of the Atlantic Avenue Railroad Company of Brooklyn, from which position he retired the early part of last year. He began his street railway experience with the Dry Dock, East Broadway & Battery Railroad Company of New York, and was acting president of that company at the time of his death. He was a regular attendant at the annual meetings of this Association, and always took a lively interest in its welfare. He was an ideal companion in his home, of the strictest integrity in business, of untiring energy, and high ambition to excel in all he undertook to do, and withal a sincere friend. We shall miss his inspiring presence.

John H. Dalzell died May 29, 1894. He was the president of the Pittsburgh, Allegheny & Manchester Traction Company, and a man of large influence in the community in which he lived. He was blessed with exceptional foresight; and determining early to make a success in life, he succeeded by his indomitable pluck, energy and earnest purpose in attaining a position of large prominence. His loss is mourned by a large circle of friends.

Allen Tindolph died July 27, 1894, aged fifty-two years. He was president of the Vincennes Street Railway Company, and was prominent in other business enterprises in the place where he lived. He was a man who stood very high in the esteem of his fellow citizens, by reason of his sterling qualities of character. He was a Christian gentleman, a public spirited citizen, and a model in his home life.

For the first time in the history of the Association, an officer has died during his incumbency. William J. Stephenson left the sphere of his earthly activities on August 31, 1894. He was president of the Metropolitan Railroad Company, of Washington, having been previously connected with the Columbia Railway Company of the same city in a like capacity.

He was energetic, enterprising, in short a typical progressive American. Always enjoying the best of health, with ruddy, clear complexion, of commanding appearance, having convictions and the courage of them, a ready speaker, always with something to say, reinforced with deep interest in this Association. His was a familiar figure and voice at the annual meetings.

We shall sadly miss our friends and companions.

Respectfully submitted,

EXECUTIVE COMMITTEE.

On motion of Mr. Littell, the report was received.

The report of the treasurer was presented and showed the financial transactions of the year to have been :

Receipts	$8,290.79
Expenses	8,196.72
Balance	94.07

On motion of Mr. Bean, the report was approved.

A communication from the Georgia Electric Light Company was read, extending an invitation to the delegates to visit the plant.

The first committee report presented was on "The Best Method of Treating Accidents and Complaints." The report was presented by P. M. Dyer, claim agent of the West Chicago Street Railway Company. This will be found on page 695.

Mr. Dunlap, of Washington: We have been pursuing that course exactly as the gentleman has represented, and if I had been writing the paper, I should have said about the same thing.

Mr. Payne: The course pursued by the Chicago companies, is practically that pursued by the company which I represent; and I presume our experience is the same as that of all of you, that we have very little chance before a jury, and the sooner we settle a case the better it is for the company. It does not seem to make much difference what the merits of the case are; if we go before a jury we are almost sure a case will go against us. It is only in cases where the points of law are in our favor, that we stand any chance of success.

Mr. Littell, of New Orleans: I would like to ask Mr. Dyer when he gets a statement from his employes if it is sworn to be before a notary public?

Mr. Dyer: Sometimes but not always.

Mr. Littell: Where a motorman is responsible for an accident, either to a vehicle or a person, and you know he is responsible, what do you do with him?

Mr. Dyer: It depends upon the frequency of his accidents and what record he has. Sometimes we assess it against him.

Mr. Littell: Suppose that you had evidence that the car was going at the rate of eight or ten miles an hour, and the motorman had his head turned away and ran over a person, and cut off his legs, what would you do with your man?

Mr. Dyer: He would be discharged.

Mr. Littell: Discharged immediately?

Mr. Dyer: He would be suspended pending an investigation, and then he would be discharged.

Mr. Littell: You would discharge him as soon as you got his statement?

Mr. Dyer: Yes; because if we did not do that, and retained him in our employ, we would be criticized for having kept such a man in our employment, and it would get before the jury.

Mr. Shaw, of Newburyport: Would it make any difference from what cause he was looking off? I ask the question because I want to state a case.

Mr. Dyer: I do not think we would accept any excuse, if he did not have his car under control.

Mr. Shaw: In a road I am interested in the motorman had his attention attracted by a bicycle alongside of his car, at the time that he should have been attending to his duty. There was a car ahead of him that was grounded. He had, however, no reason to suppose that this car would stop or ground in a locality where there were no houses; but in the moment that he was looking at the bicycle, he ran up on the other car and caused an accident. What would you do in that case?

Mr. Dyer: I think that would be a matter entirely for the discretion of the superintendent.

Mr. Shaw: We decided to let that man go, although I thought it was a hardship to do so.

Mr. Fuller, of Chicago: I will say for the information of the gentleman, that it is a rule of the West Chicago Railway Company, that one car approaching another must slow down or stop before getting to it, and if the motorman does not do so, he is discharged.

Mr. Shaw: Our rule is to keep cars 500 ft. apart. In this case, where we discharged the man, he was within 175 ft. of the other car. If he had been 500 ft. away, we would have felt differently about it. That is the second instance where we had a ground without apparent cause. We found it was the rheostat; that the cable had broken and made a contact.

Mr. Littell: Has Mr. Dyer brought with him the various blank forms used for accident reports and interrogations sent out?

Mr. Dyer: I have not. The West Chicago Street Railway Company uses a report without any special interrogatories. The statement, which is sent from the office, is made up with a view of interrogating the witness as to the occurrence in a general way, touching upon the more important points, and then leaving it for the witness to explain further if desired.

Mr. Shaw: I think the report said something about temporary relief; to what extent do you carry that?

Mr. Dyer: That is carried to the extent of providing transportation to the home or hospital. A physician is also called in while the person is lying in the drug store and we pay that expense.

Mr. Shaw: That is the end of it?

Mr. Dyer: Yes, sir.

Mr. Shaw: What would you do in a case like this? We had a man who was fixing a belt, and by some means he got in the shafting and was severely injured about the head. The man was taken to the hotel by some of our men—no hospital in the place—and they have sent us in quite a bill; physician $60, and hotel, $75. The man is recovering, and will eventually get well. We had an assistant engineer who did not wait until his engine had turned over the last time, and he had his hand jammed, the wheel making only one part of a revolution, so that it was nearly stopped. He had three fingers amputated, and they want to know who is going to pay the expense of his medical care. We claimed that it was no fault of the company and there is no liability on our part. I had a talk with the representatives of the injured person, and also with physician and hotel keepers, and told them that we could not assume liability, as it might lead to further trouble.

Mr. Dyer: I should think the first thing to do would be to ascertain the law, whether or not there was any liability, before paying any charges. Of course, even if it was a case where we did not feel that we were legally responsible, there would often come up the question of charity, whether we should not give the man something, at the same time exacting a release, to relieve us from further liability. I would say that there is a great deal of money paid out year after year, which we charge up to donations. For instance, a person not connected with the company, who lost his leg, came into the office and said, "I have had my leg cut off by one of your cars. You are not in any way to blame, but I want a wooden leg. I am willing to make an affidavit that you are not to blame." This was an unusual thing for a man to do, and we gave him $100 to get his wooden leg, although there was no liability. These cases are disposed of on their own merits, each case by itself.

Mr. Shaw : Is your company insured ?

Mr. Dyer : We were from 1890 to '91 ; since then we have taken our own risks.

Mr. Littell : Did you carry it for a full year or did you abandon it ?

Mr. Dyer : We carried the contract for one year.

Mr. Payne: Bearing upon the question of the gentleman in regard to the propriety of paying expenses of taking care of people, we had an experience in our company in that direction, where the evidence seemed to point to the conclusion that the company was not liable. Our attorneys so advised us, and friends of the injured party admitted that there was no liability, and upon their admissions and representations, we sent the injured person to the hospital and cared for him for several months. I think we spent nearly a thousand dollars in the case. When we went to get a release, and offered to throw in, as a gratuity, a few hundred dollars, they refused to settle with us. We litigated,

because we were assured we had a perfect defense. Judgment was rendered against us for $7,800, and the fact that we had done something to alleviate the distress of the injured person, was used against us on the trial upon the ground that we must have believed that we were guilty of negligence, or we would not have expended so much money. That seems pretty hard—to help poor people out when they get injured and then have a jury render a verdict entirely against the weight of the evidence.

MR. SHAW: If we are liable the insurance company which insures us is liable.

MR. PAYNE: The trouble about insurance companies is, that they do not insure more than half the accidents. We think it a wise policy, as the gentleman from Chicago says, to settle our cases.

MR. CONNETTE, of NASHVILLE: We pursue about the same method outlined in the paper read. After the accident has occurred we investigate it immediately. If we find, upon investigation, that the company is liable, we then go ahead and take care of the parties the very best we can. If we find that the company is not liable, we then cease all expense in the case. Frequently, where we have the most trouble is with lawyers. They will hunt up a case and institute suit immediately, without making any effort toward a compromise. The only method I have found satisfactory in an instance of that kind is to endeavor to settle the case outside of a lawyer, which I have done in a number of instances, and cut him out of his fee. Where we cannot settle the case, I have found about the best way is to keep the matter in court as long as we can, because as long as it remains in court, the more easy it is to effect a compromise. After a case has been in court two or three years, it is easier to effect a compromise than it is at the time of the accident. I find another thing of importance, that is, to pursue these cases after they get into court. We should endeavor to use our influence to get such men on a jury as will give a corporation justice. I believe it is just as essential to keep up the political end of street railway management as it is any other part; and if you will endeavor to stand in with the powers that be, and with those who have influence, and with the authorities who have the appointment of these jurors, it is likely that you will secure better results. That has been our experience, and very few judgments have been rendered against us, the largest being $1,500.

MR. LITTELL: I suggest that Mr. Dyer furnish the secretary with a complete set of the blanks used on his road, and that they be published in conjunction with the report.

MR. COLE, of Elmira: It has been our experience that the sympathy of the average juror is usually with the plaintiff, and that the testimony of the witnesses is also apt to be warped in their favor; and I have been able to obtain favorable evidence from the witness by promising the motorman that if he cannot obtain such evidence as will exonerate him from blame, he will not be reinstated in his position. He will go to this witness, and get a written statement of his views of the accident, and, in a great many instances, where he represents that he is liable to lose his position, he will get fair and favorable evidence, and then the witness will keep to this before the jury when the trial comes off.

MR. MINARY, of Louisville: I understand you suspend the motorman?

MR. COLE: Yes, until he gets such evidence from the witness as will exonerate him from any blame, and we have been able to get good evidence in that way. If he cannot obtain the evidence, we will let him go on, but I think it is well to suspend him for a time.

MR. MINARY: As soon as you let him go, you acknowledge your responsibility for the accident.

MR. COLE: We do not let him go until after the matter is disposed of.

MR. SEMMES, of Mobile: Is the evidence which the motorman gets reduced to writing?

MR. COLE: Yes, we do this as far as possible.

MR. SEMMES: As I understand you, you simply suspend him during the investigation, and if you find he does not bring this testimony, then you discharge him?

MR. COLE: Not at that time; that would be hard against us in court, he is not discharged entirely from the company until the case is disposed of.

MR. SEMMES: What would you do in a case of that kind—put him on the "extra list" and pay him for his time?

MR. COLE: No sir, we give him some other work—in the shops.

MR. PAYNE: I take it in case you settle at the time, then you do not hold the motorman responsible?

MR. COLE: We do not.

The next business was the report on "A Uniform System of Street Railway Accounts," by H. I. Bettis. This paper is published in full on page 673 and following pages.

MR. PERRINE, of Trenton: I have listened with a great deal of interest to the paper of Mr. Bettis, and have given a great deal of attention to the subject. I move that the paper of Mr. Bettis be accepted and printed and the new arrangement of accounts be adopted by the Association and a copy be mailed to the auditor and treasurer of every street railway company in the country. Carried.

MR. MCNAMARA, of Albany: I wish that the committee was present so that he might answer some questions. I would call the attention of the Association to the maintenance of way and buildings. In Albany, we are required to distinguish between roadways and track, and renewals of ties, rails and paving. We put these under one head—everything for the roadbed, ties, rails and paving come under the head of roadbed, and in New York City there are other matters about monthly reports—how we shall submit a report to show the actual earnings of every month and every three months. Our dividends are declared in New York City quarterly, and it is quite important that the manager of a company should be able to demonstrate that the dividend of a particular quarter which the directors desire to declare was earned. Our auditor claims that a report of that kind should be made up from the books, so that the books should be compelled to verify everything in the report. Shall we put in the August account the expense for removal of snow and ice? It looks odd; but that is what we are doing. I regret the committee is not present so that we might be able to have an explanation. It seems to me it is just as the committee stated, that there is too much here. Take that one item of roadway and railway—what enters into roadbed? Ties, rails, spikes, joint plates, paving, sand, stone, labor. They ought to come under one head, and that is what is required by the railroad commissioners of New York. They do not object to our dividing it as much as we want in our books, but in the report submitted to them, it must all come under one head.

MR. DYER, of Augusta: I do not suppose it would be possible to get a form to fit every case. I imagine that a small road, if you carried out that plan entirely, would find it expensive, because they would be compelled to have a storekeeper, who would charge up these different things we use each day. I think it is the custom, as a rule, with small roads, to charge up their bills, each month as they come in, as if they had been used. It is not correct, but the expenditure for the man to take charge of the store room and keep accounts of the material used, would be in some cases almost as much as the cost of the material.

MR. MCNAMARA: That is what we find it necessary to do. We have not a large road, but we have a storekeeper, and he charges the several accounts with the material as it is used. There is no other way to determine what you have used in any particular month in the year as the writer of the paper suggests. We do not pay our storekeeper such a large amount, but we find he does good work for us, and it pays.

MR. PAYNE: Undoubtedly all of the larger roads do pursue the course recommended by the committee, but the suggestion in regard to the cost of removing snow is rather new. It never occurred to me to charge up by the month during the year the cost of removing snow during the winter months. It is uncertain what the cost will be. This year you may have very little or no snow or ice, and

if you undertake to make the charges next year on what you have expended in '93, you might fall short or over, and our company has never adopted that method, although I can see if there is any uniformity in the account expended, it would be the proper thing to do.

MR. MCNAMARA: I may say that the repairs to roadway and railway are reported in the winter months when we make no repairs. The question is, Which is the best way to get at the proper amount. We find, taking the average of three winters—we do not include the "blizzard"—they do not vary very much in the amount of expense involved. The important question is, How shall roads determine questions of this kind? Perhaps every road is to determine it for itself.

The secretary announced that upon the adjournment of the meeting the Convention would inspect the exhibits; that at four o'clock a visit would be made to the car house of the Atlanta Consolidated Street Railway Company, and that from six until nine o'clock a reception would be tendered to the delegates, and ladies accompanying, at the Capital City Club. On motion, adjourned.



The meeting was called to order promptly at 10 o'clock, and an executive session was at once ordered for the purpose of privately discussing several proposed amendments to the Constitution and By-Laws of the organization, as well as insurance and other matters of special interest to the members of the Association.

The secretary then read a letter from Mr. John Kilgour, president of the Cincinnati Street Railway Company, suggesting that city as the place of meeting for the fourteenth annual convention of the Association. Mr. Kilgour said, that at Cincinnati an excellent chance is presented to study the operation of the single and double trolley systems, as they are working side by side in the same street, also the cable, and inclined plane systems and grooved rail track construction. Letters were also read from Mr. J. J. Sullivan, president of the Electric Traction Company, of Philadelphia, and Mr. Samuel P. Ferree, treasurer of the Street Railway Advertising Company, inviting the Association to meet next year in Philadelphia.

The secretary stated that he felt that in connection with these invitations he should read a letter from a prominent street railway man in Montreal, written a year ago, asking that the convention for 1895 should he held in Montreal.

INVITATION TO MEET IN MONTREAL NEXT YEAR.

MR. EDWARD LUSHER, OF MONTREAL: Gentlemen, at the meeting of the Committee this afternoon, in arranging for a place for the next meeting, I desired to get in edgeways that there is such a place as Montreal, but I was very properly ruled out of order, being a member of the Committee.

I should be very much pleased if the members of the Association would think of Montreal through the coming year, so that the year after next we might find a place in your memory. If you come to Montreal you will come to us as foreigners, but we will treat you as friends. We have good hotels and all that good hotels bring forth. We consider we have some interesting things in our city, and should like to get you there to see them, and will treat you in the best possible way we can. If the Convention will kindly think of this during the coming year, so that we might have the satisfaction and pleasure of your coming, we would be very glad.

A few years ago—in 1885—it was partly decided that you should go to Montreal; but 1885 proved to be a year of small-pox in our city. Small-pox, however, does not come more than once in twenty years. As I said before, if you come we will do everything we can to make your visit pleasant; we have only one railway, but that covers the entire city. [Applause.]

Mr. Ostrom ably advocated the selection of Philadelphia, stating that this city is no longer a slow town, but has become one of the most progressive in the country.

The question of the next convention city was referred to a committee appointed by the president to nominate new officers for the Association, this committee consisting of Messrs. T. H. McLean, of Indianapolis; E. G. Connette, of Nashville; G. W. Baumhoff, of St. Louis; A. F. Breed, of Lynn; R. Semmes, of Mobile, and John E. Rugg, of Pittsburgh.

Mr. Hurt, of Atlanta, chairman of the special committee on "T Rail Construction," appointed at the last meeting, submitted the committee's report, which will be found on page 681.



President Payne called the meeting to order at 10.30 A. M. The first business was the report of the Committee on "City and Suburban Electric Railways." This report is published in full on pages 677 to 680. On motion, the report was ordered to be printed in the proceedings.

The report on "The T Rail Construction of the Terre Haute Street Railway Company," was read by Mr. Harrison. This is published on page 696.

MR. SEELY: I would like to ask Mr. Harrison what is the cost of the T rail construction as compared with the girder rail construction of the same weight?

MR. HARRISON: I could not give any comparison as to the same weight of rail, because I never laid girder rail of that dimension. Our experience was with thirty-eight and forty-five pound girder rail, and that was all taken up long ago.

MR. SEELY: Have you had any experience with the T rail, outside of the brick and asphalt pavement; have you had any experience with granite blocks?

MR. HARRISON: No, sir; the brick pavement is much superior for smoothness and durability to granite blocks; but I am confident we can lay the rail as well and as successfully with the granite blocks as with the brick or asphalt pavement.

MR. SEELY: Do you not find that the concrete foundations are extremely rigid for the cars; that the wear takes place in the cars instead of the rail?

MR. HARRISON: The traffic is perfectly smooth, and there is no jolting or jar; no oscillation with our cars. When the car comes to a rail joint you cannot tell that you are passing over it. Our track foreman has had long experience in steam railroad practice, and he is instructed to spare no pains or expense in making the joints as solid and rigid as possible. I do that, because I believe that after you once put a track in a paved street, you do not want to repair the rail joint. You want to have it so that it will not give you any trouble, and for that reason there is no money spared in laying the joints. The joints are laid as close as the natural expansion and contraction will permit.

MR. SEELY: The reason I bring up that point is that at the present time a great many railroads are being constructed where they are not allowing any space for contraction and expansion.

MR. HARRISON: My experience on that point is that there is so much metal down below the surface, where it is cool, and so little of it exposed to the heat, just the head—we have no grooved or girder rail in our city—and just a little on one side, that we do not suffer from contraction and expansion, as in the case of a girder rail. The joints are the Wheeler joints, and rest on the tie, and then we tamp the rail up with concrete, not only the ties supported with concrete, but under the rail also, and the concrete comes up over the tie, so that the rail and the tie both rest on solid concrete, with a heavy bed below, and when this brick paving is put on, and all cemented together, there are practically no joints; and you cannot feel them in passing over the rail. It gets no wear and tear, and that is why, in economy of operation, it is superior, because there are no joints to rattle a car in passing over

them. Our motors and cars last longer, and we have better service.

Telegrams were read from Thomas Lowry, president of the Twin City Rapid Transit Company, Minneapolis, and also from the Commercial Clubs of Minneapolis and St. Paul, inviting the Association to hold its next meeting in the great convention city of the Northwest—Minneapolis.

A letter from O. T. Crosby was read, regretting his inability, owing to pressure of business and absence from the country, to present a report on "Standards for Electric Street Railways," and asking that a new chairman be appointed in his place.

On motion of Mr. Perrine, the Committee on Standards was continued.

The following letter was read from M. K. Bowen, superintendent of the Chicago City Railway Company, recommending that a committee be appointed to investigate the subject of the validity of patented articles used by street railways.

CHICAGO CITY RAILWAY COMPANY.

2020 STATE STREET.

CHICAGO, OCTOBER 15, 1894.

To Henry C. Payne, Esq., President, and Members of the Executive Committee, American Street Railway Association:

GENTLEMEN:—The list of patented articles in use on street railways is growing very fast, and has increased wonderfully since the adoption of electricity as a motive power. All street railways are paying either directly to the patentee or indirectly to the manufacturer, a royalty on one or more devices in use in the operation their lines. In many cases the patent is worthless, yet no test or investigation has been made to determine whether a royalty is rightfully due the holder of the patent or not, and consequently many thousands of dollars are spent annually in royalties that could be otherwise saved, or the price of such articles reduced by concerted action in fighting and exposing all such so-called "patents."

The street railway companies are also liable to be made defendants in the suits for using articles that are an infringement on some patent, while the manufacturer is the party that should stand the burden of such litigation, and not the purchaser or consumer.

In this matter we are far behind the steam railroads of this country. In this city there is an organization known as the Western Railroad Association, that has been in successful operation for twenty-four years, and has a membership of ninety. There is also an Eastern Association, with headquarters at Washington, similar to the one here, and the two organizations have as members all the important railways in the United States, and most of the smaller ones. The several railways pay annual dues based either on their mileage or gross or net receipts. This Association furnishes reports and opinions on all patent matters on request from its members, and defends all patent suits in which the railroads are made defendants.

The railroad, as a rule, gets an opinion from the Association before buying, making or using any patented device. An association of this character would be highly beneficial to our street railway companies. If this could be carried into active operation by an association of street railways, all patented articles in use on our lines should be investigated and reported on.

In conclusion, will say that if it meets your approval I would recommend that a committee be appointed to take up this matter and submit a plan of organization, to report to the Executive Committee at their meeting in January. Your's respectfully,

M. K. BOWEN, Superintendent.

Mr. Perrine moved that a committee be appointed on this subject. Carried; and the Chair appointed the following committee: F. R. Greene, secretary Chicago City Railway Company, chairman, and John W. McNamara, Albany, and C. W. Wason, Cleveland.

The matter of the proposed amendments to the Constitution and By-Laws, to provide for associate members, was then considered. An informal vote was taken as to the advisability of the adoption of the amendments; and it was the unanimous judgment of the members that the amendments should be adopted.

Action on the same will be taken at the next annual meeting.

The special committee appointed to interview the representatives of the Underwriters' Association of the South reported that they had been unsuccessful in meeting such officials.

MR. BROPHY, of Boston, president of the New England Reserve Fund Association, was introduced and said: I think it would be better for each state association of street railways, to make application to the board of underwriters of the mutual companies which controls its territory. I think something might be done in the way to secure a reduction of rates. Our company is not a stock company. We have no agents and pay no premiums, so that we can afford to carry the business at somewhat lower rates. Ours is the only mutual company which is at the present time carrying electric light and railway properties. We have been insuring electric light stations and power houses for two years, and car houses for one year. We have at the present time $7,000,000 of property of this class, and for the last ten or twelve months, ending October, our losses have been $2,300 on the $7,000,000. We have been able to pay a dividend of 70 per cent. on business written one year ago. We have been insuring this character of business for two years. I state this to show you that the electric business is not so hazardous as some people think it is. (Applause.) It can be insured at a profit. We have paid some losses; at the same time we have paid to our policy holders 40 per cent. of the premiums paid. The premiums collected have paid losses and expenses and left a balance to be returned to policy holders, so that the business is not so very bad. Our rate on electric light stations is 1 per cent., which calls for a station which is a model in every way. We do not ask for cement floors or iron floors, nor do we ask that the roof shall be eighteen feet high; but we want a plant that is clean and has no oil on the floors, no finish on the walls, and no attics or basements. If it has a basement or second floor, used for storage, they must be equipped with automatic sprinkers. Our experience with car houses has been very satisfactory. We do not know just what the losses will be, but our premiums so far have met all expenses. Our expenses for inspectors have amounted to 6 per cent. of premiums received, and the total expense, including losses, is 12 per cent. The stock company, of course, must necessarily pay commissions to its agents, and these commissions amount to about 33 per cent. of premiums, losses something like 63 per cent.

MR. BAUMHOFF: I would like to ask the gentleman in what cities his company carries insurance on electric railways; have you any district?

MR. BROPHY: We have no special district. Of course, the majority of our business is in New England; and the greater part of our insurance is on electric light property. We have $7,000,000 on this classed together, and about $500,000 of that is on railway property. Our basis rate on brick power houses is 1 per cent.; frame, 1¼; car house and contents, including cars, brick, 1¼; frame, 1½ per cent.

MR. BAUMHOFF: Are you limited as to the amount?

MR. BROPHY: We cannot carry over $60,000 on any one building and contents. We are somewhat handicapped; our company is not large enough to carry the insurance the large street railway companies would desire to place with us. We had an offer from a railway company recently, to place $300,000; power house, car house and shops; and as they were practically one building we could not take it. Of course, if they had formed three or four separate risks, we might have done the business. A mutual company will not take property exposed to a risk which it would not carry if it were offered. I think it might be well to appoint a committee to confer with some of the New England mutuals to see what they will do.

MR. HARRISON: I have had a satisfactory experience with the company Mr. Brophy represents, and I agree with the suggestion that it would be of interest and profit to the Association to have a committee appointed. I move that a committee of five be appointed to take the matter up with the New England companies. As far as our company is concerned, we can get all the insurance we want from the company represented by Mr. Brophy, but larger companies could not do it. They would not carry so much in one risk; it would be necessary to deal with two or three to carry the full risk.

MR. SEELY: In relation to insurance companies, the members of the National Electric Light Association had the same trouble that you are laboring under, and I believe the company which Mr. Brophy represents came to their relief. I have no doubt that the street railway

companies could get substantial relief in this direction by a conference with the representatives of the mutual companies. The Standard Oil Company carries its own insurance, and has a profit every year, and there is no reason why this great business should not do likewise. We could establish a mutual company of our own, and have a central office.

The motion to appoint the special committee was then put and carried.

The president appointed the following gentlemen: Messrs. Harrison, Terre Haute; Dyer, Augusta; Perrine, Trenton; Lusher, Montreal; Baumhoff, St. Louis.

Mr. Perrine offered the following resolution:

Resolved, that the Executive Committee is hereby requested to take under consideration the question of the enlargement of the field and scope of the Association, and submit a plan, suggesting ways and means therefor, at the next meeting of the Association. Carried.

The Nominating Committee presented the following report: President, Joel Hurt, Atlanta, Ga.; vice-president, W. Worth Bean, St. Joseph, Mich.; 2d vice-president, John M. Cunningham, Boston, Mass.; 3d vice-president, Russell B. Harrison, Terre Haute, Ind.; secretary and treasurer, William J. Richardson, Brooklyn, N. Y. Executive Committee: Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo.; G. C. Cuningham, Montreal, Can.; J. N. Partridge, Brooklyn, N. Y.

The Committee recommended Montreal, Can., for the next meeting.

A motion was made to adopt the report, except as to Montreal for the place of next meeting. This motion was amended by a motion to adopt the report of the Committee as a whole. This latter motion was put to vote—ayes, 17; noes, 19.

On motion, Mr. Penington, of Chicago, was instructed to cast the ballot of the Association for the officers nominated.

This was done, and they were declared duly elected.

Mr. Penington moved that Philadelphia be substituted for Montreal as the place of meeting.

A spirited discussion ensued on the question; and during the calling of the roll there was much interest manifested. The vote when taken, stood:

Montreal, 38; Philadelphia, 17.

Mr. Cuningham, of Montreal: Gentlemen, I wish to say a few words to you to show how very pleased, indeed, I am to know that next year Montreal will receive this large and important Association. I can assure you that we will do everything in our power to remove any difficulties that may exist as to entering any supplies for the purpose of exhibition. I can confidently promise you that there will be no difficulty in bringing supplies to Montreal, any more than there was in bringing them to Atlanta. We recognize in Montreal, as well as do the residents of other places, that this exhibition, which is a part of the annual meetings, has become a very important feature, and should be maintained and improved, if possible, every year; and therefore, for that reason I can promise you that we will do all in our power to remove any difficulties that may exist in coming to Montreal. You will receive there a most warm and hearty welcome. [Applause.]

The report of the Committee on "Mail, Express and Freight Service on Street Railway Cars," was then read by title only. This is published on page 687. On motion the report was ordered to be printed in the proceedings.

The report of the Committee on "Transfers and Commutation" was read by title, and ordered to be printed in the proceedings. The report is given on page 680.

The report of the Committee on the "Use of the Booster on Electric Railway Circuits" was next in order, and after a few remarks by Mr. Vail, giving the substance of the paper, was ordered to be printed in the proceedings. The report is given on page 700.

Messrs. Dunlop, of Washington, and McNamara, of Albany, were appointed a Committee to escort the newly elected president to the chair.

Mr Payne introduced Mr Hurt, who said: Mr. President, and gentlemen of the Convention. I thank you sincerely for this honor. I have not sought it, but I appreciate it none the less. I assure you that I shall not take up your time in making a speech. I am fully in accord with those who have the interests of this Association at heart, and I shall do my best during the year to come to further its advancement. I can do no more than ask your co-operation, free consultation and help in every direction. The Executive Committee, of course, will have certain important matters before them; but with your secretary must lie main weight; and I have no doubt that he will in the future, as he has in the past, discharge his full duty. I feel that this Association is entering upon an era of much more useful work than has marked its past career. Its scope should be enlarged. There are many features of the work devolving upon the managers of street railways, in which they need help from this Association; and this question should have your special attention during the next twelve months. I can only promise you that my feeble effort will be given with the greatest earnestness whenever I see it can be of any avail. Thanking you again, gentlemen, for the honor, I wish you all God speed, and hope that we will meet again in another year, and have quite as full an attendance as we have had here. (Applause.)

On motion of Mr. Perrine, a vote of thanks was passed to the retiring officers. The Atlanta Consolidated Street Railway Company, the Capital City Club, the local press, and the citizens generally of the city of Atlanta, for the courtesies, kindness and attention, and courteous hospitality, which had been extended to the Association.

The report on "Destructive Arcing of Five Hundred Volt Fuses," was read by title, and ordered to be printed in the proceedings. The report is given in abstract, on page 699. The paper on "Brake Shoes" was read by its title, and was ordered to be printed in the proceedings. An abstract of this paper is given on page 689.

Mr. Davis: In accordance with the recommendation of the author of the paper, I move that a committee be appointed, to consist of two members of the Association, and one manufacturer, to investigate the subject of the adoption of a standard style of brake shoes, conduct experiments, and to report the data collected, and its conclusions, at the next meeting, without expense to the Association. Carried.

The report on "Power Brakes *vs.* Hand Brakes," by E. J. Wessels, was read by title only. It was ordered to be printed in the proceedings. The report is given on page 683.

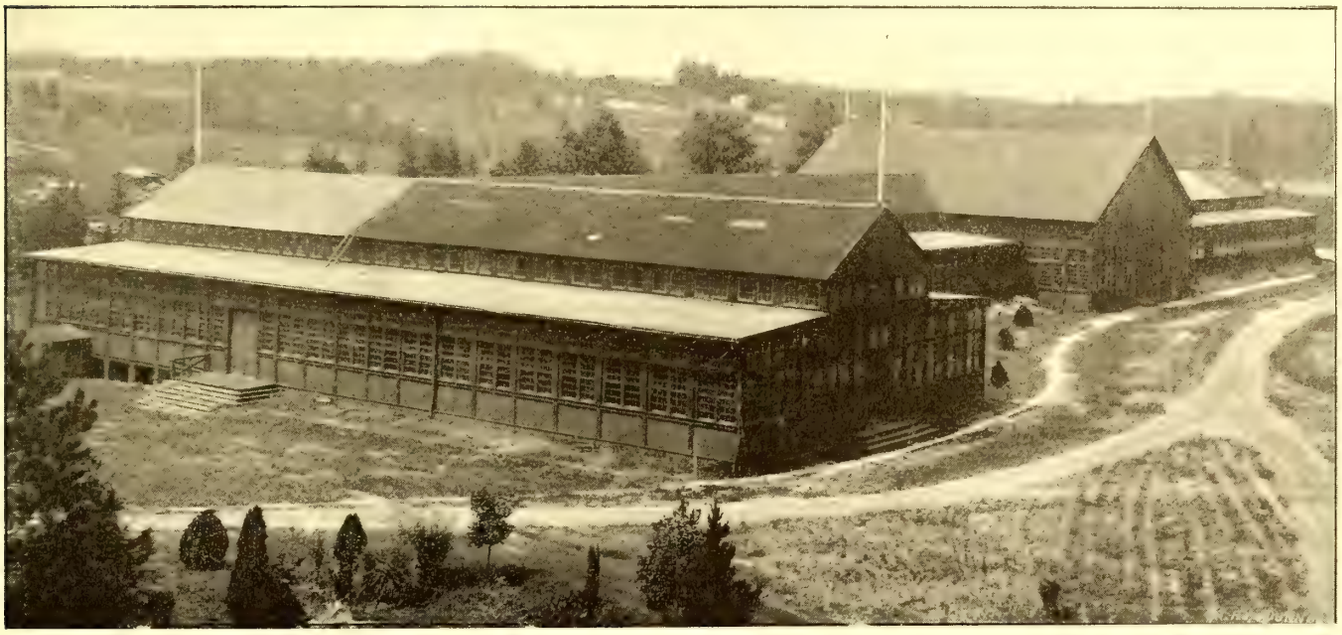
Mr. E. A. Sperry: The paper just read by title contains a reference to a paper read by me before the American Institute of Electrical Engineers last month. The reference being somewhat unjust, I would like the opportunity of showing wherein some of such errors have occurred. My paper contained fourteen points of excellence, in which the electric brake was superior. These points have been taken up by Mr. Wessels in their order, and remarks attached to each, embodying claims on behalf of the air brake. For instance, I said that the use of the electric brake, which does not employ brake-shoes in the operation at all, would cause an entire saving in brake shoes, with a resultant saving of wheels from two to threefold. The author has attached to this the remark that a good air brake saves wheels. The air brake is used simply to increase the power of the application of the brake-shoes, which, while smeared with sand and dirt, attack the rims of the wheels, "drawing" the chills, and very soon grind off the face of the wheels to a point below the chills, when the wheels will have to be pressed off, and others substituted. The air brake, instead of saving wheels, simply tends to grind them down sooner by the superior pressure of the shoes upon the wheels, over and above that readily obtainable by hand. With the electric brake the wheels are retarded and brought to rest without the application of brake shoes, and the rolling contact between the wheel and rail, being the only point of wear, the grinding and ruining of the chill is entirely avoided.

Another point referred to by the author is that of the air brake not causing flat wheels. It will be readily understood that with the electric brake this cannot occur, from the fact that when the wheels stop momentarily, the

motor, which has been converted into a dynamo, also stops, and therefore it cannot generate current with which to further and continuously hold such wheels, and they simply start again to roll slowly, which gives far better retardation than while sliding, and therefore cannot be ground flat. The comment upon this point is that a good air brake prevents flat wheels. It is not clear why the statement is made, no reasons being given.

With the air brake, a constant demand for energy is made at moneyed cost from the power station, which at the same time may be already well taxed and running up to its capacity. With the electric brake, on the other hand, we use nothing but the momentum or power stored up in the moving mass, and which in any case we is fully applied or fully on, the motorman is enabled to hold a heavily loaded car on an 8 per cent. grade. The holding is perfect, and remains so as long as the handle is in this position. We find one fact which greatly aids this process, namely, the friction of quiescence, which is, the natural resistance of any mass starting to move, after being once brought to rest.

I most heartily agree with the author as to the necessity of power brakes, but think that the highest order of engineering should be employed; and inasmuch as we have ample power stored up in the mass, this power should be used rather than to employ an additional draught of power from the central station at moneyed cost, and additional and otherwise unnecessary devices,



VIEW OF CONVENTION HALL, PIEDMONT PARK, ATLANTA.

wish to get rid of, the brake simply being a device whereby a part of this energy of motion is used to apply the brake and stop the car.

In answer to most of the points raised, the paragraphs quoted from my paper above referred to, are self-explanatory, and need not receive comment here. One, however, is an important one, which should receive explanation, namely, that of holding a car on a grade after it has been brought to rest. On the car in operation at this Convention, though unaware of it, you have nearly all seen a portion of the apparatus which is used to hold the car on grades ; but which, on advice of counsel, has been removed from the wheels, and cannot be shown publicly until December 15. I might say, that by means of this device, the single controller handle by which the car is first started, may, by swinging around, bring the car to rest by use of the electric brake. By the simple act of holding this handle in the position where the brake which in some cases are liable to derangement, and also liable to give unnecessary and disagreeable noises in its operation. If the same controller handle can be used to start and stop the car by reverse motions, it is in the cause of simplicity to adopt it, and avoid a multiplicity of handles, whereby a motorman in case of an emergency, might become confused in their use. In the electric brake a single handle is used for all purposes, to run the motors, apply the brakes and hold the car upon a grade.

The special paper, by Allen R. Foote, on "Taxation," was read by title, and ordered to be printed in the minutes. Mr. Foote's paper defined what are proper subjects for taxation and what are not, and recommended for adoption by the legislatures of the different states the clauses defining taxes given in the appendix to a paper on the same subject, read by Mr. Foote at the last meeting of the New York State Street Railway Association, and published in our last issue. The meeting then adjourned.



The social life of a great convention is to many of those in attendance more interesting than its business life. The story of how Atlanta was stormed and captured in the year of our Lord, one thousand eight hundred and ninety-four, by the largest and most successful convention of the American Street Railway Association ever held, and of how the hearts of the assaulting party were in turn conquered and, indeed, enslaved by the citizens of "The Gate City of the South," is one of such exceptional interest as to fully warrant the telling.

The Trip To Atlanta

Convention life began on the many trains, special and regular, which started from all parts of the country toward Atlanta—the first city in the South to receive as guests the American Street Railway Association. Acquaintances were formed on these trains which, strengthened into friendships during Convention time, have become permanent possessions for a life time. Who, for example, of those who joined in the war cry

Rat tat too,
Royal Blue,
Shenandoah Valley,
Brought us through.

as the magnificent special train from New York drew into the Atlanta station at six o'clock on Tuesday night, will ever forget the pleasant social visitations from car to car, the games of pok—er—whist, which beguiled the flitting hours, or the "horse play" possible only to men in rollicking mood who "own the train," and are able to act on the dictates of a passing fancy, untrammeled by officialism or severe glances from unfriendly eyes?

Tuesday afternoon and evening found Atlanta's expectations of a large attendance fully realized. A committee of prominent citizens received the many trains rolling into Atlanta, from East, West and North and "passed them on," with cheerful greetings, to the fine hostelries of the city. Soon the latters' corridors were filled to overflowing with nearly 1,000 men, shaking hands, renewing acquaintances, introducing each other and passing congratulations upon the weather, the attendance, the excellence of the accommodations and the prospects for "the biggest convention ever held," forgetting in the electric atmosphere of jollity and good cheer such minor troubles as overflowing chambers, cot beds, "lodgings out," etc., inseparable from the great meetings of the Association. At the Aragon, the earlier arrivals saw a cluster of well known street railway men resplendent in swallow tails and white ties, and found that the manager, Mr. Dodge, had proffered to a few choice spirits among the arrivals of Monday, an elegant little private dinner—if sixteen courses can be respectfully referred to as "little" —in honor of the first anniversary of his management of the hotel. At the Kimball House all was music and merriment, flags and bunting, in honor of the city's guests, and at the Marion and Markham Hotels, smaller but presumably more select gatherings found life quite bright enough for all practical purposes. In the later evening and after the wants of the inner man had been satisfied by substantial and well served dinners, bands of delegates might be seen parading the principal streets, singing war and other songs, and impressing upon the sober citizens of Atlanta, the fact that Convention life was gay, indeed, even to prosaic street railway engineers and operators.

Those who did not find each other on Tuesday night were satisfied on the following day at the Exhibition Hall, where the extensive exhibit of apparatus was made the excuse for a general reunion of friends.



"Delegates are requested to hand their names to some member of the local committee in order that the courtesies of Atlanta's Club may be extended to them, together with invitations to a reception tendered to the American Street Railway Association and others in attendance by the Capital City Club."

This is the substance of the kind and cordial note which was placed in each box at the different hotels, and Tuesday evening found many of the most cultured and delightful ladies and gentlemen in Atlanta society assembled in the beautiful home of the Capital City Club prepared to greet their new friends. The large ball room of the club was soon filled, and the inspiring music of a fine orchestra, in conjunction with a smooth and waxy floor, proved too great a temptation to be resisted, so that the reception was quickly turned into an impromptu ball, greatly to the pleasure of all concerned. The ladies of the Convention were many, but were so far outnumbered by the gentlemen that each lady was quickly surrounded by half a score of gallants eager for the honor of a dance—a situation so unusual in social entertainments as to be almost embarrassing, though quite satisfactory to the favored representatives of the fair sex.

Early in the evening, Major Livingstone Mims, president of the club, and a typical Southern gentleman of the old school, delivered from the floor a fine address of welcome which elicited the hearty applause of his hearers. Later on, an excellent collation was served in the banquet hall. The evening was thoroughly enjoyable from every point of view.

Thursday morning and afternoon were given over to shopping and sight seeing on the part of the ladies, while the gentlemen devoted themselves strictly to business at the Exposition Grounds. In the evening occurred the great social event of the Convention.



By eight o'clock the halls and parlors of the Kimball House were thronged with would-be banqueters waiting for the opening of the doors leading to the immense dining room of the hotel. Within a short time the latter had been so completely filled that hardly a seat was free for late comers. The banquet hall was draped with the national colors, caught into folds with shields and relieved in places by special effects in other decorative material. At the head of the hall were palms and potted plants in abundance, and directly in front, running transversely

across the hall, was the table reserved for the officials of the Convention and the speech makers. The remaining tables, four in number, extended throughout the entire length of the hall, and the beautiful linen, the bright silver and the fruit pieces "dressed" the banquet hall to an effect brilliant, cheerful and hospitable.

The menu was as follows:

Blue Points. Celery. Green Olives. Salted Almonds.	MANHATTAN COCKTAIL.
Green Turtle Clear.	SAUTERNES.
Broiled Pompano. Sauce Tartar. Duchess Potatoes.	
Fresh Lobster in cases à la Newburgh.	PONTET CANET.
Sweet Breads Glacé with fine French Peas.	
Electric Punch. Wafers.	
Roast Young Turkey with Cranberry Sauce. Asparagus.	POMMERY SEC.
Quail on Toast with Cresses. Currant Jelly.	
Celery Salad.	
Tutti Frutti Ice Cream with Cakes.	
Assorted Fruits.	
Roquefort and Edam Cheese with Bent's Crackers. Mocha Coffee.	CREME DE MENTHE.

The banquet over, President Payne rose to introduce Mr. J. H. Stedman, of Rochester, who read a witty poem on the origin of toasts, toasting and toastmasters, thus serving to pave the way for the president himself, who acted as toastmaster and called up the speakers of the evening.

In response to the toast on the "City of Atlanta," Hon. Howard E. W. Palmer eloquently set forth the virtues and advantages of the city, claiming for its citizens an enterprise and public spirit second to none found elsewhere South or North. In conclusion he proposed a toast to the American Street Railway Association, which was drunk standing, and with much enthusiasm.

Mr. C. D. Wyman, of Milwaukee, worthily responded to the toast "Our Association."

In the absence of Gen. W. H. Jackson, of Nashville, Mr. Lewis Perrine, Jr., of Trenton, talked about the "Street Car as a Factor of Civilization," and told a number of personal experiences and anecdotes which were highly appreciated.

Capt. Henry Jackson responded to the toast, "Railroads and the Law" in a vein generally serious, but enlivened by flashes of wit and humor, which met with a quick response from his audience.

Hon. Leonel C. Levy, of Columbus, delivered an eloquent oration upon "The New South" in the fervid, figurative style of the Southern orator of the old school.

Mr. James H. McGraw, of the STREET RAILWAY JOURNAL, responded to the toast, "The Technical Press," briefly outlining the services which the latter was rendering to the street railway industry, and giving several specific illustrations, humorous and otherwise, of what the press had been able to accomplish.

One of the most brilliant and eloquent speeches of the evening was that of Mr. Lucien L. Knight, of the *Atlanta Constitution*, who charmed his hearers no less by his interesting personality, than by the substance of a most excellent speech.

The final toast, on the subject, "Our Country" was answered in a serious vein by Hon. Fleming duBignon, whose speech was enthusiastically applauded, and was a decided success.

The Convention then called loudly for Mr. Joel Hurt, "the next president of the Association," who spoke briefly and earnestly upon the future of the Association.

Capt. Robert J. Lowry, of Atlanta, in response to an urgent call, delivered the final speech of the evening—a speech refusing to make a speech. The banqueters then dispersed promising solemnly to meet each other again another year.



"A Royal Georgia Barbecue"—this was the attraction which drew to the beautiful grounds of the Ponce de Leon on Friday afternoon nearly all in attendance at the Convention. The barbecue was in charge of Mr. B. W. Kribacker, a prominent caterer, locally famous for his special ability as a "barbecuist." The process was decidedly interesting to the visitors, most of whom knew only by reputation the nature of the feast. A large trench, fifty feet long and three feet deep, had been dug and filled with burning coals. Across this trench were stretched five large hogs, seven kids, ten lambs, fifty chickens and twenty calf livers, about 750 lbs. of meat in all. The odor of the roasting flesh was simply delicious, and whetted the appetites of the 500 guests to a point where all care for formality and daintiness was forgotten. About 700 ft. of tables had been erected, and, standing around these, the guests partook of the roasted meats, of a "Brunswick stew," and of bread, beer and other eatables, the whole forming a most enjoyable, and long to be remembered feast.

While the barbecue was in progress, a roaring farce was being enacted in a portion of the grounds. It is hard for the average Southerner to understand how intensely amusing to the average Northerner is the Southern darkey of all ages—particularly of the pickaninny age. To get a couple of half grown lads to engage in a "butting match," to see the piles of colored humanity imitating a foot ball scrimmage where a nickel is the prize instead of a football, and to see a dozen darkeys in all conditions of clothing scampering around the Piedmont Race Course "for a dollar"— all these were sights which would cause even an anchorite to howl with laughter.

The breaking up of the Convention parties had to come at last, and the hotel scenes on Friday evening were in some cases pathetic, in others ludicrous. Each lady attending the Convention was surrounded by a group of newly formed admirers begging the privilege of further acquaintance, swearing eternal friendship, and expressing hopes of pleasant homeward journeys. At the desk, accounts were being wound up, and pocketbooks emptied in the process. In the corridors might occasionally be seen red faced, thick voiced individuals who had been noted during the Convention for their good fellowship and conviviality. In the café, a half dozen colored boys were singing and dancing, accompanied by a violin and 'cello, to an audience large, enthusiastic and decidedly liberal in its ideas of remuneration.

The magnificent special trains for New York, on the Southern—Pennsylvania and the Norfolk & Western—Baltimore & Ohio routes, started for Chattanooga at 11 and 11:30 o'clock, the former to treat its passengers to pleasant sojourns in Chattanooga on Saturday, and Asheville, N. C., on Sunday, and the latter to give its patrons even more delightful experiences at Chattanooga, Natural Bridge and Luray Caverns.

Thus closed the Convention, perhaps the most successful, from a social point of view, in the history of the Association. Atlanta was cordial and generous to us in the year of our Lord, one thousand eight hundred and ninety-four, and, with a warm and wholly fraternal feeling, her guests wish her a future full of good fellowship, and a material prosperity second to no other city in the world.

Railroad Officials Thanked.

The party of nearly one hundred who visited the Convention by the special train, on the Shenandoah Valley route, were treated to a number of special privileges not enjoyed on other trains. The train, as made up at Hoboken, consisted of four sleepers, a dining car and a baggage car, all going through without change and arriving at Atlanta almost exactly on schedule time. The dining car service was unusually fine, all the delicacies of the season being offered to the guests, and as the company was thoroughly congenial and well assorted, the Southbound trip was a highly enjoyable affair. But an even greater pleasure was in store on the return trip, for, through the kindness of the Norfolk & Western and the Baltimore & Ohio Companies, the train was run as an "excursion special," leaving Atlanta at 11:30 Friday night, and arriving in Chattanooga in the early morning. Leaving Chattanooga at 6:30 in the evening, after a most pleasant trip to Lookout Mountain, Missionary Ridge and other points of interest in the city, the train arrived at Natural Bridge early Sunday morning. Tally-ho coaches had been telegraphed for, and the entire party enjoyed a beautiful morning ride over the Virginia hills to this world famed natural curiosity, which was thoroughly explored from top to bottom. The train then left for Luray, which was reached at about 4:30, and again carriages and guides were found in attendance. The trip through the wonderfully beautiful caverns, rivaling the famous Mammoth Cave of Kentucky, was one of unusual delight. Some of the great halls of the weird and mysterious cave seemed like most charming cathedrals, appropriate to the day, and the "organ," formed by certain stalactites and stalagmites in the heart of the cave, carried out the hallucination. It was with much difficulty that the party could be brought together so as to leave Luray at the schedule time, 7:15 Sunday evening. The train arrived at Jersey City less than ten minutes late—a remarkable record, due largely to the skill, forethought and railroad experience of Mr. Leroy J. Ellis, Eastern passenger agent of the Norfolk & Western Railroad Company, who was in charge of the excursion throughout the trip, and who was indefatigable in his efforts to please passengers and to save them trouble. His kindness and attention were so exceptional that an impromptu mass meeting was held at Luray, at which the following resolutions were adopted:

Natural Bridge, Va., Oct. 21, 1894.

Whereas: A large number of those attending the Atlanta Convention, of the American Street Railway Association, have traveled to and from that city over the Shenandoah Route, and

Whereas: The unqualified pleasure and the brilliant success of the railway trip have been due to the unwearied efforts and thoughtful supervision of Mr. Leroy J. Ellis, Eastern Passenger Agent of the Norfolk & Western Railway, be it therefore

Resolved, That the hearty thanks of the passengers on the special train personally conducted by Mr. Ellis, be and hereby are extended to that gentleman for his unremitting attention to their comfort and his prompt acquiescence in any suggestion that could be made.

Resolved, Further, that Mr. Ellis be and is hereby congratulated upon the striking punctuality in the adherence to the train schedule, as evidencing the high standard of railroad efficiency in the New South, and

Resolved, That a copy of these resolutions be engrossed and presented by a committee to Mr. Ellis, together with a souvenir that may serve to remind him of the occasion as well as of the high esteem in which the street railway men and street railway supply men hold a typical steam railroad man.

Committee for Presentation.
E. Peckham,
W. J. Richardson,
J. R. Beetem,
J. H. McGraw,
W. S. Silver,
H. C. Evans.

Chairman, E. Peckham.
Secretary, T. C. Martin.

These resolutions were ordered to be engrossed and presented to Mr. Ellis with a handsome souvenir of the trip, to be selected by Mr. E. Peckham, chairman of the meeting.

It is also fair to say that to Maj. F. K. Huger, superintendent of the Southern Railway Company, and vice-president of the Knoxville Electric Railway Company, is due considerable credit for his efforts in pushing forward the special train and making up time between Bristol and Atlanta on the Southbound trip.

Resolutions on the Southern Railway.

Representatives from the several cars composing the special train from the East to Atlanta and return, October 15 to 27, assembled in the car "Tiber," at Hickory, N. C., and were called to order by Col. John H. Cunningham, of Boston, second vice-president of the American Street Railway Association, who stated that he had been requested to convene those present for the purpose of giving expression to their appreciation of the attentions they had received from the railroad representatives.

On motion of Mr. Charles Clark, Colonel Cunningham was requested to appoint a committee to draft proper resolutions. The committee reported later the following preamble and resolutions which were enthusiastically adopted.

Whereas: The ladies and gentlemen composing the special train from New York to the Convention of the American Street Railway Association at Atlanta, October 17 to 19, traveling over the Pennsylvania Railroad and the Southern Railway, have enjoyed unusual privileges and advantages over the system of the Southern Railway, whereby they have been enabled to visit the historic grounds of Lookout Mountain and Missionary Ridge, at Chattanooga, Tenn., and view some of the grandest scenery of the world in the Blue Ridge Mountains around Asheville, N. C., and have received unsurpassed accommodations at every point, therefore be it

Resolved, That the cordial thanks of this entire party be heartily extended to the above corporations for their courtesy and kindness throughout.

Resolved, That special special thanks are due to W. A. Turk, of Washington, D. C., general passenger agent of the Southern Railway; to S. H. Hardwick, Atlanta, assistant general passenger agent, and to A. S. Thweatt, of New York, Eastern passenger agent of the company, for the general plan and arrangement of our itinerary.

Resolved, That we particularly desire to thank Mr. Geo. C. Daniels, New England traveling passenger agent of the Southern Railway, who accompanied us on the entire trip, for his courteous, tireless and unceasing attention, and we do most sincerely congratulate the Southern Railway Company, on having such an efficient and obliging agent in their service.

(Signed) R. S. Brown, Chairman.
Chas. W. Price. Secretary.
John N. Partridge.
John H. Cunningham.
W. L. Candee.
I. A. Shaler.

Hickory, N. C., October 21, 1894.

Ladies in Attendance.

Bean, Mrs. W. Worth, St. Joseph, Mich.
Berry, Miss Mary, Rome, Ga.
Blackwell, Mrs. J. H., Trenton, N. J.
Bradford, Mrs. H. P., Cincinnati, O.
Candee, Mrs. W. L., Brooklyn.
Connette, Mrs. E., Nashville, Tenn.
Dimmock, Mrs. W. S., Council Bluffs. Ia.
Dunlop, Mrs. G. T., Washington, D. C.
Farson, Mrs. J., Chicago, Ill.
Gordon, Mrs. J. R., Charlotte, N. C.
Hardin, Miss Lucille, Rome, Ga.
Harris, Mrs. H. E., Birmingham, Ala.
Higgins, Mrs. D. W., Victoria, B. C.
Hunt, Mrs. W. T., New York.
Johnston, Mrs. W. J., New York.
Jones, Miss, Milwaukee.
Kelly, Mrs. W. F., Columbus, O.
McLean, Mrs. Thos. H., Indianapolis, Ind.
McNamara, Mrs. John W., Albany, N. Y.
Musser, Mrs. F. B., Harrisburg, Pa.
Nourse, Mrs., Chicago.
Payne, Mrs. H. C., Milwaukee.
Perrine, Mrs. Lewis, Trenton, N. J.
Pond, Mrs. A. E., New Haven, Conn.
Richardson, Mrs. H. C., Brooklyn.
Richardson, Mrs. W. J., Brooklyn.
Seely, Miss, New York.
Seguine, Miss, New York.
Short, Mrs. S. H., Cleveland, O.
Simmons, Mrs. E. A., New York.
Simons, Miss Susan, Buffalo, N. Y.
Smith, Mrs. E. A., Chicago.
Smith, Mrs. E. W., Philadelphia.
Stone, Mrs. E. K., Quincy, Ill.
Sullivan, Mrs. M. J., Chicago.
Turner, Mrs. A. M., Chicago.
Van Dorn, Mrs. W. T., Lincoln, Neb.
Windsor, Mrs. H. H., Chicago.
Wyman, Mrs. E. B., New York.

STREET RAILWAY MEN AT THE CONVENTION.

Adair, A. D., Atlanta, Ga.
Adams, J. T., Atlanta & Chattahoochee Railroad Co., Atlanta, Ga.
Adkins, Jas., Lindell Railway Co., St. Louis, Mo.
Aitken, Jno. N., Carbondale & Forest City Pass. Ry. Co., Carbondale, Pa.
Akarman, John N., Worcester, Con., St. Ry. Co., Worcester, Mass.
Allen, John C., Southern Electric Railway Co., St. Louis, Mo.
Armstrong, R. C., Atlanta, Ga.

Baker, R. F., Columbia Railroad Co., Washington, D. C.
Baldwin, Bert L., Cincinnati Street Railway Co., Cincinnati, O.
Bartlett, Chas. H., Manchester Street Railway Co., Manchester, N. H.
Baumhoff, Geo. W., Lindell Railway Co., St. Louis, Mo.
Beall, Robert, Metropolitan Railroad Co., Washington, D. C.
Bean, W. Worth, St. Joseph & Benton Harbor Electric Railway & Light Co., St. Joseph, Mich.
Belden, D. A., Aurora Street Railway Co., Aurora, Ill.
Barnes, C. E., Plymouth & Kingston St. Ry. Co., Plymouth, Mass.
Bickford, J. H., Salem, Mass.
Blackwell, J. H., Trenton, N. J.
Bradford, H. P., Cincinnati Incline Plane Railway Co., Cincinnati, O.
Bradley, Chas. G., Atlanta Consolidated Street Ry. Co., Atlanta, Ga.
Brang, C. A., Clearfield Traction Co., Phillipsburg, Pa.
Breed, E. S., Central Railway & Electric Co., New Britain, Conn.
Bridges, E., Wayne Street Railway Co., Dayton, O.
Brown, N. W. L., Consolidated Street Railway Co., Atlanta, Ga.
Bull, J. V., Easton Transit Co., Easton, Pa.
Burke, M F., Terre Haute Electric Railway Co., Terre Haute, Ind.

Cameron, W. H., Milwaukee Street Railway Co., Milwaukee, Wis.
Chidsey, A. D., Easton Transit Co., Easton, Pa.
Clark, C. S., L., L. & H., Street Railway Co., Lawrence, Mass.
Cole, Wm. W., West Side Railway Co., Elmira, New York.
Connette, E. G., Nashville Street Railway Co., Nashville, Tenn.
Convers, C. G., Hot Springs Street Railroad Co., Hot Springs, Ark.
Costello, Thos., Lowell & Suburban St. Ry. Co., Lowell, Mass.
Cougot, P., Orleans Railroad Co., New Orleans, La.
Coolahan, Edw. L., Montgomery St. Ry. Co., Montgomery, Ala.
Cuningham, G. C., Montreal Street Railway Co., Montreal, Can.
Cunningham, J. H., Gloucester Street Railway Co., Boston, Mass.

Davis, F. C., Miami Valley Railway Co., Piqua, O.
Davies Ernest H., Williamsport Pass. Ry. Co., Williamsport, Pa.
Dimmock, W. S., Omaha & Council Bluffs Railway & Bridge Co., Council Bluffs, Ia.
Dodge, G. A. W., New Haven Street Railway Co., New Haven, Conn.
Duncan, D. J., Lackawanna Valley Rapid Transit Co., Carbondale, Pa.
Dunlop, G. T., Wash'n & Georgetown R. R. Co., Washington, D. C.
Dyer D. B., Augusta Railway Co., Augusta, Ga.
Dyer, P. M., West Chicago Street Railroad Co., Chicago, Ill.

Edgar, H. T., Georgia Electric Light Co., Atlanta, Ga.
Elkins, W. L., Pittsburgh Traction Co., Pittsburgh, Pa.
Elliott, Thos., Consolidated Street Railway Co., Atlanta, Ga.
Eno, J. W., Wilkesbarre Traction Co., Wilkesbarre, Pa.
Evans, Clement A., Atlanta, Ga.
Evans, D. E., Gainesville Hall Co. St. R. R. Co., Gainesville, Ga.
Ewing, A. B., People's Railroad Co., St. Louis, Mo.
Ewing, F. W., Nashville Street Railway Co., Nashville, Tenn.

Fagan, J., Wilkesbarre Traction Co., Wilkesbarre, Pa.
Farson, John, Calumet Electric Street Railway Co., Chicago.
Ferguson, W. B., Worcester, Leicester & Spencer Street Railway Co., Worcester, Mass.
Ferguson, W. L., City Electric Railway Co., Decatur, Ill.
Fishbrome, Julian, Charleston, S. C.
Flesh, L. M., Miami Valley Railway Co., Piqua, O.
Flynn, C. E., Central Railway Co., Peoria, Ill.
Ford, D. J., Gloucester Street Railway Co., Gloucester, Mass.
Fuller, J. P., Consolidated Street Railway Company, Atlanta.

Garth, R. L., Chicago City Railway Co., Chicago, Ill.
Gillee, O. C., Columbia Railroad Co., Washington, D. C.
Glasier, A. F., Brockton Street Railway Co., Brockton, Mass.
Glenn, Walker, Consolidated Street Railway Co., Atlanta, Ga.
Glenn, W. F., Atlanta, Ga.
Glenn, W. H., Consolidated Street Railway Co., Atlanta, Ga.
Goff, R. S., Globe Street Railway Co., Fall River, Mass.
Goodrich, E. S., Hartford Street Railway Co., Hartford, Conn.
Graham, J., Wilkesbarre Traction Co., Wilkesbarre, Pa.
Green, Alfred, Rochester Railway Co., Rochester, N. Y.
Green, Chas., People's Railroad Co., St. Louis Mo.
Green, E. M., City Electric Railway Co., Rome, Ga.
Griffith, J. B., Hamilton Street Railway Co., Hamilton, Ont.

Hamilton, D. G., National Ry. Co., of St. Louis, Chicago, Ill.
Hammond, J. A., Atlanta Con. St. Ry. Co. Atlanta, Ga.
Hauck, C. A. B., Lehigh Traction Co., Hazleton, Pa.
Harper, T. J., Atlanta, Ga.
Harris, Geo. H., Birmingham, Ala.
Harrison, Russell B., Terre Haute St. Ry. Co., Terre Haute, Ind.
Harrington, W. E., Camden Horse Railroad Co., Camden, N. J.
Hendricksen, B. F., Bay City, Mich.
Henry, W. L., Brockton Street Railway Co., Brockton, Mass.
Herley, J. H., Macon & Indian Spring Railway Co., Macon, Ga.
Heyward, J. F., City & Suburban Railway Co., Baltimore, Md.
Hickson, F. A., Rochester, N. Y.
Higgins, D. W., Victoria, B. C.
Hippee, G. M., Des Moines City Railway Co., Des. Moines, Ia.
Hollenback, J. W., Wilkesbare Traction Co., Wilkesbarre, Pa.
Hollis, R. W., Atlanta, Ga.
Hood, W. S., Springfield Railway Co., Springfield, O.
Howard, W., Youngstown Street Railway Co., Youngstown, O.
Hull, J. H., Trenton, N. J.
Hunter, Frederic W., Nashville Traction Co., Nashville, Tenn.
Hunter, R. S., Springfield Railway Co., Springfield, O.
Hurt, C. D., Consolidated Street Railway Co., Atlanta, Ga.
Hurt, H. N., Consolidated Street Railway Co., Atlanta, Ga.
Hurt, Joel, Consolidated Street Railway Co., Atlanta, Ga.

Jackson, Henry, Consolidated Street Railway Co., Atlanta.
Jackson, Walter M., Augusta, Ga.
Jenkins, Thomas M., So. Covington & Cincinnati Street Railway Co., Covington, Ky.
Jewell, W. S., Consolidated Street Railway Co., Toledo, O.
Johnson, C. S., Consolidated Street Railway Co., Grand Rapids, Mich.
Johnson, J. W., Citizens' Street Railway Co., Kalamazoo, mich.
Jones, C. L., Milwaukee Street Railway Co., Milwaukee, Wis.
Jones, F. G., Citizens' Street Railroad Co., Memphis, Tenn.

King, J., City Electric Railway Co., Rome, Ga.
Knight, F., Easton Transit Co., Easton, Pa.
Kobusch, G. J., Citizens' Street Railway Co., Kalamazoo, Mich.
Koche, J., Cleveland City Railway Co., Cleveland, O.
Krotz, A. S., Springfield Railway Co., Springfield, O.

Landon, E. F., Dry Dock Railroad Co., New York.
Larendon, W. S., Atlanta & Chattahoochee River R. R. Co., Atlanta. Ga.
Lemon, W. H., Atlanta, Ga.
Levy, Lionel, Columbus, Ga.
Littell, H. M., New Orleans Traction Co, New Orleans, La.
Lott, Chas. D., Atlanta, Ga.
Lowe, Henry E., Macon, Ga.

McAdoo, M. R., Paterson Railway Co., Paterson, N. J.
McClary, J. B., Birmingham Ry. & Elec. Co., Birmingham, Ala.
McCrary, J. B., Consolidated Street Railway Co., Atlanta, Ga.
MacCredie, James, Albany Railway Co., Albany, New York.
McCulloch, Richard, Cass Ave. & Fair Grounds Ry., Co., St. Louis, Mo.
McCulloch, Robert, St. Louis Railroad Co., St. Louis, Mo.
McFarland, J. W., Electric Railway Co., Savannah, Ga.
McKinney, C. A., Houston City Street Railway Co., Houston, Tex.
McLaughlin, Jas. F., Philadelphia, Pa.
McLean, Thos. H., Citizens' Street Railroad Co., Indianapolis, Ind.
McNamara, John W., Albany Railway Co., Albany, N. Y.
McWater, G. S., Consolidated Street Railway Co., Atlanta, Ga.
Mahoney, D. J., People's Railroad Co., St. Louis, Mo.
Malochee, H. J, Orleans Railroad Co., New Orleans, La.
Maltby, Geo. E., Jamestown Street Railway Co., Jamestown, N. Y.
Markle, A., Lehigh Traction Co., Hazleton, Pa.
Marshall, J. Q., Col. Elec. St. Ry., Lt. & Pow. Co., Columbia, S. C.
Meixell, J. C., Wilkesbarre Traction Co., Wilkesbarre, Pa.
Meons, E. C., Pittsburg, Pa.
Miley, C. E., Springfield Ry. Co., Springfield, O.
Minary, T. J., Louisville Railway Co., Louisville, Ky.
Moore, Morton, Atlanta, Ga.
Moore, W. E., Augusta Railway Co., Augusta, Ga.
Morgan, J. W., Camden Gl'ster & Woodbury Ry. Co., Camden, N. J.
Morse, Geo. C., Taunton St. Ry. Co., Taunton, Mass.
Moses, Maurice, Natchez Street Railroad Co., Natchez, Miss.
Musser, F. B., East Harrisburg Railway Co., Harrisburg, Pa.

Nelson, S. L., Springfield, Railway Co., Springfield, O,
Nyhan J. T., Macon & Indian Springs Electric Ry Co., Macon, Ga.

Oliphant, John, Jr., Calumet Electric Street Ry., Chicago, Ill.
Orr, A. M., Miami Valley Railway Co., Piqua, O.

Parke, J. G., Washington & Georgetown R. R. Co., Washington, D.C.
Parker, B., Consolidated Street Railway Co., Atlanta, Ga.
Partridge, John N., Bklyn. City & Newtown R. R. Co., Brooklyn, N. Y.
Passailaigue, T. W., Enterprise Railroad Co., Charleston, S. C.
Patterson, W. H., Bloomington City Railway Co., Bloomington, Ill.
Payne, H. C., Milwaukee Street Railway Co., Milwaukee, Wis.
Penington, T. B., Chicago City Railway Co., Chicago, Ill.
Perrine, Lewis, Jr., Trenton Passenger Railway Co., Trenton, N. J.
Pierson, C. H., Union Depot Railroad Co., St. Louis, Mo.
Read, W. P., Salt Lake City Railroad Co., Salt Lake City, Utah.
Rhea, R. M., West End Street Railroad Co., Knoxville, Tenn.
Rice, F., Jr., Atlanta Consolidated Street Railway Co., Atlanta, Ga.
Richards, E. J., Passenger & Belt Railway Co., Lexington, Ky.
Ruick, H., Easton Transit Co., Easton, Pa.
Rugg, J. E., Citizens' Traction Co., Pittsburgh, Pa.
Rush, C. C., Bay Cities Consolidated Street Ry Co., Bay City, Mich.
Pond, A. E., Winchester Ave. Railroad Co., New Haven, Conn.
Pratt, Chas. B., Worcester Consolidated St Ry Co., Worcester, Mass.
Pratt, E. J., Southwest Missouri Electric Railway, Webb City, Mo.

Sanders, W. C., Consolidated Street Railway Co., Atlanta, Ga.
Sargeant, Chas. S., West End Street Railway Co., Boston, Mass.
Scott, R. F., Montgomery Street Railway Co., Montgomery, Ala.
Seddon, W. L., Atlanta Traction Co., Atlanta, Ga.
Seibel, G. F., Taunton Street Railway Co., Taunton, Mass.
Semmes, R., Mobile Street Railway Co., Mobile, Ala.
Sloan, Frank H., City & Surburban Railway Co., Baltimore, Md.
Shaffer, H., Seashore Electric Railway Co., Asbury Park, N. J.
Sharp, James, Atlanta, Ga.
Shaw, E. P., Winchester Avenue Railway Co., New Haven, Conn.
Sinclair, Wm. H., Galveston City Railroad Co., Galveston, Tex.
Smith, B. G., La Crosse Street Railroad Co., La Crosse, Wis.
Smith, C. H., Troy City Railway Co., Troy, N. Y.
Smith, E. A., Consolidated Car Heating Co., Chicago.
Smith, J. A., Cincinnati Inclined Plane Railway Co., Cincinnati, O.
Smith, W. A., Omaha Street Railway Co., Omaha, Neb.
Smith, W. Nelson, New Orleans Traction Co., New Orleans, La.
Somerset, H. J., Winnipeg Electric Railway Co., Winnipeg, Man.
Spalding, A. T., Atlanta, Ga.
Steele, A. B., Atlanta, Ga.
Stevens, E. H., Johnson City & Carnegie St. Ry, Johnson City, Tenn.
Stone, E. K., Jr., Quincy Horse Railway & Carrying Co., Quincy, Ill.
Stratton, Jas. A., Birmingham Ry. & Elec. Co., Birmingham, Ala.
Sullivan, P. F., Lowell & Suburban Street Railway Co., Lowell, Mass.
Sweetzer, D. H., Washington, D. C.

Thomas, T. J., West End Street Railroad Co., Knoxville, Tenn.
Thompson, A. C., Missouri Railroad Co., St. Louis, Mo.
Thompson, S. B., City & Suburban Railway Co., Baltimore, Md.
Titus, A. C., Newport Street Railway Co., Newport, R. I.
Tully, A. C., Metropolitan Street Railway Co., New York.
Turner, A. M., Hammond, Whiting & E. Chicago Railway Co., Hammond, Ind.
Tyson, L. D., West End Street Railway Co., Knoxville, Tenn.
Urie, J. K., Galveston City Railroad Co., Galveston, Tex.
Wason, Chas. W., Cleveland Electric Railway Co., Cleveland, O.
Wakefield, R. S., Queen City Railway Co., Dallas, Tex.
Wallace, Alfred, Columbia St. Ry. Lt. & Pow. Co., Columbia, S. C.
Wendell, S. S., Union Street Railway Co., New Bedford, Mass.
White, H. B., Calumet Electric Street Railway Co., Chicago, Ill.
Whitehead, W. E., Atlanta, Ga.
Wight, Chas. L., Toledo Consol. Street Railway Co., Toledo, O.
Williams, Chas., Manchester Street Railway Co., Manchester, N. H.
Williams, S. A., Rochester Ry. Co., Rochester, N, Y.
Williams, W. M., Easton Transit Co., Easton, Pa.
Wilson, J. H., Mobile, Ala.
Woodruff, E., Consolidated Street Ry. Co., Atlanta, Ga.
Woodruff, R. S., Trenton Pass R. R. Co., Trenton, N, J.
Wyman, C. D., Milwaukee Street Ry. Co., Milwaukee, Wis.

Others in Attendance.

Ackerman, P. C., American Electrical Works, Providence, R. I.
Allen, E. H., Allen Electric Supply Co., Philadelphia.
Allen, J. H., *Dixie*, Atlanta, Ga.
Allen, Wilbur B., Brownell Car Co., St. Louis, Mo.
Allison, J. W., St. Louis Register Co., St. Louis, Mo.
Angell, F. R., National Malleable Casting Co., Chicago.
Atkinson, J. M., Walker Manufacturing Co., Cleveland, O.

Bailey, T. P., General Electric Co., Chicago.
Baird, M. E., Eddy Electric Manufacturing Co., Windsor, Conn.
Baker, John W., E. T. Burrowes Co., Portland, Me.
Ball, G. M., American Iron Bolt Co., Cincinnati.
Ball, G. Mays, American Engineering Co., Atlanta, Ga.
Barr, B. N., Walker Manufacturing Co., Cleveland, O.
Baylis, R. N., Walker Manufacturing Co., Cleveland, O.
Batchelder, Mark D., The Mark D. Batchelder Co., Atlanta, Ga.
Barnard, G. A., Buckeye Engine Co., Salem, O.
Barrett, C. E., Hale & Kilburn Manufacturing Co., Philadelphia.
Baylor, A. K., General Electric Co., New York.
Beadle, Edward, Railway Register Manufacturing Co., New York.
Bennett, J. B., Street Railway Journal, Chicago.
Benton, John B., Sterling Supply & Manufacturing Co., New York.
Berg, Max A., Wallace Electric Co., Chicago.
Bibber, C. E., Cutter Electrical & Manufacturing Co., Boston.
Bone, W. H., Walker Manufacturing Co., Cleveland, O.
Bouchard, S. O., R. D. Nuttall Co., Allegheny City, Pa.
Boughton, W. E., The Johnson Co., Philadelphia, Pa.
Boyd, F. C., New Haven Car Register Co., New Haven, Conn.
Boyd, J., *Street Railway Review*, Chicago.
Bowman, S., Morris, Tasker & Co., Philadelphia.
Bradley, John S., New Haven Car Register Co., New Haven, Conn.
Bragg, F. A., Bragg Fender Co., Troy, N, Y.
Brill, John A., J. G. Brill Co., Philadelphia, Pa.
Brooks, Woodford, Georgia Equipment Co., Atlanta, Ga.
Brophy, W. B., Industrial Mutual Insurance Co., Boston.
Brown, Geo. S., Brown & King Supply Co., Atlanta, Ga.
Brown, R. S., Westinghouse Elec. & M'f'g. Co., Boston.
Bruner, H. C., Pontiac, Ill.
Bullen, D. R., General Electric Co., Atlanta, Ga.
Burke, J. W., E. T. Burrowes Co., Portland, Me.
Burns, Chas. F. Chas. F. Burns & Co., Rochester, N. Y.
Burter, O. A., Genett Air Brake Co., New York.
Bushe, J. F., Keller Printing Co., New York.
Bushnell, E. M., Bushnell Manufacturing Co., Easton, Pa.
Buss, E. W., Chapman Valve Manufacturing Co., Chicago, Ill.

Caldwell, Edward, Street Railway Journal, New York.
Candee, W. L., Okonite, Co., New York.
Card, J. F., Card Electric Co., Mansfield, O.
Card, Geo. H., Card Electric Co., Mansfield, O.
Carpenter, Reid, Card Electric Co., Mansfield, O.
Carson, J. H., Sterling Supply & Mfg. Co., New York.
Carry, E. F. Jr., Wells & French Co., Chicago.
Case, F. R., Hoopes & Townsend, Philadelphia.
Cicott, Frank X., Pettingell Andrews Co., Boston.
Clark, W. C., Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Clark, Charles S., Pennsylvania Steel Co., Boston, Mass.,
Clark, Wm. J., General Electric Co., New York.
Cobb, J. M., Fairbanks, Morse & Co., Chicago, Ill.
Colgate, Geo. L., The Geo. L. Colgate Co., New York.
Collins, G. Frederic, Valentine & Co., New York.
Collins, W. F., *Western Electrician*, Chicago, Ill.
Cornell, Chas. L., Electrical Engineer, Hamilton, O.
Corson, H. H., General Electric Co., Nashville, Tenn.
Cooagna, Chas. A., R. D. Nuttall Co., Cincinnati, O.
Cooke, Wm. E., Peckham Motor Truck & Wheel Co., New York.
Cooke, W. J., McGuire Manufacturing Co., Chicago, Ill.
Coolidge, Dan'l, The Johnson Co., Johnstown, Pa.
Crandall, W. M., United States Street Car Fender Co., New York.
Crane, W. F. D., H. W. Johns Manufacturing Co., New York.
Crawford, R. A., R. A. Crawford Manufacturing Co., Pittsburgh, Pa.
Crossman, T. C., Official Stenographer, Brooklyn, N. Y.
Crowley, H. J., General Electric Co., Philadelphia, Pa.
Curwin, M., J. G. Brill Co., Philadelphia, Pa.
Curwin, Sam., J. G. Brill Co., Philadelphia, Pa.
Cushing, Geo. A., Adams & Westlake Co., New York.

Deegan, Thomas, The Stirling Co., Chicago, Ill.
Dewitt, E. F., E. F. Dewitt & Co., Lansingburgh, N. Y.
Dorley, E. C., Rankin & Fritsch F'ndry & Mach. Co., St. Louis, Mo.
Douglass, W. A., *The Car*, Chicago.
Davis, H. M, *Electric Power*, New York.
Dean, D. B., Terre Haute Car Manufacturing Co., Chicago, Ill.
Degenhardt, F. E., Standard Underground Cable Co., Chicago, Ill.
Devon, Geo., Post-Glover Electric Co., Cincinnati, O.
Dick, Henry C., Flood & Conklin, Newark, N. J.
Dutton, W. A., Dorner & Dutton Mfg. Co., Cleveland, O.

Edwards, B. E., Maxwood Brake Shoe Co., La Crosse, Wis.
Ellicott, Jos. R., The General Agency Co., N. Y.
Ellis, L. J., Norfolk & Western Railroad, New York.
Englund, A. H., International Register Co., Chicago, Ill.
Entwisle, E. B., The Johnson Co., Johnstown, Pa.
Estep, F. A., R. D. Nuttall Co., Allegheny, Pa.
Evans, E. O., The Johnson Co., Boston, Mass.
Evans, H. C., The Johnson Co., New York.
Evans, H. F., Hartford Woven Wire Mattress Co., St. Louis, Mo.
Evans, O. C., The Johnson Co., Cincinnati.
Evans, Powell, Wm. Wharton, Jr., & Co., Philadelphia.
Ewing, Geo. C., Composite Brake Shoe Co., Boston, Mass.

Fairbrother, Howard, New York Leather Belting Co., New York.
Fairchild, C. B., Street Railway Journal, New York.
Faucett, E. V., Safety Clutch Brake Co., Philadelphia.
Field, C. J., New York City.
Field, John M., Berlin Iron Bridge Co., East Berlin, Conn.
Fisher, W. H., Hoopes Manufacturing Co., Springfield, O.
Flanders, C. T., Morris, Tasker & Co., Philadelphia, Pa.
Foster, Horatio A., *Electric Power*, New York.
Foster, H. H., Dreher Manufacturing Co, New York.
French, A., A. French Spring Co., Pittsburgh, Pa.
French, P. N., A. French Spring Co., Pittsburgh, Pa.,
Fuller, C. M., Davis Car Shade Co., Portland, Me.
Fuller, F. G., with W. R. Brixey, New York.

Gerleman, J. F., American Electrical M'fg. Co., St. Louis, Mo.
Gordon, J. R., Westinghouse Elec. & M'fg. Co., Charlotte, N. C.
Gould, W. H., H. W. Johns Mfg. Co., New York.
Graham, Geo. H., Chicago Electric Truck Co., Chicago, Ill.
Gray, L. E., Adams & Westlake Co., Chicago.
Greene, B. E., *Electricity*, New York.

Hanna, J. A., McGuire Manufacturing Co., Chicago, Ill.
Harding, H. Mc.L., Walker M'fg. Co., New York.
Harris, H. E., Harris Life Guard, Boston.
Harrison, H. H., White-Crosby Co., Baltimore, Md.
Haskell, G. M., J. G. Brill Co., Philadelphia.
Hastings, Jack, *Atlanta Journal*, Atlanta, Ga.
Hatch, E. B., Johns-Pratt Co., Hartford, Conn.
Haycox, W. E., Fulton Truck & Foundry Co., Mansfield, O.
Hazelton, Wm., 3rd., Fulton Truck & Foundry Co., New York.
Heinrichs, E. H., Westinghouse Electric & Mfg. Co., Pittsburgh.
Heinrichs, R. O., Weston Electrical Instrument Co., Newark, N. J.
Heulings, Wm., J. G. Brill Co., Philadelphia.
Hicks, L. P., Davis Car Shade Co., Portland, Me.
Higgins, E. E., New York.
Hills, E. P., Davis Car Shade Co., Portland, Me.
Hoagland, C. A., John H. Graham & Co., New York.
Hoch, Sydney, Central Electric Heating Co., New York.
Hoffman, Albert, Falk Manufacturing Co., Milwaukee, Wis.
Hoffman, G. E., General Electric Co., Schenectady.
Hopkins, J. M., Barney & Smith Car Co., Dayton, O.
Hough, A. H., Brush Electric Co., Cleveland, O.
Huntress, Franklin E., Laconia Car Co., Laconia, N. H.
Hurley, Thos. A., Holmes, Booth & Haydens, Waterbury, Conn.
Hunt, W. T., *Electrical Age*, New York.

Issertel, H. G., H. W. Johns Manufacturing Co., New York.

Jackson, J. H., Jackson & Sharp Co., Wilmington, Del.
Jeans, J. F., Thiel's Detective Service, St. Louis, Mo.
Jerome, R. S., Central Electric Heating Co., New York.
Jessop, Wm., Technical School, Atlanta, Ga.
Johnston, W. J., *The Electrical World*, New York.
Jones, B. J., Sargent & Lundy, Chicago, Ill.
Jones, F. W., Anniston Cordage Co., Anniston, Ala.

Kelley, W. M., Carnegie Steel Co., Atlanta, Ga.
Kenfield, H. J., *Street Railway Review*, Chicago, Ill.
Kennelly, J. J., Sterling Supply & Mfg. Co., New York.
Kern, F. P., Southern Iron & Equipment Co., Atlanta, Ga.
Kimball, F. M., General Electric Co., Boston.
King, C. K., Ohio Brass Co., Mansfield, O.
Kingston, Wm. W., The Johnson Co., Atlanta, Ga.
Kissam, George, Carleton & Kissam, New York.
Kittridge, A. M., Barney & Smith Car Co., Dayton, O.
Kling, P. M., St. Louis Car Co., St. Louis, Mo.
Kohler, Franklin W., Walker Mfg. Co., Chicago, Ill.
Kohler, G. A. E. Walker Mfg. Co., Chicago, Ill.
Kuhn, E. C., Flood & Conklin, Newark, N. J.

Lawless, E. J., American Car Co., New York.
Leach, P. F., Bass Foundry & Machine Works, Ft. Wayne, Ind.
Lederle, Frank, Lederle-Taylor Co., Atlanta, Ga.
Lee, Geo. S., Genett Air Brake Co., New York.
Leideneyer, Joseph, Dayton Manufacturing Co., Dayton, O.
Leideneyer, Peter, Dayton Manufacturing Co., Dayton, O.
Lenhart, W. M., Standard Electric Co., Chicago, Ill.
Lenz, Chas. O., Graham Equipment Co., Providence.
Leonhardt, Wm., Leonhardt Pneumatic Safety Car Fender Co., Baltimore, Md.
LeVan, W. B., Jr., Brooklyn Car Wood & Veneer Works, Bklyn., N.Y.
Lex, Frederic A., A. Whitney & Sons, Philadelphia.
Linburg, W. H., Linburg, Sickel & Co., Trenton, N. J.
Linn, J. B., Sperry Electric Railway Co., Cleveland, O.
Littlefield, A. S., The Johnson Co., Chicago, Ill.
Lockwood, Jos. E., Michigan Electric Co., Detroit, Mich.
Lodge, Geo., Electric Railway Switch, Philadelphia.
Loughridge, J. E., Quaker City Car Equipment Co., Philadelphia.
Louttit, W. S., Pullman's Palace Car Co., Chicago, Ill.
Lovejoy, J. R., General Electric Co., Schenectady, N. Y.
Lowry, R. J., Lowry Banking Co., Atlanta.
Luscomb, H., Johns-Pratt Co., Hartford, Conn.

McCardle, J. R., Linburg, Sickel & Co., Trenton, N. J.
McCarthy, J. G., W. E. & M. Co., Newark, N. J.
McElroy, J. F., Consolidated Heating Co., Albany, N. Y.
McGraw, James H., STREET RAILWAY JOURNAL, New York.
McLaren, P. M., Abendroth & Root Co., New York.
Magee, F. A., The E. S. Greeley & Co., New York.
Martin, T. C., *Electrical Engineer*, New York.
Mason, W. R., Mason Electric Co., Chicago, Ill.
Mayer, Chas. J., R. D. Nuttall Co., Philadelphia, Pa.
Meaker, J. W., Meaker Manufacturing Co., Chicago, Ill.
Meier, E. D., Heine Safety Boiler Co., St. Louis, Mo.
Mercur, R. J., New York Car Wheel Works, Buffalo, N. Y.
Myers, Louis E., Electrical Installation Co., Chicago, Ill.
Miles, Fred, Southern Electric Works, Atlanta, Ga.
Millen, Thos. C., with Chas. G. Smith, New York.
Mitchell, R. P., Robert Mitchell & Co., Montreal, Can.
Moan, A. J., Wadhams Oil & Grease Co,, Milwaukee, Wis.
Morgan, D. Goode, *Atlanta Journal*, Atlanta, Ga.
Morrell, Frank A., Lewis & Fowler M'f'g. Co., Brooklyn, N. Y.
Morse, Geo. C., Rochester Car Wheel Works, Rochester, N. Y.
Murphy, J. C., Berlin Iron Bridge Co., East Berlin, Conn.
Myers, Garson, Standard Railway Supply Company, Chicago, Ill.

Naeef, M. A., Civil Engineer, Atlanta, Ga.
Nagle, Jas. W., *The Car*, Philadelphia.
Nalley, W. J., Atlanta, Ga.
Nethercut, E. S., Paige Iron Works, Chicago, Ill.
Newbert, W. F., Griffin Wheel & Foundry Co., Chicago, Ill.
Newbold, —, Merchant & Co., Philadelphia.
Noble, D. C., A. French Spring Co., Pittsburgh, Pa.
Nourse, H. O., Scarritt Furniture Co., St. Louis, Mo.

Ostrom, John F., Pennsylvania Steel Co., Steelton, Pa.
Oswald, Edwin H., Benedict & Burnham Mfg. Co., New York.
Outcault, R. F., STREET RAILWAY JOURNAL, New York.

Packer, E., Hughes Fare Register Co., New York.
Paige, Alonzo W., Paige Iron Works, Chicago, Ill.
Palmer, H. E. W., Atlanta, Ga.
Pantaleoni, G., Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Parish, Chas. F., Atlanta, Ga.
Parshall, F. C., Georgia Electric Light Co., Atlanta, Pa.
Partridge, Jas., The Partridge Carbon Co., Sandusky, O.
Partridge, Arthur S., St. Louis, Mo.
Pearson, B., Fuel Economizer Co., New York.
Peckham, E., Peckham Motor Truck & Wheel Co., New York.
Peirce, Geo. W., Stamford, Conn.
Perkins, Thos. C., Mather Electric Co., Manchester, Conn.
Perry, J. W., H. W. Johns Manufacturing Co., Philadelphia, Pa.
Peterson, C. A., Thiel's Detective Service, St. Louis, Mo.
Pilson, B. F., Hale & Kilburn Manufacturing Co., Philadelphia, Pa.
Plumb, Harry H., Titusville, S. C.
Poe, George, with Levi Dederick, Albany, N. Y.
Pomeroy, Jos., Pomeroy & Fisher, New York.
Pool, H. W., STREET RAILWAY JOURNAL, New York.
Porter, Geo. F., National Electric Light Association, New York.
Potter, W. B., General Electric Co., Schenectady, N. Y.
Powers, E. L., *Electrical Industries*, Chicago, Ill.
Pratt, Mason D., Pennsylvania Steel Co., Steelton, Pa.
Pratt, Geo. E., Jackson & Sharp Co., Wilmington, Del.
Price, Chas. W., *Electrical Review*, New York.
Pugh, D. W., John Stephenson Co., New York.
Pugh, John S., Dorner & Dutton Manufacturing Co., New York.

Randall, F. C., J. G. Brill Co., Chicago.
Ransom, H. N., Consolidated Car Heating Co., Albany, N. Y.
Record, E. A., Vacuum Oil Co., Boston, Mass.
Regenstein, J., Jr., Georgia Equipment Co., Atlanta, Ga.
Rein, Gustav, St. Louis Register Co., St. Louis, Mo.
Reinoehl, Chas. W., Pennsylvania Steel Co., Steelton, Pa.
Rhotehamel, J. H., Columbia Incandescent Lamp Co., St. Louis, Mo.
Richards, Wm. G., Water Works, Atlanta, Ga.
Richardson, H. C., Brooklyn, N. Y.
Richardson, W. J., Secretary, Brooklyn, N. Y.
Rittenhouse, N. M., Leonhardt Car Fender Co., Baltimore, Md.
Roane, A. L., Atlanta, Ga.
Robinson, W. Robinson Electric Truck & Supply Co., Boston, Mass.
Rosenburg, J. S., Easton Transit Co., Easton, Pa.
Rosenthal, Geo., General Electric Co., St. Louis, Mo.
Rogers, L. H., Sperry Electric Railway Co., Cleveland, O.
Rogers, Frank A., Fulton Truck & Foundry Co., Cleveland, O.
Ross, E. L., Chapman Valve Mfg. Co., Indian Orchard, Mass.
Russell, F. D., Rochester Car Wheel Works, Rochester, N. Y.
Rutherford, J. A., Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Scarritt, S. G., Scarritt Furniture Co., St. Louis, Mo.
Schieren, Chas. A., Jr., Chas. A. Schieren & Co., New York.
Scrugham, G. R., Creaghead Engineering Co., Cincinnati, O.
Seguine, W. P., Frost Veneer Seating Co., New York.
Shainwald, J. C., Standard Paint Co., New York.
Short, Sidney H., Walker Manufacturing Co., Cleveland, O.
Silver, Wm. S., W. S. Silver & Co., New York.
Simmons, Edw. A., *Railroad Gazette*, New York.
Skinner, H. E., Chas. Munson Belting Co., Chicago, Ill.
Smith, Edmund N., Pennsylvania Steel Co , Steelton, Pa.
Stadelman, W. A., Niles Tool Works Co., Pittsburgh, Pa.
Stanwood, F. H., Stanwood Manufacturing Co., Chicago, Ill.
Stedman, J. H., Rochester, New York.
Stewart, B. F., Westinghouse Elec. & Mfg. Co., Chicago, Ill.
Stewart, R. D., Young Lock Nut Co., New York.
Stitch, Geo. F., Western Telephone Construction Co., Chicago, Ill.
St. John, Wm., Safety Car Heating & Lighting Co., New York City.
Streeter, G. A., Wadhams Oil & Grease Co., Milwaukee, Wis.
Stump, C. E., *Street Railway Gazette*, New York.
Sullivan, M. J., *The Electrical World*, Chicago, Ill.

Taft, Benjamin, Industrial Mutual Ins. Co., Boston, Mass.
Taylor, John, Taylor Electric Truck Co., Troy, N. Y.
Taylor, J. W., Stilwell-Bierce & Smith-Vale Co., Atlanta, Ga.
Taylor, Wm. H., Pratt & Letchworth, Buffalo, N. Y.
Taylor, W. H., STREET RAILWAY JOURNAL, Chicago, Ill.
Thomas, Eugene, Johnson Co., Atlanta, Ga.
Thomas, R. L., National Lock Washer Co., Newark, N. J.
Tolles, C. L., Jewell Belting Co., Hartford, Conn.
Tompkins, D. A., Westinghouse Electric & M'fg Co., Charlotte, N. C.
Trawick, S. W., General Electric Co., Atlanta, Ga.
Tuckerman, H. G., *Electrical Review*, Boston, Mass.

Vail, J. H., Electrical & Mechanical Eng. & Trading Co., New York.
Vandegrift, F. B., *The Car*, Philadelphia.
Van Dorn, W. T., Fitzgerald-Van Dorn Co., Lincoln, Neb.
Van Fleet, C. W., New York Electrical Works, New York.
Vincent, C. R., The Ball & Wood Co., New York.
Vosburgh, A. C., New Process Raw Hide Co., Syracuse, N. Y.

Wadhams, E., Milwaukee, Wis.
Wadhams, G. A., Wadhams Oil & Grease Co., Milwaukee, Wis.
Wagstaff, H. C., *Atlanta Journal*, Atlanta, Ga.
Wessels, E. J., Genett Air Brake Co., New York.
Whipp, Geo. S., Lewis & Fowler Co., Brooklyn, N. Y.
White, T. C., Central Union Brass Co., St. Louis, Mo.
Whitehead, E. J., Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Wick, S. J., Electric Railway Equipment Co., Cincinnati, O.
Wightman, H. J., H. J. Wightman & Co., Scranton, Pa.
Wilkinson, W. H., Peckham Motor Truck & Wheel Co., Kingston, N.Y.
Willcox, Chas. H., The Lane & Bodley Co., Cincinnati, O.
Williams, C. H., American Engineering Co., Atlanta, Ga.
Willis, H. C., Washburn & Moen Manufacturing Co., New York.
Windsor, H. H., *Street Railway Review*, Chicago, Ill.
Winser, Henry J., Vernon Fare Register, New York.
Wirt, H. C., General Electric Co., Schenectady, N. Y.
Wood, Chas. N., R. D. Nuttall Co., Boston.
Woodward, C. F., Wakefield & Stoneham St. Ry., Wakefield, Mass.
Woodward, J. H., Benedict & Burnham M'f'g. Co., New York.
Wyman, Edward B., Central Electric Heating Co., New York.
Wurts, Alexander Jay, Westinghouse Elec. & M'f,g. Co., Pittsburgh.

Yardley, John H., Philadelphia Car Wheel Co., Phila., Pa.

Zimmermann, W. F., Westinghouse Electric & Mfg. Co., New York.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

The Convention at Atlanta was successful in every material respect. "The first Southern city to receive the Association" opened its arms with a cordiality and heartiness of welcome most gratifying to all its guests. The hotel accommodations—and all know to how great an extent the success of a convention depends upon these—were ample and satisfactory to a degree surprising to those who feared that Atlanta was too small a city to properly take care of so large a convention. The magnitude of these street railway conventions, and the business and social standing of the representatives in attendance, is now so generally understood, that great preparations are made, not only to provide sufficiently for physical comfort and well being, but to see that social entertainment is not wanting. The privacy of a city's clubs is guarded with a care almost as jealous as that of its homes. It was, therefore, a graceful and not undeserved compliment to the Association, that its members were freely welcomed to the privileges of Atlanta's most exclusive clubs, and that a special club reception even should be tendered to those who, while entire strangers to Atlanta's ladies and gentlemen, were yet recognized as possessing, as a body, all the attributes which go to form the best society in all sections of the country.

* * * * *

We speak strongly of the social life at Atlanta, not only because it formed so enjoyable a feature of the week, but because it almost interfered in some degree with the real business of the Convention. The pressure upon the time of the Association, particularly in these later years, has become too great to permit sufficiently careful consideration and discussion of the many valuable papers which represent the best thought and effort of the members. Five papers out of eleven presented at Atlanta were read by title only, and but three of these were discussed to any extent by the delegates. This is wrong, and we are glad, indeed, that the Executive Committee has taken steps to correct this tendency to haste by providing for a four days' session instead of three. It is unfortunate that the remedy cannot be officially applied at next year's Convention. Would it not be possible—since the Association is shown by a test vote to be unanimously in favor of a four days' session—for the manufacturers to have their exhibits ready for inspection at Montreal on Tuesday instead of Wednesday, and for the delegates to reach the convention city next year one day earlier than usual, so as to perform one of the most important parts of the convention function, the investigation of new apparatus?

* * * * *

The exhibition of apparatus and material at Atlanta was exceptionally fine, and there is no doubt that the time and effort annually given to this branch of the convention work is well spent, and brings about a closer understanding and harmony of interests between the manufacturers and the street railway operators, than could possibly be achieved in any other way. The Exposition Buildings were large enough to permit the most lavish use of space, and the display of apparatus was attended, not only by the street railway men themselves, but by large numbers of Atlanta citizens, attracted by the novel and gaily painted cars sent down by the manufacturers for operation on the city street railway lines, and by the glowing and highly eulogistic accounts of the Convention given in all the Atlanta papers.

* * * * *

One of the most high-minded and prominent street railway men in the country has been chosen by the Association as its next president. Mr. Joel Hurt, president of the Atlanta Consolidated Street Railway Company, is too well known to require extended mention here. Those who were at Atlanta, found that, in his case, a "prophet has honor in his own country," for no one, in that enterprising city of the South, stands higher than he in the confidence and respect of his fellow citizens. Mr. W. Worth Bean, the newly elected first vice-president, enjoys the almost unique distinction of having attended every one of the thirteen conventions of the Association. His election is a well deserved recognition of his faithfulness and devoted services. The selection of Montreal as the Convention City for 1895, was, on the whole, a wise action, notwithstanding the fear, which is probably quite groundless, that trouble will be experienced in getting the exhibits through the Custom House. The Association is *American*, not National, and in no way can this fact be more clearly enunciated than by the choice of a Convention city outside the United States; and when, as it happens, this city is one of the most enterprising, progressive and hospitable on the American continent, no fault can be found with a determination to ignore precedent, and to strike out into new fields.

* * * * *

It is difficult to speak of the retiring president of the Association without a feeling of regret that a personality so fine and so unusual cannot come more intimately into our daily lives. Mr. Payne is a man of broad human sympathies, of wide culture and experience, and of so kindly and generous a nature that respect for his achievements in the world of railroad finance and management is lost in what almost dares to be a warm personal affection. It has been the privilege of the Association to honor him with its highest office. He has given care and attention

to its interests to a degree hardly to be expected from one whose burdens and responsibilities in other fields are so serious. In leaving the presidency of the Association he takes with him the knowledge that no "past president" will be held in more genuine honor and esteem than he who has so wholly won our hearts in this—the twelfth year of the Association's life.

The Papers and Committee Reports prepared for the Association were of important practical interest and these, together with the president's address and certain important communications received from absent members, will furnish material for serious thought and careful experimental work during the coming year. The address of President Payne dealt briefly with the effects of the financial depression, the elevation of the street railway business to a higher plane by the general adoption of electricity, difficulties in dealing with adverse legislation, the overvaluation of franchises, and the insurance problem—all matters of anxious consideration among conscientious managers. Well deserved tributes were paid to the memories of William Richardson and William J. Stephenson, who have done so much for the Association, and whose loss is keenly felt by its members.

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Mr. Dyer's report on "The Best Methods of Treating Accidents" was a clear and valuable description of the system adopted by the prominent Chicago companies to ascertain the real responsibility for accidents and to effect settlements as promptly as possible without costly litigation. The brief discussion following the report might well have been heard by the public at large, and the newspaper editors of the country in particular, for the speakers expressed so keen an appreciation of their duties and responsibilities to those injured by their cars that the current opinion about the heartlessness of corporations would surely be revised in the interests of justice. Street railway companies almost invariably bear the expense of temporary medical care and transportation, without regard to their corporate liability for the accident; they seek to avoid damage suits by offering a prompt settlement, thereby saving to themselves the expense and annoyance of protracted litigation, and to the claimants the exactions of "shyster lawyers," who are only too anxious to take up all cases, just or unjust, against corporations; and, finally, they often donate to the injured in simple charity what could not, by any process of law or reason, be obtained from them otherwise.

* * * * *

The report on "A Standard Form of Street Railway Accounts" was in some respects admirable, in others disappointing. The subdivision of accounts recommended by the committee has evidently been thought out with care on the broad lines laid down by railroad practice, but we believe that Mr. Bettis has missed the true function of railway accounting in laying so much stress upon its usefulness to bankers, brokers, stockholders and directors. The real purpose of systematic accounting is the continuous education of *managers*. It is the manager—not the stockholder or director, except in a far more general way—who wants to know whether or not he is operating his power house as cheaply per car mile as his neighbor is doing elsewhere, if his repairs of roadbed or cars are above the average, or if he is making a saving in special departments from year to year. His stockholders look to him for broad results—for net earnings, in short, as Mr. Bettis well says—but what is not clearly brought out is that, in order to produce these results, the manager must himself classify his expenditures so as to know how to effect economies in every detail of his business. Street railroad accounting, therefore, is by no means superfluous, and its importance should not be depreciated in the slightest degree. As to Mr. Bettis' subdivision of operating expenses, our chief criticism would be that he puts too many principal accounts upon his report blanks. For example, the ten headings which he gives under "Transportation Expenses" are valuable as ledger accounts and for the detailed information of managers, but for reports to directors they may all be grouped under two, or at the most three, principal headings, such as "Operation of Power Station," "Operation of Rolling Stock," and "Miscellaneous," the latter covering, perhaps, "Wrecking," and one or two other charges not easily classified. Other changes in nomenclature and arrangement might be suggested, and we doubt if the classification can be considered final, or will be generally adopted by the members of the Association. Nevertheless, Mr. Bettis' work in this direction is worthy of commendation, and we shall hope to see a steady advance towards uniformity in street railway accounting, to the end that those who are directly responsible for the profitable operation of their properties may be guided by statistical wisdom of real and not of doubtful value.

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There is no question that T rail construction is, in important respects, superior to any other from a street railway point of view, hardly excepting even the long time favorite center bearing rail, whose usefulness is lessened by the necessity of using wooden stringers in the older construction, and by the side strains produced by heavy teaming in the more recent girder construction. The real question has been, therefore, whether or not it is possible in individual cases to get permission to use T rails. The excellent methods described by the special committee appointed at the last Convention and by Mr. Harrison, seem to point to an affirmative answer to this question, although much missionary work will doubtless have to be done before sceptical city fathers can be convinced that there is any rail construction half so good as the ideal (*sic*) side bearing sections.

* * * * *

Mr. Foster's paper on "City and Suburban Electric Railways" contained many valuable and suggestive hints as to the possibilities and limitations of different classes of street railway work. Mr. McCulloch's paper on "Mail, Express and Freight Service for Street Railway Cars" was a revelation to us, and we have no doubt to many street railway operators also, of what has been accomplished in this branch of profit making, hitherto considered an almost unimportant side issue. Mr. McCulloch's suggestions are practical and absolutely sound, and his paper has, in addition, a distinct literary merit not always found in technical dissertations. Mr. Beckley's paper on "Transfers on Street Railways" deals with a subject of great importance, and one in which the Rochester Railway Company has taken advanced ground.

The Special Papers presented at Atlanta were five in number, viz., "Brake Shoes," by Powell Evans and D. F. Henry; "Power Brakes *vs.* Hand Brakes," by E. J.

Wessels; "The Use of the Booster on Electric Railway Circuits," by J. H. Vail and S. H. Wynkoop; "The Destructive Arcing of 500 Volt Fuses," by W. E. Harrington; and "Taxation," by Allen R. Foote. It was unfortunate that the time of the Association did not permit a thorough discussion of these papers, as there were a number of very important facts brought out in them, and the experience of others would undoubtedly have proved of great value.

* * * * *

The first two papers mentioned treat upon a subject to which very little attention has been given in previous conventions, though the subject of braking is a most important one. The authors of the first paper mentioned echo a popular sentiment in advocating the standardizing of brake shoes, for, however difficult and even inadvisable it might be to attempt to standardize many portions of a street railway company's rolling stock, wheels and brake shoes seem certainly adapted for standardization. A company using several different types of trucks has often as many different styles of brake shoes, a number of each of which must be kept in stock.

The energy of a car can be overcome by the brake shoes in two ways; first, through the generation of heat by friction, and second, by grinding off the metal in either shoe or wheel or both, which also produces heat. As the shoe is cheaper than the wheel it seems better to provide a shoe which will itself wear out, rather than one which will wear the wheel out. According to Mr. Evans, it is generally conceded that the use of chilled iron or steel brake shoes is not advisable. Practice in many cases seems to be tending towards some type of composite shoe. Conditions of grades, track, etc, vary so widely, however, that we are not disposed to agree with Mr. Evans' statement that the best material for shoes on one road would be best for all. The Master Car Builders' Association, to whose 1893 proceedings reference was made in the paper, continued at its last (1894) annual meeting, its committee on the subject of brake shoes. Very valuable work, it was reported, is being performed under the direction of this committee, although the results have not yet been announced. Seven steam railway companies are carrying on a series of tests to determine the value of different materials for brake shoes under different conditions, and a series of experiments are also being conducted in the same line in the laboratory of the Westinghouse Air Brake Company under the direction of the Association's committee. It should be borne in mind, however, that the conditions on steam railways differ so greatly from those met on street railways that the results of these researches cannot probably be made exactly applicable to street railway companies. The work of a committee therefore, which is to be appointed by the American Street Railway Association will in no respect traverse ground covered by other associations. We regret that in neither of the papers the subject of the effect of braking or of different forms of brake shoes on the life of wheels was taken up. The first paper gave some figures from steam railway practice on this subject, but the wear on street railway wheels from the application of brake shoes, owing to the large amount of grit on the wheels, must make these figures almost useless as a criterion in street railway practice. We would also be very glad to have had some facts presented on the effect of the kind of soil in which the track is laid on the life of the brake shoes and wheels.

Recognition of the need of power brakes on heavy electric or cable cars, especially where there are heavy grades, or where high speed is maintained, seems to be general As Mr. Wessels has well pointed out, many disastrous accidents might have been avoided by the use of a more powerful brake than could be applied by hand. The brake being under more ready control of the operator, we should imagine that the life of wheels might be quite as long under cars equipped with power brakes as with hand brakes, and we would have been glad to have seen some figures on this subject.

* * * * *

On long lines the question of keeping up the voltage at the ends of the line is an important point. A limit will soon be reached where the ordinary feeder system cannot be relied upon, as, with a given percentage loss in the lines, the size of the feeder increases as the square of the distance. In a number of cities an extra positive bus bar is used to keep up the voltage on long lines. This is kept at a higher potential than the main bus bar, and to it any feeder or generator can be connected. The paper by Messrs. Vail and Wynkoop relates to the use of the "booster" system employed to a considerable extent in electric lighting plants. It consists in the use of an additional generator, which is operated from the main circuit, and which raises the voltage of the feeder at the station end to an amount equal to that required at the farther end. The system is, in some respects, superior to that of auxiliary bus bars above referred to. The Poughkeepsie City & Wappingers Falls Railway, the first, we believe, to employ boosters, is described in this issue of the Journal, and the results secured on that road will be watched with interest.

* * * * *

Of the other two special papers, that of Mr. Harrington is interesting, as showing that long fuses do not necessarily guard against short circuits any better than short ones. The economic absurdity of our taxation laws is again described by Allan R. Foote. Street railway companies, like other corporations, as shown in Mr. Foote's paper, pay a double tax, once on their property, and again on the certificates of their stock. Most street railway companies are also taxed over and over again, under the guise of car licenses, compensation for the use of streets, etc. We have always maintained that, as a matter of economic policy, the most liberal treatment of surface transportation systems will be found to be identical with the prosperity of the communities in which they operate, and Mr. Foote's treatises on this subject show that, from the standpoint of justice as well, street railway companies should be relieved of many of the burdens now imposed upon them.

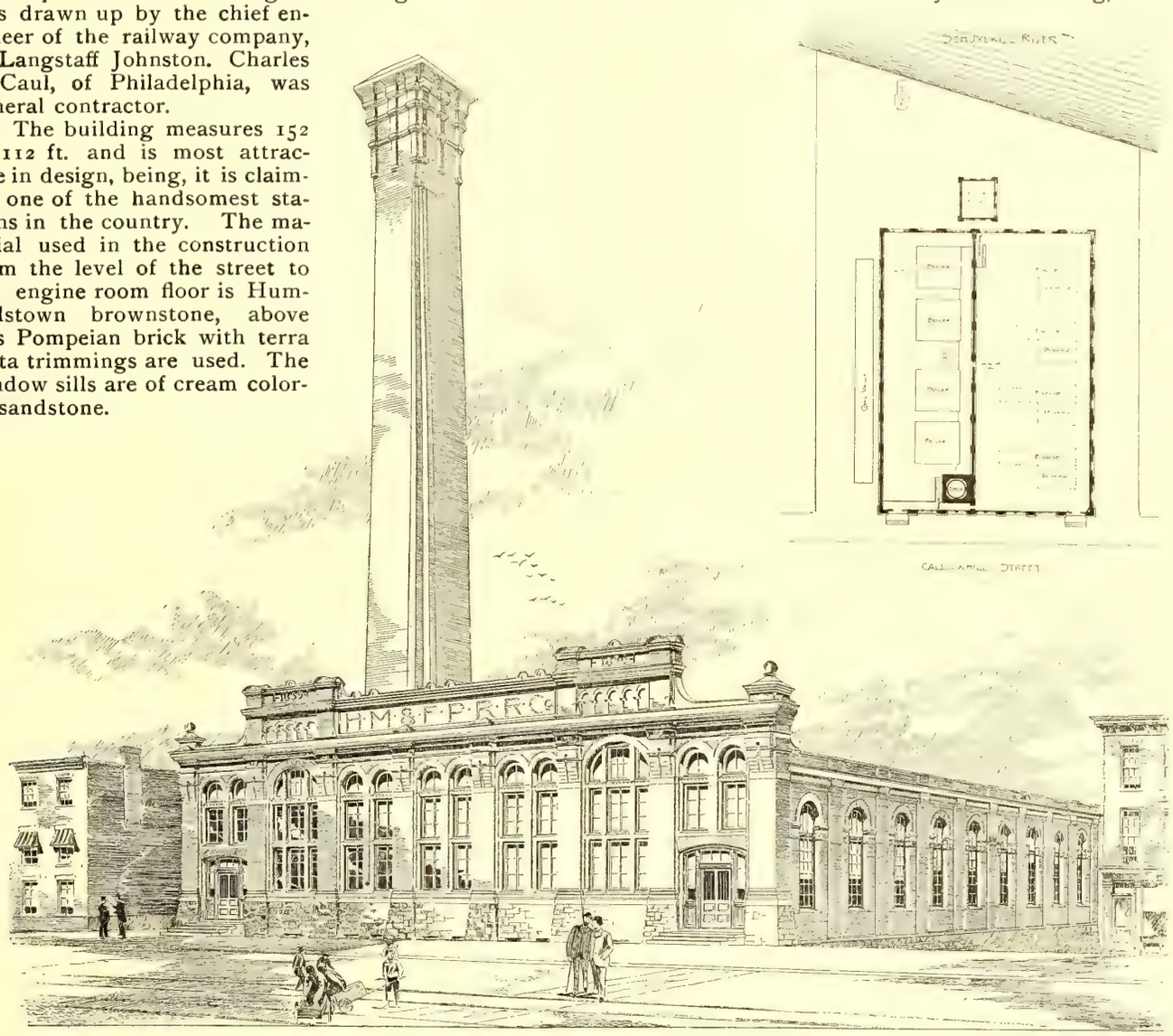
Our Souvenir.

We confess that we were, even at first, a little proud of the "Souvenir," which we issued last month, in commemoration of the tenth anniversary of our own birth, and the twelfth anniversary of that of the Street Railway Association, but we were hardly prepared for the storm of congratulations upon our "magnificent special number" which greeted us on every hand at the Convention, nor for the kindly and generous words of appreciation, which have come to us through the columns of our contemporaries in the electrical and street railway field. It is with sincere gratitude, that we say to our friends, and to the Executive Committee of the American Street Railway Association, which has seen fit to honor our Editor with special and favorable mention, that their kindness will never be forgotten.

The Power Station of the Hestonville, Mantua & Fairmount Passenger Railway Company.

A full description of the electric railway system of the Hestonville, Mantua & Fairmount Passenger Railway was published in our last issue, together with several sections of the power station of that company located on the Schuylkill River at 25th and Callowhill Streets. We present on this page an engraving showing the completed power station. The general design of the station was drawn up by the chief engineer of the railway company, A. Langstaff Johnston. Charles McCaul, of Philadelphia, was general contractor.

The building measures 152 × 112 ft. and is most attractive in design, being, it is claimed, one of the handsomest stations in the country. The material used in the construction from the level of the street to the engine room floor is Hummelstown brownstone, above this Pompeian brick with terra cotta trimmings are used. The window sills are of cream colored sandstone.



POWER STATION OF THE HESTONVILLE, MANTUA & FAIRMOUNT PASSENGER RAILWAY CO.—PHILADELPHIA.

As mentioned in our last issue, considerable difficulty was experienced in the construction of the foundation of the building and the solution of this problem required a great deal of study. The machinery which is now being installed will consist of four Greene tandem compound, condensing engines of 500 H. P. each, direct connected to General Electric multipolar generators of 400 K. W. each.

The company hopes to commence operations electrically by December 1.

Rapid Transit in Europe.

At a meeting of the Rapid Transit Commission, of New York, held October 9, W. B. Parsons, chief engineer of the commission, presented a report upon what he saw of European rapid transit systems during the summer visit which he paid to London, Glasgow, Liverpool and Paris. This report included many interesting details of the lines visited. In regard to cost of operation, the report gives the following figures for the City & South London underground electric road, and the Liverpool overhead electric road, covering the half year up to June 30, 1894.

City & South London: Train miles, 8,769 per week; expenses, eight and a half cents per train mile. Each locomotive weighs thirteen and a half gross tons, and draws three thirty-two foot cars at a speed of eleven and a half miles per hour, including stops.

Liverpool elevated electric railway: A total of 265,349 train miles had been run at an expense of less than six cents. The cars are each forty-five feet long, and seat sixteen first class passengers and forty-one of the second class. The trains are made up of two cars each.

Then follows a full description of these railways as well as of the Glasgow rapid transit system and a new electric underground road to be installed in Paris. Of this Mr. Parsons speaks in the highest terms.

Mr. Parsons believes in an underground electric railway for New York, and states that the advice and experience of foreign engineers lean toward keeping the rail level as close to the surface as possible, and that excavating from the surface is cheaper and safer than tunneling, but, if conditions demand, a deep tunnel can be constructed, for which the circular form is best. He also believes that the work can be carried on through a busy street without endangering the houses and without seriously impeding travel.

Two Passengers for One Cent.

A street railway war between the lines of Savannah, Ga., has been in progress all summer and fares have gradually been reduced until, October 15, one of the lines announced two rides for one cent. It is said that the rival company will meet the cut.

The Street Railway System of Roanoke, Va.

Roanoke is a beautiful city of approximately 20,000 inhabitants, situated in the southwestern part of Virginia between the Blue Ridge and Allegheny Mountains and at the junction of the Norfolk & Western, Shenandoah Valley and Roanoke Southern Railways. It has acquired the title of the "Magic City" of the South, from its rapid growth from only 400 inhabitants in 1882 to 20,000 in 1892. As Roanoke had been making advancing strides in other directions, it was necessary, in order to keep up with the procession of progress, that a change be made in the street railway system, and electricity as a motive power be introduced. Up to April 1, 1892, the street railway system of Roanoke consisted of two steam dummy lines running into the suburban towns of Salem and Vinton, the former eight and a half miles distant, the latter two and a half miles, together with about two miles of track in the city proper, with mules as a propelling power. The rolling stock consisted of two steam dummies, five Brill cars and four Stephenson ten foot body cars. These last were some of Stephenson's first make.

On February 1, 1892, the old company was bought out by a new local corporation with a capital stock of $300,000, composed of leading capitalists of the city, and officered as follows: S. W. Jamison, president; Jos. T. Engleby, vice-president; treasurer, Geo. C. McCahan; secretary. Board of directors: Payton L. Terry, Henry S. Trout, S. W. Jamison, Jos. T. Engleby, T. T. Fishburne, James R. Terry and John Sexton.

This new company secured the services of W. Frank Carr, formerly engineer in charge of construction of the large Minneapolis & St. Paul system, as its general manager and engineer. Mr. Carr was given full authority to go ahead and remodel and extend the system. Contracts were immediately let for power plant and rolling stock, the General Electric Company furnishing the station equipment, E. P. Hampson & Company the steam plant, Westinghouse Electric & Manufacturing Company the motor equipment, and the Gilbert Car Company the cars.

On May 12, 1892, the same body of capitalists purchased the plant and franchise of the Roanoke Electric Light & Power Company, capitalized at $55,000, and officered as follows: Jos. T. Engleby, president; S. W. Jamison, vice-president and treasurer; Geo. C. McCahan secretary, with W. Frank Carr as manager and engineer. This purchase facilitated matters for the street railway company by providing it a power house for its machinery.

On June 17, 1892, electricity was first introduced on the Crystal Spring line. June 18, 1892, was "Decennial Day," and on that day the two electric cars carried on the Crystal Spring line 6,997 passengers without a hitch of any kind or an accident to person or property of any kind.



FIG. 2.—T RAIL IN BRICK PAVING—ROANOKE.

By the spring of 1893 the business of the electric light department had increased so considerably, it was decided to build a new power house in the rear of the car house on Earnest Avenue. The contract for the building was let in June and by September 30 was ready for occupancy. Foundations for engines and boilers were built, all outside wiring arranged, switchboard erected and inside wiring ready, the street railway machinery and switchboard appliances were shifted between 10 P. M. and 7 A. M. one night, and cars running without a hitch. The

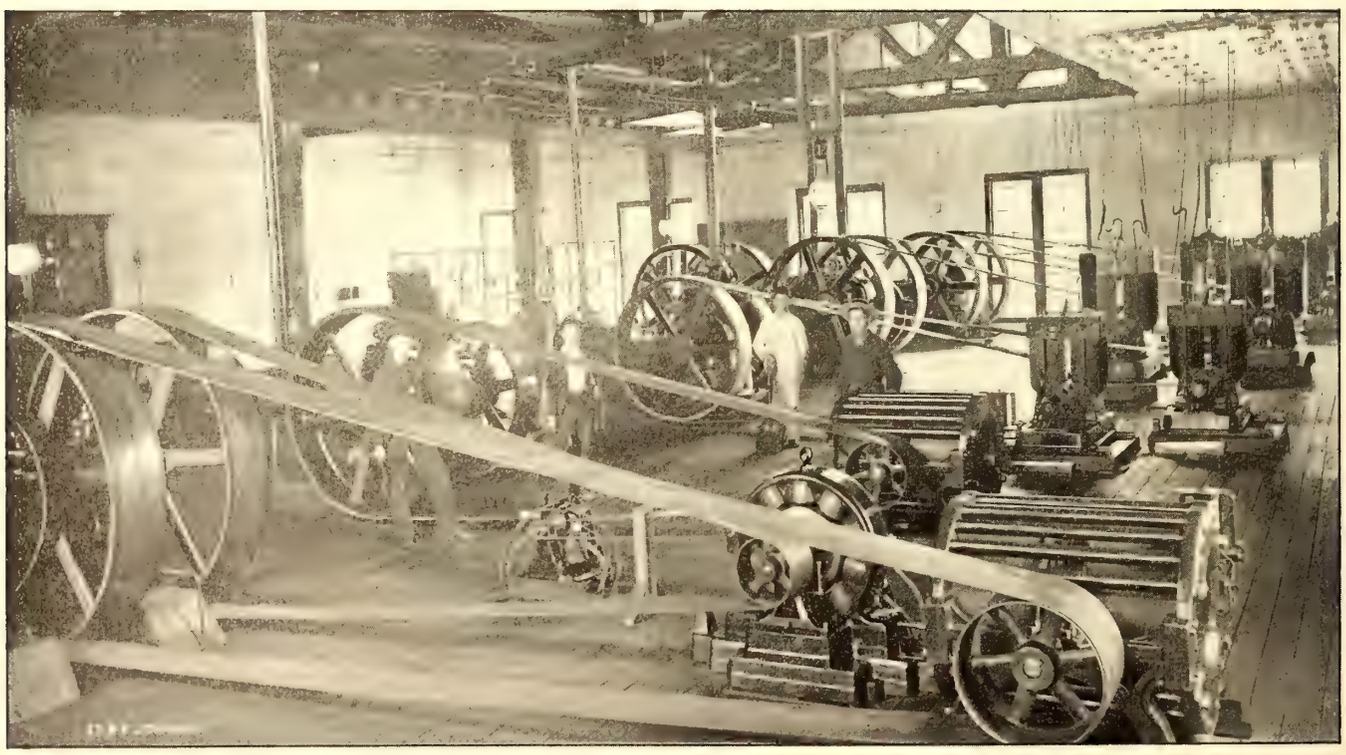


FIG. 1.—INTERIOR OF POWER STATION—ROANOKE STREET RAILWAY CO.

shifting of the electric light plant was somewhat slower, as all outside wiring had to be brought to a new station, and shifting made so as not to interfere with the full twenty-four hours a day run. By December 1, 1893, the new station was complete and in running order. By this change the engine power was increased from 535 H. P. to 1,100 H. P., thereby providing plenty of relay power. The plant has had very few shutdowns, and those due to trolley wires breaking as a rule.

The total damage claims paid by the company, from April 1, 1892 to July 1, 1894, has not exceeded $300. No injury to person is recorded.

All plans and estimates of entire plants of street railway and electric light companies, even to the minutest detail, were made by General Manager and Engineer Carr, and construction of same personally supervised by him. The setting and erecting of all engines, generators and boilers was under the personal charge of W. J. Updyke, chief engineer of power plant.



FIG. 3.—EXTERIOR OF POWER STATION—ROANOKE STREET RAILWAY CO.

The power station measures 95 × 125 ft. and is of brick with three stacks 48 ins. in diameter and 70 ft. high. The engine house is 125 × 55 ft., and contains a 250 H. P. Armington & Sims engine for railway work, with cylinder dimensions 21½ × 18 ins., and for lighting work two 200 H. P. McIntosh & Seymour engines, two 90 H. P. Armington & Sims engines and two 125 H. P. Buckeye engines. The boilers are five in number, two 150 H. P., two 125 H. P. and one 150 H. P., the latter three being of the National tubular type. Stilwell & Bierce open feedwater heaters and Knowles pumps are used.

The water supply is from a private well sixty feet in depth, the city pressure being relied upon for fire protection. For all work the company uses about 1,000 gals. per hour, pumped by a steam pump to a tank directly above the well, giving thirty feet head of water. Vacuum oil is used throughout for lubricating purposes.

The railway generators are two in number, of the 100 K. W. General Electric bipolar type, and are driven from the engines by Graton & Knight sixteen inch belts. Room is provided for adding four 100 K. W. machines. On the switchboards, which were designed by W. F. Carr, each line is provided with an ammeter and fuse switch. The line of the company consists of twenty-two miles of single track with a maximum grade of 7 per cent. T rail is used throughout, sixteen and a half miles being fifty pound rail and the balance twenty-five pound. In the business portions of the city the T rail is laid in brick paving, using next to the rail, both on the inside and on the outside, a special shaped brick. Space is allowed on the inside for the flange of the car wheel. This construction has proved very satisfactory. About three miles of track is also laid on macadam paved streets. Johnson girder switches and the standard crossings of the Weir Frog & Crossing Company are employed.



FIG. 4.—CAR HOUSE—ROANOKE STREET RAILWAY CO.

The trolley wire employed is No. 0 hard drawn copper, supplied by John A. Roebling's Sons Company, and the feed wires vary from No. 0 to 0000. A double riveted bond, using No. 4 B. & S. iron wire, is employed. The overhead construction is very substantial, requiring very little attention to maintain, and one man has been found all that is necessary to perform all the repairing for both the street railway and electric light service wires.

The rolling stock consists of seven sixteen foot Gilbert cars, with cherry finish, two Brill cars, with twenty-five foot bodies, same finish, and two open Laclede cars. The short cars are mounted on Baltimore trucks, and the long cars on the Brill Eureka maximum truck. The motors used are five Westinghouse No. 3, three G. E. No. 14, and one G. E. F 40. The cars are equipped with Stanwood steps, Nuttall trolleys, and Lewis & Fowler registers. The company also owns a tower wagon and hurry-up team.

The car house is of brick, 85 × 100 ft., which, as shown in Fig. 5, has eight parallel tracks. Owing to the fact that the street upon which the car house is located is very narrow, and to lack of room on the car house lot, preventing the use of curves for entering, a transfer table was erected outside of the car house, as shown in Fig. 5. The car house is provided with a pit room for repairs, a shop and store room. The pit room has a glass roof, and the shop contains two lathes, testing boards, a blacksmith shop, etc., allowing the company to rewind all its own armatures, and do other repair work necessary. The car house force consists of four men—a car repairer, blacksmith, general helper and night inspector. One of the motormen works part of the day on a car, and part keeping up all electrical repairs. Wages paid to motormen are twelve and a half cents per hour, and on one high speed line fifteen cents. The cars on the latter line make an average of 200 miles per day.

The company early realized the advantage of keeping careful account of all expenses, and though all clerical

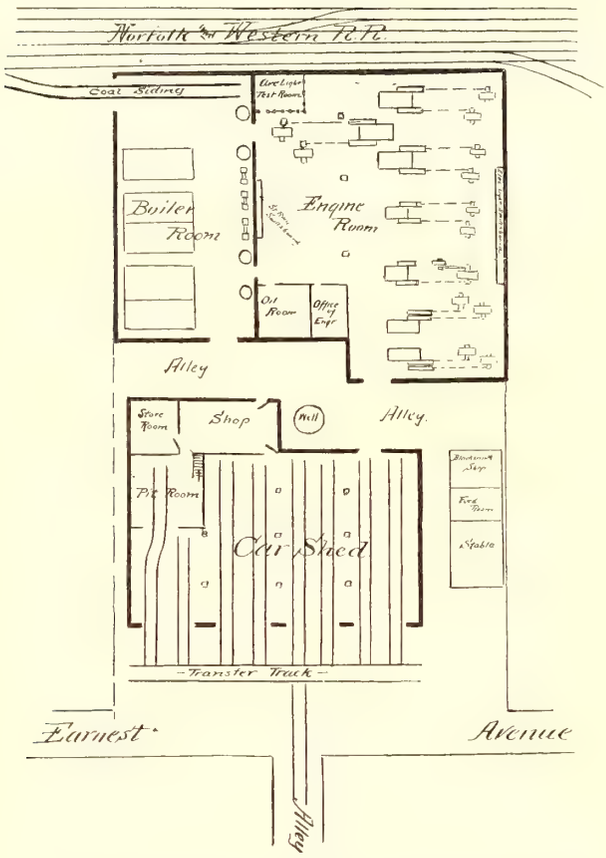


FIG. 5.—PLAN OF CAR HOUSE AND POWER STATION—ROANOKE STREET RAILWAY CO.

work of both the lighting and railway company is done by Secretary McCann and one assistant, the details of operation are kept with the minutest detail. The number of passengers carried during the last fiscal year was 750,000, and the average expense per car mile last year was ten cents, it being brought up to this figure by damages due to a cloudburst. From January 1, 1894, to August 1, the company operated at an expense per car mile of $.0798, this item including all disbursements except for taxes, insurance and interest. Pocahontas coal, costing $2.75 per ton, is used. From January 1, 1893, to January 1, 1894, the maintenance of cars and motors was found to average $.016 per car mile, that of overhead wires, $.0014 per car mile; that for track, $.0053 per car mile.

Transportation of Milk by Electric Cars.

The electric railway at Newburgh, N. Y., has commenced the transportation of milk between the suburban districts and the New York steamboat landing.

Notes from England.

By Our London Correspondent.

The recent publication of the half yearly reports of the London and Liverpool electric railways, and of the Birmingham and Edinburgh cable tramways, has led to quite a lively discussion in some of the English technical journals, as to the merits and demerits of the two kinds of traction. Fresh fuel has also been provided, by a statement having been made on the traction charges for the first year's working on the South Staffordshire electric tramway. The various figures may be put briefly thus: City & South London electric railway: Expenses per train mile, 31.64 cents; receipts, 51.2 cents. Liverpool electric railway: Expenses, 27.04 cents; receipts, 36.2 cents. Birmingham cable tramway: Expenses per car mile, 12.06 cents; receipts, 24.78 cents. Edinburgh cable tramway: Expenses, 10.66 cents; receipts, 21.78 cents. The South Staffordshire electric tramway figures, which include only running charges and repairs (the former embracing wages, fuel, stores, water and gas, and sundries) are given at 8.12 cents per car mile, or about one cent more than the cost on the Birmingham cable line for the same items in the past year.

The trains on the London and Liverpool electric railways each weigh, empty, about thirty-one tons. The cable cars on the tramways cited are of the usual eight wheeled type, weighing from four to six tons each. On the electric accumulator line in Birmingham there has been little improvement, and the expenses still slightly exceed the receipts. The tramway company wishes to install the trolley wire on the route, but the Town Council refuses its sanction. The South Staffordshire figures are interesting as far as they go, because they are the first accounts of expenses of a street railway worked by the overhead conductor in this country. The item of repairs amounts to only 2.16 cents per car mile, and there is no doubt this will be exceeded in future years.

The *Electrical Review* thinks the Liverpool results excellent, and points out that what is required is not a decrease in working expenses, but an increase in receipts per train mile. It also comes to the important conclusion that the poles and wires of the trolley system for street lines must he endured, as it is the only method by which the benefits of electric traction on streets and roads can be secured. After this conversion of an eminently cautious and conservative technical journal, we may hope to see a corresponding change in the attitude of local authorities.

The installation of the cable system on the tramways of Newcastle and Edinburgh still hangs fire owing to various little difficulties, but I learn on inquiry that these are likely to be only of a very temporary nature. Where town councils, as in the case of these two cities, have so large a hand in the matter, any change of importance can only come about slowly.

Much importance is attached to the electric tramway recently opened in the Isle of Man, from Douglas to Laxey. The traffic, however, will be very light in the winter season, though heavy in summer, when holiday makers in tens of thousands resort to the island. For this reason the expenses and receipts of the line will not form a very good basis on which to calculate for a city traffic which is more constant all the year round. The equipment, which is by Messrs. Mather & Platt, seems to be of the best.

There has been a good deal of grumbling among a section of the public in Glasgow regarding the working of the tramways by the Town Council, an arrangement, it will be remembered, which came into force last summer. This, of course, was inevitable, no matter how efficient the management, for every ratepayer thinks the Council ought to suit his particular convenience and ideas. This is one of the evils of municipal tramway working. The Tramway Committee of the Corporation has, however, shown a fair amount of backbone, and if it can only resist pressure which would have injurious effects if yielded to they may get along fairly well. The weekly gross receipts are gradually going up, despite the com-

petition of the omnibuses run by the displaced tramway company, but, of course, no record of the expenses has yet been issued. Nothing is heard of yet of the adoption of electric and cable haulage which was so lavishly promised at one time.

A trial on a somewhat extensive scale is promised of the Lührig gas motor for street cars. The Blackpool, St. Anne's & Lytham Tramways Company, a newly formed body, proposes the construction of a line, eleven miles long, between the towns in Lancashire whose names it bears, and the twenty five cars required are to be worked at a rate of nine cents per car mile run for seven years by the Traction Syndicate, Ltd., which owns the Lührig patent rights. It is estimated that the shareholders will get a dividend of 7 per cent. per annum.

Decision Reversed in the Case of the Detroit Railway Company.

On October 2 the United States Court of Appeals, sitting at Cincinnati, handed down a decision in the celebrated Detroit Street Railway case, unanimously reversing the opinion of Judge Taft of the United States Circuit Court and deciding the case in favor of the company.

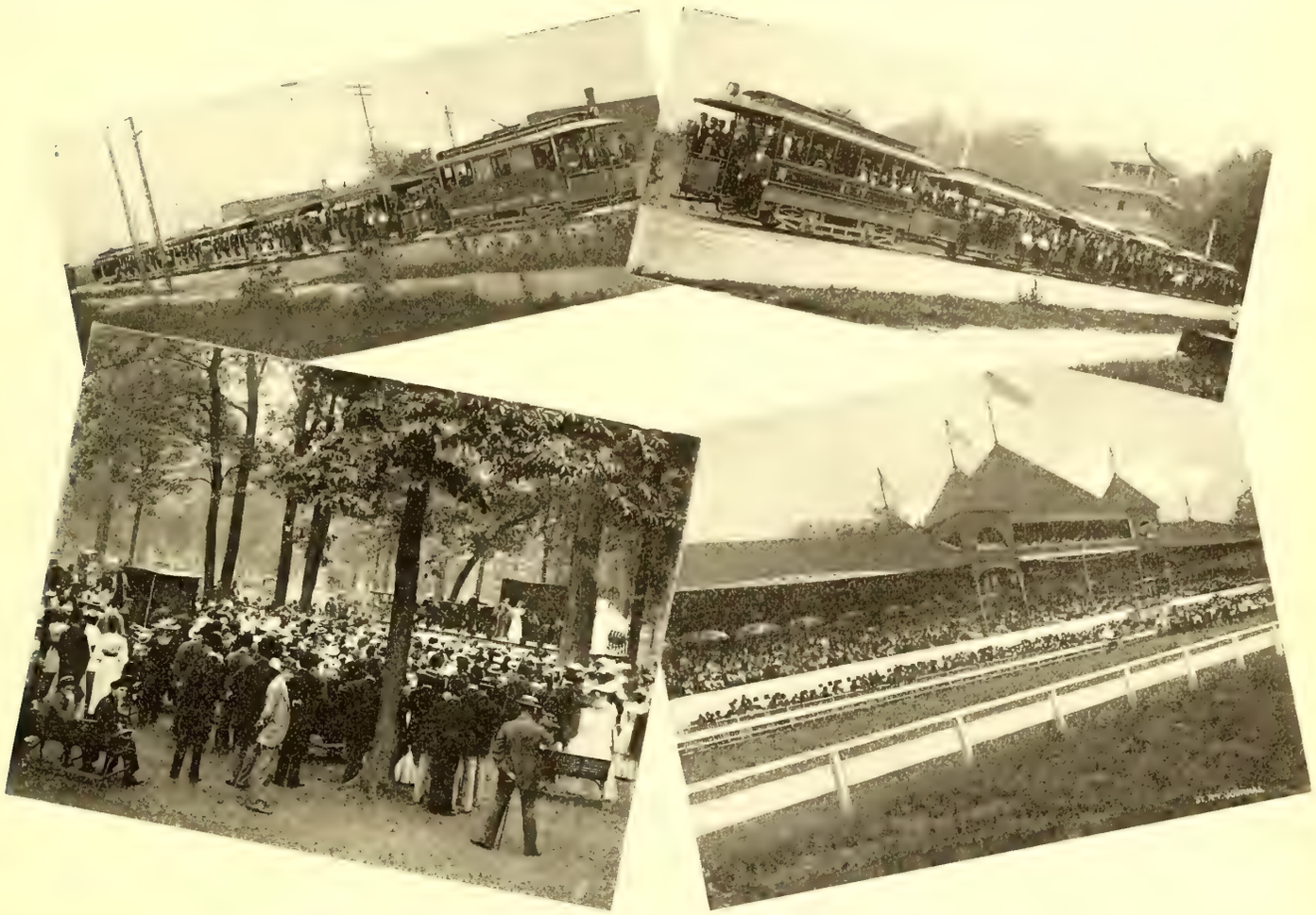
The suit was brought by the city to oust the Detroit Street Railway Company from the streets. The principal point involved was the right of the Detroit Street Railway Company to operate under franchises which ran for a period longer than its corporate existence.

The company's charter expired in 1893, and the franchises extended to 1905. The suit was first begun in March, 1892, and was taken to the United States Court, where Judge Taft decided in favor of the city, declaring the franchises void. The control of the street car lines had in the meantime passed into the control of a new company, the Detroit Citizens' Street Railway Company. The case was appealed to the United States Supreme Court, and was by that body sent to the United States Court of Appeals. Arguments were made before the latter court at Nashville last June.

The property has just passed into the hands of R. T. Wilson & Company, the New York bankers.

Promoting Traffic in Terre Haute.

We present some views herewith of scenes on the Terre Haute Electric Railway during the great light harness race meeting held in that city during September. One view shows a motor car drawing seven trial cars, all of which are crowded with passengers. The estimated number of passengers on the train was 500. The equipment of the motor car consisted of two thirty horse power, No. 12 motors of the Westinghouse type mounted on a Peckham truck. Another view shows the same motor car drawing a train of five loaded trailers from Collett Park, the passengers numbering 400. A view of the Terre Haute race track, on September 14, when Robert J., made 2.02½, breaking the world's record for harness racing, is shown in the engraving in the lower right hand corner of the group.



VIEWS ON THE LINE OF THE TERRE HAUTE ELECTRIC RAILWAY CO.

The Terre Haute Electric Railway Company has paid special attention to the subject of promoting traffic on its lines, and at Collett Park has provided a number of attractions which have added to the revenue of the road. The view shown in the lower left hand corner of the group on this page is from a photograph taken at the park during a Sunday concert by musicians employed by the railroad company.

THE first electric cars of the Fair Haven & Westville Street Railway Company of New Haven, Conn, were put in operation last month. Power is being taken from the power house of the Winchester Avenue Railway Company, and the New Haven Street Railway Company, pending the completion of the company's own power station.

The Poughkeepsie City and Wappingers Falls Electric Railway.

By J. H. Vail.

In the conversion of this road from horse to electric traction, it was deemed advisable, in view of the substantial character of the horse stables and car barn, to utilize the existing buildings. To this end, the old brick horse stable, sixty-three feet square and twenty-five feet high, was remodeled by the removal of the interior studding and beams, and the building of a central twelve inch brick partition. The two rooms formed by this partition wall have been utilized for boilers and engines respectively.

The boiler room contains two 300 H. P. Stirling boilers, and is of capacity sufficient for a duplicate battery. It is floored with brick laid in cement and grouted. In the engine room are two 200 K. W. General Electric multipolar generators, each of which is direct connected to a 300 H. P. Ball & Wood compound, condensing engine. The foundations for these units are of extremely heavy masonry. As in the boiler room, there is here space for duplicating the plant. The condenser, feedwater heater and boiler feed pumps are located in the rear of the engines and close to the division wall. All of the piping is carried in pipe channels below the floor line, the floor being composed of twelve inches of concrete surfaced with an inch of Portland cement. The pipe channels are provided with cast iron covers, set flush with the flooring, this arrangement affording ready and convenient access to any part of the piping system.

The switchboard is built up of black enameled slate slabs of the General Electric panel type. The dynamo leads run beneath the floor in vitrified pipe conduits. In general effect the interior of the power house is extremely pleasing ; the walls are painted in buff, and in the engine room there is a Portland cement wainscoting, capped with a three inch pine nosing. There is an abundance of light and ventilation, and the metamorphosis of the old stable is so complete as to defy detection. The old car barn has been entirely remodeled and largely increased in space and convenience. The roof was raised four feet, an extension 30×90 ft. added, and an entirely new front constructed, containing superintendent's office and waiting room on first floor with large and commodious general offices on second floor, and the storage rooms in the basement. The repair shop is situated in the basement and provision has been made for the comfort of the employes by devoting a suitable room to their exclusive use. The superintendent's office and the waiting room are handsomely finished in paneled cherry wainscoting with ornamental steel pressed walls and a delicately tinted ceiling.

The entire car house is in practically two sections, the longer being 194 ft. in depth and the latter 90. There are six tracks in all, four having direct access to the street, the other two being spurs connected with the Hathaway transfer table which cuts across all six tracks near the transverse center of the building.

Several car pits are provided under each track. A convenient place for coal storage is provided under the west car house, giving ready access to the boiler room. This provides a space for a storage of upwards of 1,000 tons of coal. Berger & Slater executed the mason work, and Isaac G. Manning, of Poughkeepsie, attended to the wood construction.

The track system consists of ten miles of single and double track, laid through the streets of the city. A spur ten miles in length reaches from Poughkeepsie along the Ridge Road to Wappingers Falls and thence to New Hamburg. The heaviest grades within the city limits occur on that portion of the line leading from the steamboat landing on the Hudson River, near the New York Central depot, up Main Street for about one mile. The grades here vary from 5 to 8½ per cent. The track on Main Street is laid with the best ninety pound girder rail, rails and special construction being furnished by the Johnson Company. The remainder of the track is laid with sixty pound and fifty-six pound T rails. The track is bonded throughout with two No. o B. & S. copper wires, riveted in place, all of the electric bonding being performed by the employes of the railway company, under charge of the superintendent.

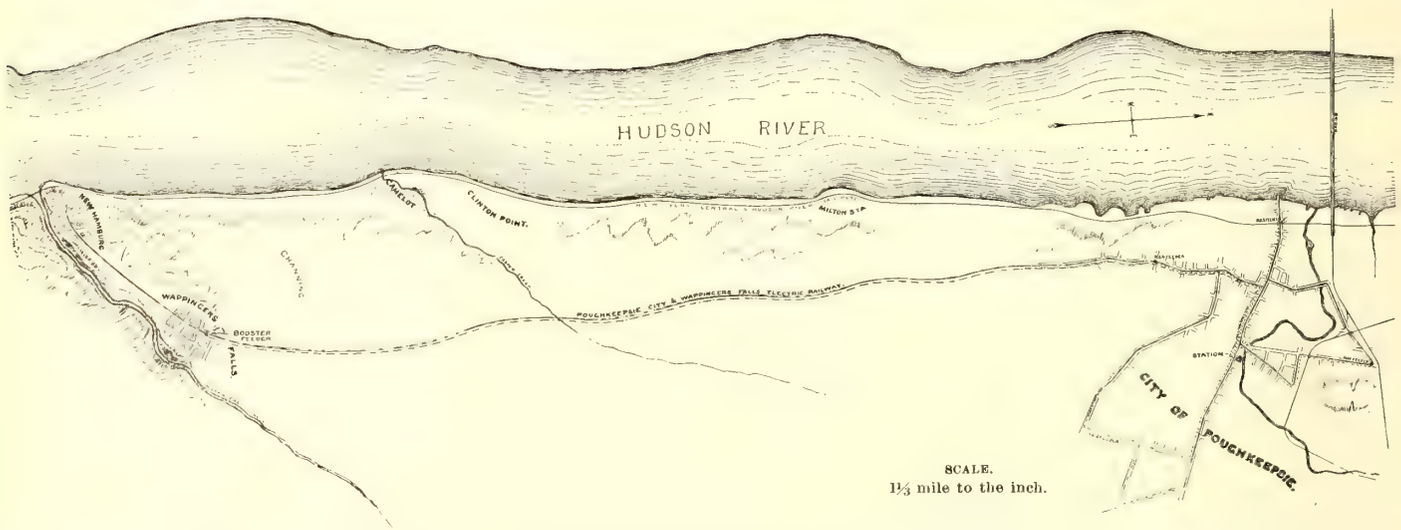


FIG. 1.—ROUTE OF POUGHKEEPSIE & WAPPINGERS FALLS ELECTRIC RAILWAY, SHOWING "BOOSTER" FEEDER.

The line leading from Poughkeepsie to Wappingers Falls is nearly straight in its course, the grades varying from 1 to 8 per cent. Between Wappingers Falls and New Hamburg, where the track leads down toward the Hudson River, the grade is as heavy as 9 per cent

The line construction consists of the usual form of stout, octagonal, hard pine poles with treated butts. These are set up on Main Street and Market Street, the remainder of the poles throughout being round, shaved and painted. Span wire construction is used throughout the city and bracket construction is used on the line leading to Wappingers Falls and New Hamburg. The trolley wire is No. o B. & S., supported by five-sixteenths inch stranded steel span wire. The line material is of the H. W. Johns manufacture.

Feeders of No. oooo B. & S. wire are placed as required for electric distribution within the city limits. An interesting feature of the feeding system is the application of the booster idea to the long distance feeder from the power house to Wappingers Falls. The feeding point is eight miles from the station with a 9 per cent. grade two miles beyond the end of the feeder. By the use of the booster it is possible to properly supply this section of the line through two No. oooo B. & S. wires. The Woodbridge & Turner Engineering Company constructed the line work, while the track construction, including bonding, was under the charge of Superintendent C. M. Davis, of the railway company.

The rolling stock equipment consists of eight closed

motor cars, eighteen feet in length, built by James A. Trimble, of New York; ten open motor cars, thirty feet in length, built by the American Car Company, of St. Louis, Mo., and two closed vestibule cars, made by the latter company. All motor cars are mounted on the latest type of Peckham cantilever truck. The electric equipment of the cars consists of two G. E. 800 motors per car, with type K series multiple controller. All cars are fitted with the Star electric headlights, and all closed cars with the American Car Heating Company's electric heaters.

Several of the views were taken while the construction was under way. Details shown in this way are frequently more interesting than photographs of the completed construction could ever be. Surveys were made by Lawlor & House, civil engineers of Poughkeepsie. The entire engineering supervision of the work has been under the charge of J. H. Vail, chief engineer of the Electrical & Mechanical Engineering & Trading Company, of New York, from whose offices all plans and specifications were issued.

The new electric railway will supplant an extensive passenger and express stage business between Poughkeepsie and Wappingers Falls. It furnishes convenient transportation facilities between the river front and the higher urban localities, such as Vassar College, the Seminary, the Driving Park, the Insane Asylum, the P. & E. R. R. Depot, and the Cemetery. The same accommodations are offered at the New Hamburg end of the line, which reaches down to the river front.

Maj. J. W. Hinckley, the enterprising and energetic president of the railway company has taken great personal interest in the construction of the entire system,



VIEWS ON THE LINE AND ABOUT THE POWER STATION OF THE POUGHKEEPSIE & WAPPINGERS FALLS RAILWAY.

and the citizens of Poughkeepsie will be largely indebted to him, as the means of furnishing in their city a first class electric railway system.

Street Railway Park Attractions at Toledo.

The Toledo Electric Street Railway Company, of Toledo, O., has purchased an extensive grove, comprising about forty acres, in the outskirts of that city. A large number of electric lights, fountains, etc., will be installed here in time for the next summer season. The ground lies on the shore of the lake, and a promenade will be built over the water to a distance of over 700 ft. At the terminus of this pier, a casino 200 × 300 ft. will be built, with a promenade forty-four feet wide at the ends and twenty feet at the sides. The casino will be constructed largely of glass, and when illuminated by electricity will present a very brilliant appeanrace. A large restaurant will be located on the second floor.

No admission fee will be charged, but only those who come on the cars of the electric railway company will be permitted entrance.

The Hartford & West Hartford Horse Railroad Company of Hartford, Conn., has completed a traffic arrangement with the Hartford Street Railway Company, by which the cars of the former company reach the center of the city over the Farmington Avenue Division.

The Peekskill (N. Y.) & Cortland Electric Railway Company was incorporated with the Secretary of State on October 9, with a capital of $150,000. Among the directors are Edgar Peckham, of New York City, Joseph H. Burton, of Kingston, and Wm. D. Southard, of Peekskill.

Trolley Parties in Boston.

The popularity of excursions taken on electric roads in chartered cars has led to the introduction on a number of electric railways of cars designed especially for this service. These are used not only for excursions to points of interest in summer, but also all through the year for special parties to balls, theatres, weddings or similar occasions, and they often provide a not inconsiderable source of income. We illustrate on this page one of two cars, Nos. 924 and 925, recently built for this service on the West End Railway of Boston. As will be seen, they are fitted up in an exceedingly handsome and tasteful style.

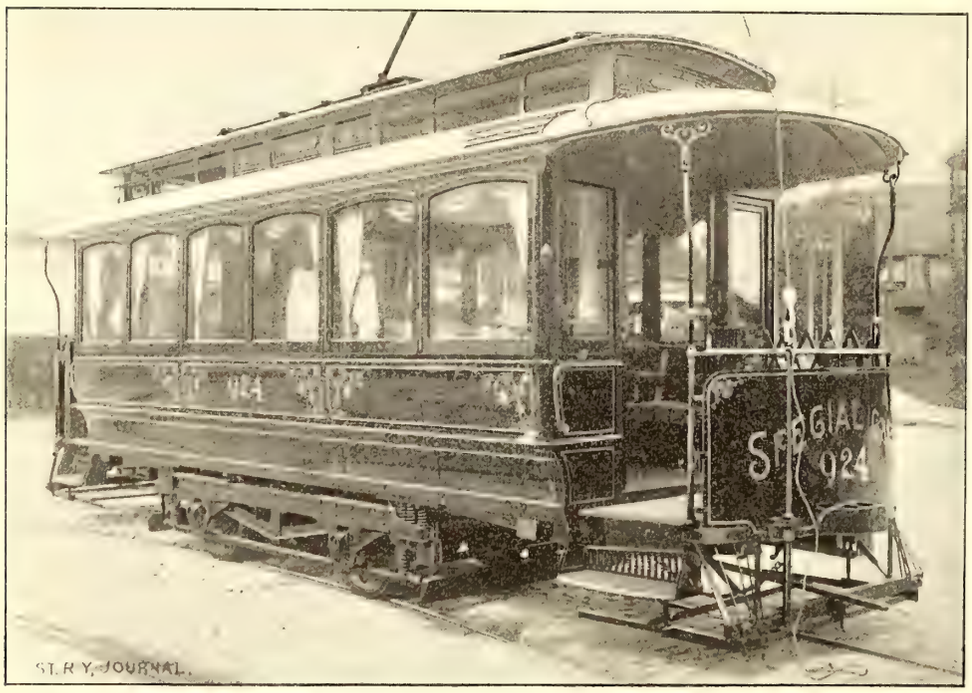


FIG. 1.—PARLOR CAR FOR EXCURSION PARTIES—BOSTON.

The car bodies measure twenty feet in length by seven feet four inches in width, and are fitted with twenty arm-chairs supplied by the Wakefield Rattan Company, of Boston, upholstered in peacock blue brocaded plush. Underneath each chair is a wire hat holder. The cars are finished in mahogany. The doors are double, opening from the center. The outside colorings are black and gold, relieved with crimson in the lower panels. The trucks are painted a dark green.

The car bodies are from the works of J. M. Jones' Sons, of West Troy, N. Y. They are mounted on "West End" trucks built by the Laconia Car Company, of Laconia, N. H. The motors on No. 924 are twenty-five horse power each, furnished by the Westinghouse Electric & Manufacturing Company. Those on No. 925 are twenty-five horse power each, furnished by the General Electric Company. The controlling mechanism of both cars was furnished by the General Electric Company, and electric headlights are used.



FIG. 2.—INTERIOR OF PARLOR CAR—BOSTON.

All Steel T Rail Track Construction in Terre Haute.

In connection with the paper read by R. B. Harrison at the Atlanta Convention on the "T Rail Construction at Terre Haute," the accompanying engravings showing the method of laying the all-steel T rail track in that city will be of interest. The construction is that of the Paige Iron Works Company, of Chicago, using seventy-two pound Shanghai T rail of the Illinois Steel Company.

The type of ties, joints and bonds used are described in Mr. Harrison's paper on pages 696, 697, 698 and 699 of this issue. Each different process in track construction is shown clearly in a separate engraving.



FIRST PROCESS—ROLLING THE ROADBED AFTER EXCAVATION.



SECOND PROCESS—PREPARING TO RECEIVE THE BROKEN STONE—SETTING STAKES.



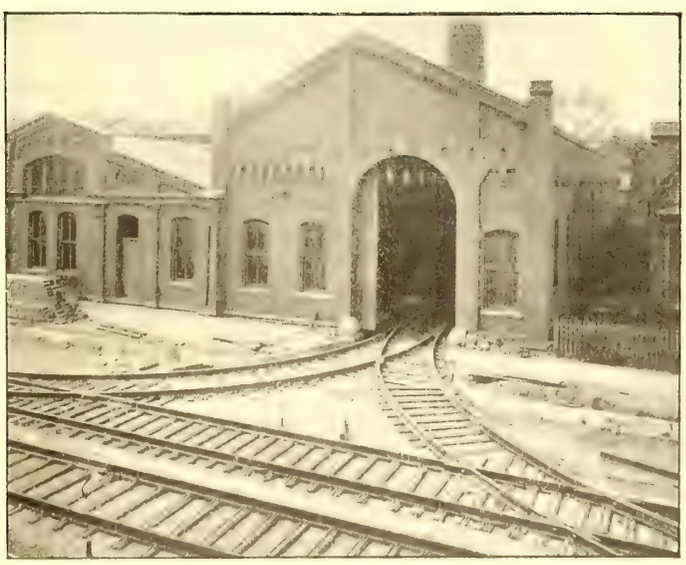
THIRD PROCESS—LAYING THE FIRST EIGHT INCHES OF BROKEN STONE.



FOURTH PROCESS—TRACK READY FOR TAMPING WITH LAST FOUR INCHES OF BROKEN STONE.



DOUBLE AND SINGLE CURVES AT POWER HOUSE.



Y CURVES AT POWER HOUSE.

The Street Railway System of Bridgeport, Conn.

The Bridgeport Traction Company is the title of a corporation chartered July, 1893, to operate the entire street railway system in Bridgeport, Conn. The company has a perpetual franchise, and is a consolidation of the Bridgeport Railway Company, the East End Railway Company and the Bridgeport Horse Railway Company.

The line of the company at present consists of thirty-one miles. Extensions are being made to Fairfield and Southport, and when completed the system will comprise about forty miles of track. The first electric cars were put in operation on August 23, 1894, and the company now has fifty motor cars in regular service.

The power station is located on Sea View Avenue near Adams Street, and is a substantial brick and iron building measuring 98 × 110 ft. The iron work was furnished by the Berlin Iron Bridge Company, and is of that company's standard construction for power stations.

The engine room is located on the Sea View Avenue side of the building, and is provided with large windows on three sides, affording good light and ventilation. The engine equipment consists of one Providence Greene tandem compound engine, with cylinder dimensions 12 × 20 × 42 ins., belted direct to one G. E. 200 K. W. generator by a two-ply, twenty-four inch wide Palmer belt, and two Watts-Campbell tandem compound Corliss engines, with cylinder dimensions 20 and 38×42 ins., direct connected to G. E. 300 K. W. generators. These generators are of the latest eight-pole type, and are provided with their own equalizing switches on the machines, and are run at 100 revolutions.

The switchboard is of marbleized slate and handsomely designed and is conveniently located in the center of the engine room. It is sixteen feet long and eight feet wide, and is provided with standard General Electric appliances and Weston ammeters and voltmeters.

All steam piping and wiring, excepting the live steam pipes, are under the floor. A ten ton traveling crane, built by the Berlin Iron Bridge Company, is provided for conveniently handling the machinery when repairs are needed. Separate jet condensers, of the Watts-Campbell type, are attached to each engine, and are located under the floor between the engine foundations. Condensing water will be taken from a canal to be built in the rear of the power station.

The boiler room is located in the rear of the engine room, and contains eight horizontal, return tubular boilers, arranged in batteries of two each. The boilers are sixty-six inches by seventeen feet each, and were built by the Pacific Iron Works, of Bridgeport, Conn.



VIEWS OF POWER STATION, DURING COURSE OF CONSTRUCTION—BRIDGEPORT TRACTION CO.

The stack is of iron, with brick lining, and is located in the center of the room, between the boilers. It is 100 ft. high, with a ninety inch flue, and was built by the Pacific Iron Works. Coal will be brought direct to the power house by boats, and carried to the boiler room by conveyors. Drew feedwater heaters and Curtis separators are used. The piping is covered with asbestos insulation, supplied by the International Asbestos & Mining Company, of Newark, N. J. Ashcroft gauges and Deane feedwater pumps are employed.

The track construction consists of six inch T and nine inch girder rail, supplied by the Pennsylvania Steel Company, and Wm. Wharton, Jr., & Company, of Philadelphia, and weighing 70 and 90 lbs. to the yard. The rails are spiked directly to ties laid eighteen inches between centers. The trolley and feed wires were supplied by the Bridgeport Brass Company, and are supported by iron and wooden poles. The trolley wire insulators are of the H. W. Johns type, similar to those employed on the Newark & South Orange Railway, and

described in the October issue of the STREET RAILWAY JOURNAL. The span wire is from the Washburn & Moen Company.

The return circuit is constructed in the most substantial way. The bonds consist of two No. 00 wires at each joint, using the General Electric channel pin, and connected to supplementary overhead return feeders, of 500,000 circular mils, at distances of every 1,000 ft.

The cars were built by the John Stephenson Company, Ltd., and the Barney & Smith Car Company. A view of one of the former cars is given on this page. The length of body is 18 ft. 7 ins. and the width is 7 ft., the car being constructed with a high monitor top roof trussed and braced. There are six large windows of double thick French glass on each side, running the full length to the top rail, and all windows are supplied with blinds.



CLOSED CAR—BRIDGEPORT TRACTION CO.

The interior is fitted up in an extremely tasteful style. The ceilings are paneled with bird's-eye maple. The interior trim of the car is ash and cherry, and all metal appointments are of full bronze. The seats and backs are covered with best Wilton carpet, and there are rolling wood mats on the floor. Twin doors are provided at each end of the car, each pair of doors being operated by one movement of the hand, affording the most ample facilities for ingress and egress of passengers, and in hot weather contributing to thorough ventilation. The cars are also provided with electric bells, and push buttons at each side pillar, so that passengers, while seated, can readily signal to the conductor their desire to stop. The interior of car is lighted with combination lamp for both incandescent lamps and candles.

The platforms at each end of cars are large and commodious with corner posts supporting bonnets. They are closed on alternate sides, the open side being supplied with lazy tong or folding gates, so that the danger of accidents in boarding the cars is reduced to the minimum. Trolley boards are provided on the roof with ready means for access thereto.

The bodies are mounted on Brill trucks and are equipped with two G. E. 800 motors. Electric signal bells are provided and Lewis & Fowler fare registers are employed on all of the cars.

The car house is located on Stratford Avenue, between Stratford and Bridgeport, and is a substantial brick building, with a storage capacity for 150 cars.

The company owns a large plot of ground adjoining the power station, and will shortly commence the construction of machine and repair shops, which will be equipped with the latest type of machine tools for making all necessary repairs.

The company has a capital stock of $2,000,000. The authorized funded debt is $2,000,000. Of this only $1,300,000, in 5 per cent. first mortgage bonds, have been issued, and these cover the forty miles of track together with all equipment, real estate and other property of every description. They were sold to Redmond, Kerr & Company, the well-known New York bankers. The financial standing of the company is high and the bonds command a good price, being exempt from taxation in Connecticut. No further bonds can be issued except for new construction, and these only at 75 per cent. of the actual cost of such improvements, as provided by the laws of the state of Connecticut, which are extremely strict in regard to the bonding of railroads, all bonds being issued under the supervision of the Comptroller of the State, at not over 75 per cent. of the actual cost of the property bonded.

The officers of the company are: President, W. H. Heft; vice-president, Elias Ward; secretary, Thomas L. Watson; treasurer, Wm. Sheerer; general manager and superintendent, Andrew Radel.

C. J. Field, as the city's electrical engineer, has had the planning and supervision of the entire work, assisted by Jos. McElroy. Mr. Field was also the designer of the power station of the Newark & South Orange Railway, described in our October issue.

New Car House of the Metropolitan Street Railway.

A car house, claimed to be the largest in the world, will be erected at Seventh Avenue, 50th and 51st Streets, New York, by the Metropolitan Street Railway Company of that city. Running back to power house on Sixth Avenue, the building will be 200 ft. 10 ins. × 618 ft. 1 in., with an average height of 100 ft. The estimated cost of the car house is $1,000,000.

The building, as shown in the engraving, will be four and five stories in height. The five story portion extends back about 100 ft. on the side streets, the remainder being of the four story construction. The structure will be thoroughly fireproof with steel skeleton construction, terra cotta floor, roof arches, partitions, etc. The walls will be of brick faced with iron-speckled brick, and the trimmings will be pink granite, fire-flashed terra cotta, and at certain parts ornamental cast iron.



50TH STREET CAR HOUSE—METROPOLITAN STREET RAILWAY CO., NEW YORK.

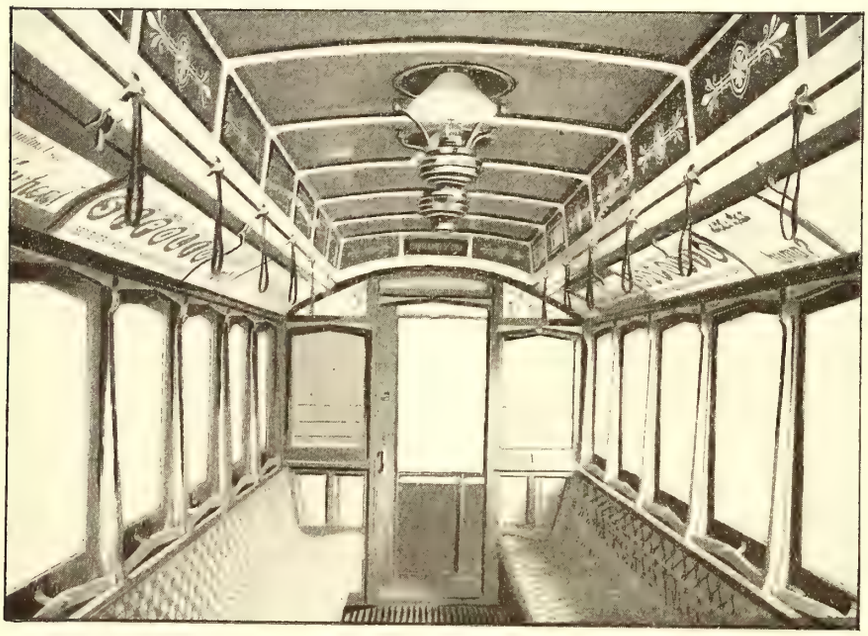
The front portion of the ground floor will be for the accommodation of the Broadway and Columbus Avenue cable cars, receivers' and starters' offices, employes' waiting rooms and the Sixth and Seventh Avenue horse cars. The repair pits will occupy the rear of the building. On the Seventh Avenue front will be located the superin-

tendent's office and offices connected with the operating department of the roads, with entrances on the 50th Street side of the building. The balance of the building will be occupied by employes' reading rooms, store rooms, repair shops, feed mill, feed, hay and car storage. There will be stable accommodations on second and third floors for 1,500 horses, and space for 650 cars. There will be six large cars, two freight, and one passenger elevators, all of most modern and improved make.

The building will be constructed in sections, this course being made necessary owing to the fact that the operation of the roads can not be interfered with. The work of removing a portion of the present structure is now under way. Work on the new building for which contracts have been awarded will commence soon. Forty per cent. of the building will be fully completed by May 1, 1895. The construction is in charge of F. S. Pearson, chief engineer of the company, and A. V. Porter, architect of the Metropolitan Traction Company.

Rebuilding Short Cars.

The Dry Dock, East Broadway & Battery Railway Company, of New York, having decided to change the equipment of one of its lines from short twelve-foot cars, which had been in use for some years, to sixteen and two thirds foot cars, found that there was practically no market for the former cars. Although well built, as the long service on the company's lines shows, the cars were practically unsalable. The company therefore decided to rebuild these cars, extending them about five feet, and as the company has quite extensive car building shops this was possible. The company has just completed the construction of one car under the direction of its master mechanic, C. E. Garey, and an inspection of the car recently made by a representative of the Street Railway Journal showed that the result was an exceedingly handsome and tasteful car. The car is also very interesting from the fact that it includes a large number of novel features, the invention of Mr. Garey.



INTERIOR OF CAR REBUILT BY THE DRY DOCK, EAST BROADWAY & BATTERY RAILWAY CO.—NEW YORK.

The first impression made upon a person entering the car is its extremely light and high appearance. The ceiling of the car is actually lower than many other cars run upon the line, but this effect is secured by employing a light paneled, bird's-eye maple ceiling, painting the inside frieze panels white and removing all straps and rods from the upper part of the car. The register rod is carried under a moulding forming part of the advertising rack frame on one side of the car, and the rod for operating the driver's bell is carried under a similar moulding on the other side. The register and bell are operated from various points in the car by handles. There is no hand strap rail, but the hand straps are hung on small brackets. This prevents any passenger from monopolizing two or three straps at one point.

Another striking feature of the interior of the car is that it is perfectly symmetrical. There are even no end lamps. The lighting of the car is all done by two large Howard lamps of thirty-five candle power each—working power thirty candles—located in the center of the car and giving sufficient light to allow of newspapers being read in any part of the car.

The ventilator deck contains eight lights on each side, four of them opening for ventilation and the other four—two at each end—are immovable and contain the names of the principal streets through which the car runs, in white letters cut in red glass. Over each door and underneath the bonnet there is an *ever open* ventilator, protected by silver wire netting. This remedies a fault in most cars which have ventilators that do not ventilate. The car is provided with seven windows on each side with Gothic heads extending to the eaves of the car, two more on each side than with the twelve foot cars, the pillars remaining the same distance as in the short car.

The interior finish of the car is in mahogany. Many of the trimmings are of especial and attractive design, and a fare wicket of an especially ingenious type is employed. Slats running lengthwise are used on the floor. At the ends the slats are cut off to facilitate sweeping. The exterior finish of the car is quite tasteful, the main panel being of lemon yellow with red trimmings, and the lower panel is white. The car weighs only 4,600 lbs., or or 600 lbs., lighter than the standard sixteen-foot cars of the company. The cost of rebuilding the car is estimated at $500, and the company will probably transform all of its short cars in this way. The wheel base is six feet two inches, and the car is equipped with the Garey brake gear. It is now running on the Cortlandt and Grand Street Ferry branch of the company's system.

Good Cable Records in New Zealand.

The Mornington Tramway Company, Limited, operates two cable lines in Dunedin, New Zealand, one from Dunedin to Mornington, and the other from Mornington to Maryhill. The main line, that from Dunedin to Mornington, is one mile in length (double track). The vertical rise is 450 ft.; the grades traversed are 1 in 6 and the curve radius 250 ft. The length of cable, spliced and running, is two miles ninety-five yards, and the speed of travel is eight miles per hour. The extension line, that from Mornington to Maryhill, is half a mile long (single track). The grade is 1 in 3½; the curve radius 75 ft.; the length of cable spliced and running, 1 mile 143 yds.; and the speed, eight miles per hour. The records made by the four best wearing cables will be of interest. The first on the main line did service during 3 years 4 months and 25 days, running 172,391 miles. The second for the same line was taken out on July 13, 1893, after 3 years 7 months 5 days' service, and 180,234 miles running.

The first on the extension line lasted 2 years 8 months 8 days, running 33,550 miles. The second was taken out on February 8, 1894, after 6 years 2 months 10 days' service, and running 53,752 miles.

The ropes in all four cases were supplied by Geo. Cradock & Company, of Wakefield, England, and, naturally, General Manager Eunson, writes that that they are very satisfactory. The last rope on the main line was afterwards sold to a colliery in New Zealand, for use in an inclined plane railway. Other makes of ropes have been used on these lines with the following records—main line: Rope No. 1; 1 year 4 months 26 days—Rope No. 2; 1 year 10 months 28 days.

The record of Craddock ropes on the Roslyn Cable Tramway Company's line at Dunedin, has also been equally good, as will be shown by the following table of records. Cables No. 4, 5 and 6 were of the Cradock make, and cables 1 and 2 were made up of odd pieces of colliery ropes bought locally.

Cable No. 3	1 year	1 month	3 days.
" " 4	2 "	2 "	11 "
" " 5	2 "	3 "	6 "
" " 6	2 "	1 "	12 "
" " 7	1 "	6 "	26 "

Rope No. 6, it should be stated, was on during the Dunedin Exhibition, and did exceptionally heavy work.

SOME IMPORTANT EXHIBITS

The general impression of the exhibition of street railway appliances made in connection with the Atlanta Convention was, that it was the best showing that has yet been made. Other exhibitions may have been larger, but none better. Individual exhibits are noticed in the following pages :

The John Stephenson Co., Limited, of New York, was represented at the Convention by D. W. Pugh.

C. R. Vincent, treasurer of the Ball & Wood Company, New York, did the honors for his company at the Convention.

Flood & Conklin, of Newark, N. J., were represented by Messrs. Kuhn and Dick.

A. Whitney & Sons, of Philadelphia, made an attractive exhibit of car wheels and axles.

The Griffin Wheel & Foundry Co., of Chicago, made no exhibit, but was represented by W. F. Newbert.

The Pullman Company made no exhibit, but its representative, W. S. Louttit did some good missionary work.

Levi Dederick, of Albany, N. Y., exhibited a sample of the dual car fender which attracted considerable attention. George Poe was in charge of the exhibit.

The Chapman Valve Co., was represented by E. W. Buss, of Chicago, and made quite an elaborate exhibit of valves of all sizes for power station equipment.

The New York Leather Belting Co., of New York City, was represented by Howard Fairbrother whose headquarters were in one of the Kimball House parlors.

The Baltimore Car Wheel Co., exhibited two large Baltimore trucks, one of which was equipped with G.E. 800 motors, and the other with Westinghouse motors.

The Harris Life Guard was exhibited by H. E. Harris, of Boston, who showed and explained a small working model which was a combined snow sweeper and life guard.

The Lederle-Taylor Co., hydraulic and electrical engineers, whose headquarters are at Atlanta, distributed cards and other literature relating to their engineering business.

The Columbian Hand Strap Co., had an exhibit in connection with that of the Scarritt Car Seat Company, and showed two or three styles of hand straps for street car service.



CONVENTION HEADQUARTERS OF THE STREET RAILWAY JOURNAL.



A CORNER OF THE DAVIS CAR SHADE CO.'S SPACE.

The New Process Rawhide Co., of Syracuse, N. Y., made no exhibit, but was represented by secretary A. C. Vosburgh.

Valentine & Co., of New York, made no exhibit, but were represented at the Convention by their railway agent, G. Fred Collins.

McNamara Brothers, of New York City, distributed as souvenirs some paper weights made of slate which they are placing upon the market.

The Heine Safety Boiler Co., of St. Louis, Mo., distributed literature regarding its boilers. This was done through the company's Southern agent.

The Dreher Manufacturing Co., New York, through its salesman, H. H. Foster, showed samples of its car and motor compound, also lubricating oils.

The Terre Haute Car Manufacturing Co., Terre Haute, Ind., made no exhibit, but was ably represented by D. B. Dean, the Chicago agent for the company.

J. H. Stedman, of Rochester, N. Y., made, as usual, a very striking exhibit of tickets and transfers, a special feature of which was the detective transfer ticket.

The Chicago Electric Truck Co., of Chicago, was represented by Geo. H. Graham, vice-president and patentee, who distributed some fine platinum prints of the Chicago truck.

Morris, Tasker & Co., of Philadelphia, did not make any special exhibit, but were represented by literature distributed by some of their agents who made exhibits in Exhibition Hall.

The Wells-French Co., Chicago, was represented at the Convention by E. F. Carry, Jr., who showed photographs of some handsome street cars that this company has recently built.

The National Lock Washer Co., of Newark, N. J., was represented by R. L. Thomas, and made an exhibit of various sizes of lock washers, from one-quarter to two and a half inches in diameter.

William S. Silver, of William S. Silver & Co., New York, was ex-

tremely liberal with glass writing pens that possessed a novel way of calling attention to their graduated car springs and railway supplies.

The Electric Railway Equipment Co., of Cincinnati, O., was represented by S. J. Wick, who explained to electric street railway men the merits of the steel tubular poles, which this company is manufacturing.

R. W. Hollis, of Atlanta, Ga., showed a two horse power, 500 volt Eddy motor, together with an automatic magnetic cut-out, an automatic, electric elevator controller and a combination D. P. switch and rheostat.

Arthur S. Partridge, of St, Louis, gave out as souvenirs a neat case containing three blue pencils. His general exhibit was made in connection with that of the R. D. Nuttall Company, of which he is the St. Louis agent.

The Safety Clutch Brake Co., of Philadelphia, was represented by E. V. Faucett, of Philadelphia, who exhibited a model, showing a brake outfit with a clutch in the handle, as well as one with the clutch at the platform.

Geo. L. Colgate, of the Colgate Company, New York, talked incessantly about the McIntosh pole paints. Mr. Colgate returned with several good orders in his bosom pocket and pronounces the exposition a perfect success.

The Hale & Kilburn Manufacturing Co., of Philadelphia, showed car seats and car springs with rattan, canvas lined covering, as well as some other styles. Three specimens of the company's well known seats were shown.

E. M. Bushnell, represented the Bushnell Manufacturing Company, of Easton, Pa., who showed both longitudinal and reversible seating for street cars gotten up in various finishes, embracing rattan, plush, leather and carpet.

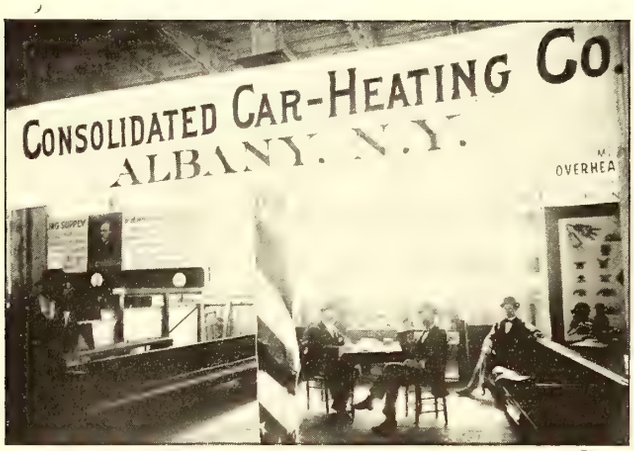


EXHIBIT OF THE CONSOLIDATED CAR HEATING CO., ALBANY, N. Y.

The Storm Manufacturing Co., of Newark, N. J., exhibited a number of its sleet cutting trolley wheels, of which John A. Graham & Company, of New York, are the sole selling agents. The company was represented by C. A. Hoagland.

The Partridge Carbon Co., of Sandusky, O., was represented by Jas. Partridge, general manager, and had on exhibition the self-lubricating motor brushes, of which the company makes a specialty for motors and generators of every type.

The Chicago Raw Hide Manufacturing Co., had a very simple exhibit in the shape of two handsomely finished street car pinions. A number of circulars containing illustrations and descriptions of the company's manufactured articles were distributed.

The Electrical Installation Co., of Chicago, was represented by L. E. Meyers, who distributed printed matter showing the number and extent of the various roads which have been constructed by the company during the past two seasons, aggregating 155 miles.

The Keystone Electrical Instrument Co., of Philadelphia, distributed illustrations and descriptions of its new electrical instruments, both ammeters and voltmeters. The illustrations especially were very conspicuous, owing to their wide distribution about the hall.

Chas. A. Schieren, Jr., was on hand and did the honors for Chas. A. Schieren & Co. All who looked pleasant received a useful souvenir in the way of a handsome note book, nicely bound and having on the cover a view of the Company's big Dixie tannery at Bristol, Tenn.

Fairbanks, Morse & Co., of Chicago, exhibited a Barrett car jack the leading feature of which is that it operates to raise the car whether the lever is raised or lowered; that is to say, it is double action. J. M. Cobb was the representative of the company at the Convention.

The Brooklyn Car Wood & Veneer Works, of Brooklyn, N. Y., was well represented by W. B. Le Van, Jr. This company showed car ceilings, plain and decorated, and wood supplies for cars and car repairs, consisting of beautiful specimens of veneered ceilings and panels.

The Veneer Seating & Church Furniture Co., of Brooklyn, N. Y., exhibited single and double settees, veneered seats and backs, and also side seating for car stations and depots, both in slat and veneer, and also in straight and round corner. W. B. LeVan, Jr., had charge of this exhibit.

The Street Railway Advertising Co., of New York and Philadelphia, through its representative, W. B. LeVan, made an exhibit of specimen advertising cards and racks. This was this company's first convention exhibit, and attracted a great deal of attention from street railway officials.

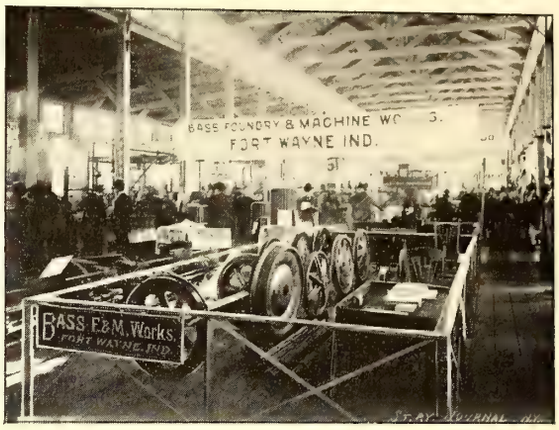


EXHIBIT OF THE BASS FOUNDRY & MACHINE WORKS, FT. WAYNE, IND.

C. E. Garey, of New York City, showed a car door change pocket, which attracted considerable attention. The model shown was handsomely finished, and the merits claimed for it were explained to those who were interested. Literature describing and illustrating the device was distributed.

The Laconia Car Co., of Laconia, N. H., was represented by F. E. Huntress, the Boston agent, who distributed circulars and other literature containing illustrations and descriptions of the company's street cars which are now in use on a number of important roads in various parts of the country.

The Abendroth & Root Manufacturing Co., of New York, made no exhibit, but P. M. McLaren, the well known representative of this company, took an active interest in the Convention, and added many new friends to his already long list. He says the company will have to be in it next time sure.

The Bragg Fender Co., of Albany, N. Y., of which F. A. Bragg, the general manager, was the representative, exhibited a model of of its new fender. The principal feature of this is that it is attached directly to the truck instead of the car, and that any blow which it may strike is cushioned by springs.

The Chas. Munson Belting Co., of Chicago, Ill., owing to the failure of most of its goods to arrive at Atlanta, in time for the exhibition, made only a very small showing compared with what it otherwise would have done. The company showed only a few samples which were in charge of H. E. Skinner, of Chicago.



EXHIBIT OF C. G. SMITH, OF NEW YORK, AND BENEDICT & BURNHAM MANUFACTURING CO., OF NEW YORK.

The Scarritt Furniture Co., of St. Louis, Mo., exhibited a number of very handsome car seats, including those in plush, rattan and leather finish. Two long seats were also shown, one finished in plush and the other in rattan. The company was represented by S. G. Scarritt, of St. Louis, and H. O. Nourse, of Chicago.

F. R. Angell, of Chicago, represented the National Malleable Castings Company, which showed several very fine specimens of the malleable castings used in overhead work, also rail braces and chairs and general castings for street car construction. This is the first exhibition of this company at a street railway convention.

The Wadhams Oil & Grease Co., of Milwaukee, Wis., showed samples of curve grease and motor lubricants and graphite axle grease. The company was represented by A. J. Moan, G. A. Wadhams and G. A. Streeter. An aluminum souvenir match box, which these representatives of the company gave out, was in great demand.

The Keller Printing Co., of New York City, exhibited a ticket printing machine, together with samples of tickets used on various roads. Taken altogether, the exhibit was an attractive one. Specimen tickets were given away to those interested. Some of the tickets shown were of special design, and others were those in ordinary service.

Henry E. Lowe, of Macon, Ga., had on exhibition a very novel model of a railway switch operated by a push button on the car, the electric power for the switch being taken from the trolley circuit. The button for operating the switch is located on the car in easy reach of the motorman, so that he can throw the switch by a slight pressure of his foot.

T. C. White, of the Central Union Brass Company, of St. Louis, was showing some electric headlights for which this company is the agent. One of the features of this headlight is that it can be reversed so that the light can be used either on the track or in the car. This headlight was gotten up by Geo. W. Baumhoff, superintendent of the Lindell Railway, of St. Louis.

E. F. De Witt & Co., of Lansingburgh, N.Y., made an exhibit of the DeWitt sand box of the latest improved type in practical operation. This box is of the firm's Common Sense type, and Mr. DeWitt, who was present and in charge of the exhibit, took especial pleasure in showing street railway men that the box would handle small pebbles and even stone, as well as sand.



EXHIBIT OF THE GENERAL AGENCY CO., OF NEW YORK.

W. T. Van Dorn was there in the interest of his firm, Fitzgerald & Van Dorn, of Lincoln, Neb. Mr. Van Dorn showed standard drawbars for electric and cable cars, automatic drawbars for elevated roads of the same pattern that were used for the equipment of the Metropolitan Elevated of Chicago, also one adapted to roads having a sharp incline such as the Kansas City cable roads.

The Benedict & Burnham Manufacturing Co., of New York, exhibited rail bonds made of solid copper in one piece, as well as samples of feed, trolley and magnet wires in various sizes. The exhibit was very handsomely arranged so as to attract attention. Sections of rail were shown with bond wires fitted to them. The exhibit was in charge of E. H. Oswald and J. H. Woodward.

The Stilwell-Bierce & Smith-Vaile Co., of Dayton, O., through its Southern agent, J. W. Taylor, exhibited the Stilwell feedwater heater, the Victor water wheel, Worrell's friction clutches, Stilwell's railroad track jack, the Fitch self oiling device for loose pulleys and clutches, as well as other specialties. Literature treating of these various devices was distributed to the street railway men.

The Western Telephone Construction Co., of Chicago, made an interesting exhibit of its new magneto telephone system, embracing magneto transmitters and receivers and the new switchboard manufactured by this company. All of the apparatus was of elegant design and finish, and was connected up in regular service. The company was represented by Geo. F. Stitch, the vice-president.

R. R. Mitchell, of Robt. Mitchell & Company, Montreal, showed a portable fare box combined with a register and bell. This device is arranged so that the passenger places the fare in the slot of a box carried by the conductor, but the money cannot enter the box without the fare being registered and ringing a bell. It is absolutely impossible to get the coins or fares out of the box without unlocking it.

The Rochester Car Wheel Works, of Rochester, N. Y., exhibited car wheels of the Salisbury iron in Barr contracting chill, from twenty to thirty-six inches in diameter. One wheel, thirty-three inches



EXHIBIT MADE BY THE SCARRITT CAR SEAT CO.

in diameter, was exhibited, which had made a record of over 10,000 miles, and which showed a loss of sixty pounds of metal due to wear. The company was represented by F. D. Russell and George C. Morse.

The Cutter Electrical & Manufacturing Co., of Philadelphia, exhibited the C.-S. automatic magnetic cut-out, the features of which are so well known that they do not need further description. This cut-out was in practical operation, and the practical tests of it in charge of W. E. Harrington, the company's engineer, attracted considerable attention. The company's Boston agent, C. E. Bibber, was also in attendance.

The Maxwood Brake Shoe Co., La Crosse, Wis., represented by B. E. Edwards, showed a compressed wood brake shoe. The wood for these shoes is treated with a compound, and then subjected to hydraulic pressure of 3,000 lbs. to the square inch. The company claims that it grips the wheel with 25 per cent. less power than an iron shoe, will not wear the wheel and brakes much smoother than an iron shoe.

Charles G. Smith, of New York, had a very nice exhibit of oil and electric lamps, including center lamps, both single and in clusters. Lanterns of various kinds were also shown, globes of various patterns, soldering torches and one or two spools of bell cord in extremely long



EXHIBITS MADE BY THE MATHER ELECTRIC CO. AND WM. WHARTON, JR, & CO.

lengths. The exhibit was very tastefully arranged, and the brass finished and polished goods made it an attractive one. Chas. G. Millen was in charge.

The Guarantors & Liability Indemnity Co., of Philadelphia, was represented by Messrs. Haas & Wilson, general agents for the South. These gentlemen erected a very handsome booth, which was quite popular, owing to the distribution of handsome leather card cases or bill holders. These contained the information that the leading street railways throughout the country are insured with this company, covering the liability of common carriers.

The New York Electrical Works, of New York, was represented by C. W. Van Fleet. The exhibit consisted of a full line of overhead material, embracing circuit breakers, crossovers, hangers and insulation. This company's devices are all put together without the use of solder, using various mechanical methods for accomplishing this purpose. The goods shown were the same as are used as standard by the Brooklyn City Company and several others.

The Leonhardt Pneumatic Safety Car Fender Co., of Baltimore, Md., exhibited a model fitted with its latest type of fender. The company also showed a working model, full size, so arranged that the car to which it was attached could be operated by hand. Tests were

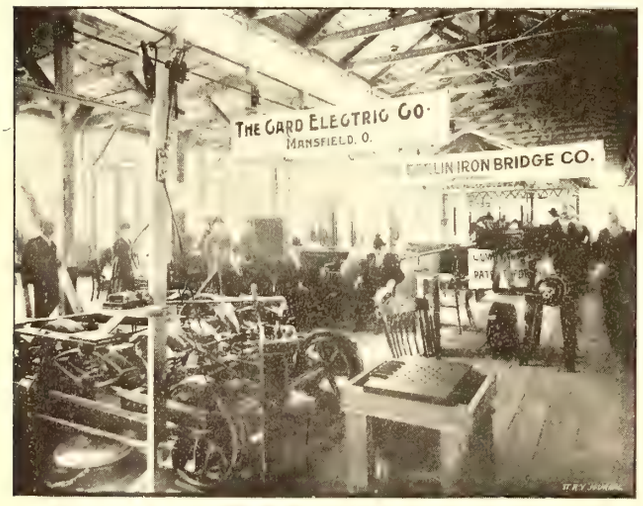


THE OHIO BRASS CO.'S EXHIBIT.

made of it, during the two days of the exhibition, along one side of the hall. The company was represented by its president and manager, William Leonhardt, and its treasurer, N. M. Rittenhouse.

The Vernon Fare Register, was shown at this Convention for the first time by Henry G. Winser, of New York City. Its simplicity of construction, and the fact that it is made under the supervision of practical street railway men, make it a matter of considerable interest to those in attendance. This is the register which accurately counted about 30,000,000 visitors at the Columbia Exposition last year.

The Meaker Manufacturing Co., of Chicago, Ill., was represented by its president, J. W. Meaker, who exhibited portable and stationary registers of two or three types, which are already well known to street railway men because of their wide use on many of the largest systems in the country. Mr. Meaker also took pleasure in exhibiting a new mechanical clip for overhead line use. This attracted a great deal of attention, and was highly commented upon by street railway men.



THE CARD ELECTRIC CO.'S EXHIBIT.

The R. A. Crawford Manufacturing Co., of Pittsburgh, was represented by R. A. Crawford. This company exhibited a full line of its patent fenders. The exhibit was very complete and showed fenders to meet every requirement in connection with street cars, for use in front and underneath the cars. The company has just supplied the Norfolk Street Railway Company, of Norfolk, with pick-up fenders; also the Paterson, Passaic & Rutherford, and several other roads.

The General Agency Co., of New York, which is the selling agent of George C. Dressel & Company for the "Dragon" headlights, had a very handsome exhibit consisting of beautifully finished headlights of various patterns, set off to good advantage by potted plants and ferns. The exhibit included various types of oil and electric headlights manufactured by the company. Jos. R. Ellicott, the president of the company, was at the Convention, and was highly pleased with the results of his exhibit.

The Jewell Belting Co., of Hartford, Conn., showed a section of three-ply Jewell railway dynamo belt, which had transmitted 1,140 H. P. at a speed of 5,200 ft. per minute. In addition to this, samples of bell cord for street railway cars were shown, as well as Jewell dynamo belt dressing and cement. Attention was also called to the fact that the company had in operation at the plant of the Georgia Electric Light Company a forty-eight inch belt. The company was represented by C. L. Tolles.

Joseph Pomeroy, represented the firm of Pomeroy & Fischer, of New York, who exhibited a full line of the celebrated Nobles & Hoare's English varnishes, and colors for street car use. They also showed a change pocket in brass, which is applied to the front stile of car doors for facilitating the collection of fares on the front platform without opening the car doors. This is a patent of C. E. Garey, master car builder, of Dry Dock, East Broadway, & Battery Street Railroad, New York City.

President Stanwood, of the Stanwood Manufacturing Company, of Chicago, of course, was on hand shaking hands with old friends and talking Stanwood steps to new comers. The exhibit of this company consisted of steps in use on the exhibition car of the Jackson & Sharp Company and of the Sperry Electric Railway Company, and, in this way, fully demonstrating by practical use the superior advantages of the well known Stanwood step which is now in use on over half the roads in the country.

The Consolidated Car Heating Co., of Albany, N. Y., made, as usual, a creditable exhibit of electric car heaters. The company was represented by James F. McElroy, its consulting electrician; E. F. Smith, general Western agent, and H. N. Ransom, of the electrical department. A number of heaters were shown, connected in place under

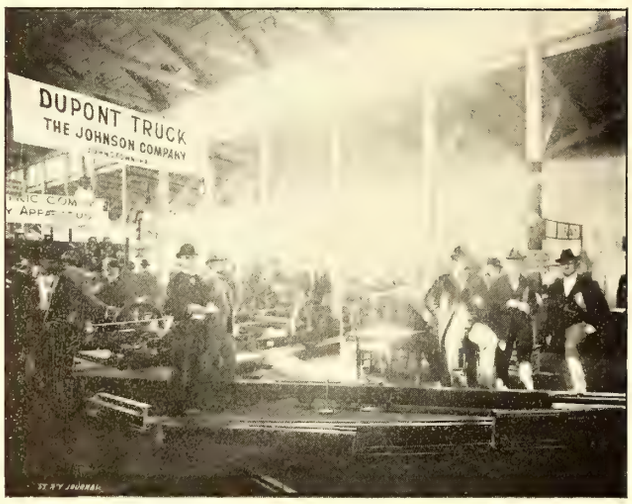


EXHIBIT OF THE JOHNSON CO.

the car seats, and some were shown in operation on a table, where they could be closely inspected. The switches, etc., used in connection with the heating system were also shown.

The Wallace Electric Co., was represented by its secretary, Max A. Berg. Among the specialities exhibited by this company, were Robinson's patent trolley wheel, Fletcher's rapid transit switch and the Paulson rail bond caps, of which the latter were distributed among those in attendance as souvenirs. The pamphlet distributed by Mr. Berg was gotten up in a very neat and attractive manner, and contained cuts and description of the various railway specalities, manufactured and sold by the Wallace Company.

The Hartford Woven Wire Mattress Co., of Hartford, Conn., was represented, as usual, by H. E. Evans. The types of car seats which this company makes are so well known that they need very little description. Among the seats shown at the Convention this year, were one or two of a new pattern which have been very satisfactory in regular service. The leading features of these seats are that they are easily cleaned, that a car equipped with them is also readily cleaned, and that they occupy a minimum amount of space.

The Davis Car Shade Co., of Portland, Me., made a very nice exhibit which was in charge of that well known veteran, C. M. Fuller, assisted by L. P. Hicks. This company showed a section of steam car containing various styles of shades, also a full sized section of an open car fitted with waterproof curtains. These shades have been adopted by the Philadelphia Traction Company, of Philadelphia, the West End, of Boston, Buffalo Street Railway Company, and many other roads which have given the strongest testimonials in their favor.

Linburg, Sickel & Co., of Trenton, N. J., were represented by J. Linburg and J. R. McCardle. They had on exhibition one of the Trenton trolley wagons, which was illustrated and described in our October issue. This attracted the attention of all the street railway men who are interested in the construction and repair of overhead trolley lines. The feature which excited the most interest was that which permitted the top of the wagon to be extended so as to allow the passage of a car on the track without interference from the wagon.

The Mather Electric Co., of Manchester, Conn., was represented by Thos. C. Perkins, vice-president. This company had en-

gaged large space and intended to make an elaborate exhibit of its new multipolar railway generator, but the company got so far behind with its orders that it was obliged to ship the apparatus which was intended for this exhibit, and the time being so short, it was unable to duplicate the exhibit. Mr. Perkins reports that his company has on hand orders sufficient to keep the factory busy for the next three months.

The Stirling Co., Chicago, made a very interesting and novel exhibit, showing a working model under steam and pressure. The model, having glass heads, enabled one to see the interior working of the Stirling boiler in actual operation. It attracted a great deal of attention, and it was the universal verdict that the circulation was marvelous. Many remarked that they had learned more of the generation of steam in ten minutes as here shown than they had in ten years of theory. Thomas Deegan, the secretary of the company, had charge of this exhibit.

The Central Electric Heating Co., of New York, showed three styles of its American car heater, styles A, B, C, designed for different types of cars. The company has equipped over 200 roads with its heaters, and has just closed a contract for the entire system of the north side of Chicago, and reports having three times as many orders as at this time last year. The heaters on exhibition were connected up and shown in actual operation. The company was well represented by Edward B. Wyman, manager, assisted by R. S. Jerome and Sydney Hoch.

The Fuel Economizer Co., of Matteawan, N. Y., was represented by B. Pearson. The company showed a case of specimen castings of



ONE FEATURE OF THE PENNSYLVANIA STEEL CO.'S EXHIBIT.

pipes for its economizers, each pipe tested up to 350 lbs. pressure per square inch. The smoothness and perfection of these castings were commented upon by every one familiar with this class of work. E. Green & Son, Manchester, England, the patentees of these economizers, have been awarded gold medals at all the exhibitions since 1851, including the Antwerp Exposition, where they were awarded the gold medal and first honor.

The St. Louis Register Co., of St. Louis, was ably represented by J. W. Allison, vice-president, and Gustav Rein, superintendent. This company had on exhibition a combination register for cars with an open and a closed compartment, such as are used in the extreme West. Also a combination register for use on double deck cars, a register that will record two fares, or a fare and a transfer, was another feature of this exhibit. The company claims to be the pioneer in exposing the mechanism of street car registers, and showed some handsome models with the works in full view.

The Michigan Electric Co., of Detroit, Mich., was well represented at the Convention by its president, Jos. E. Lockwood, who made a very attractive and creditable showing of "Michigan" overhead material, including a full line of switches, pull-offs, crossovers, insulators, etc. In addition to this, there was shown a "Michigan" signal light for electric cars, which is intended to be attached to the trolley base, and has been in use on the Detroit Citizens' Street Railway for over a year. Mr. Lockwood provided visitors with a very handsome little catalogue describing his apparatus.

H. J. Wightman & Co., of Scranton Pa., were represented by H. J. Wightman. This company showed an automatic block signal for electric railways, and also a full line of overhead material. The signal exhibit was arranged and connected up electrically to work as if in practical operation. The signal is operated by the passing of the trolley over a contact device which lights up or extinguishes lamps placed in boxes for this purpose; the danger signal is red and the clear signal white. This system is in operation on the lines of the Middletown & Goshen Traction Company, Middletown, N. Y.

The Ohio Brass Co., of Mansfield, O., showed a full line of type W overhead construction material, also the Jewell trolley sling, Spillman trolley ear, the pneumatic quick-break switch, a full line of motor bearings, the reversible and adjustable track broom holder, the Ohio trolley, Wood's flexible pole bracket and other specialties. The large

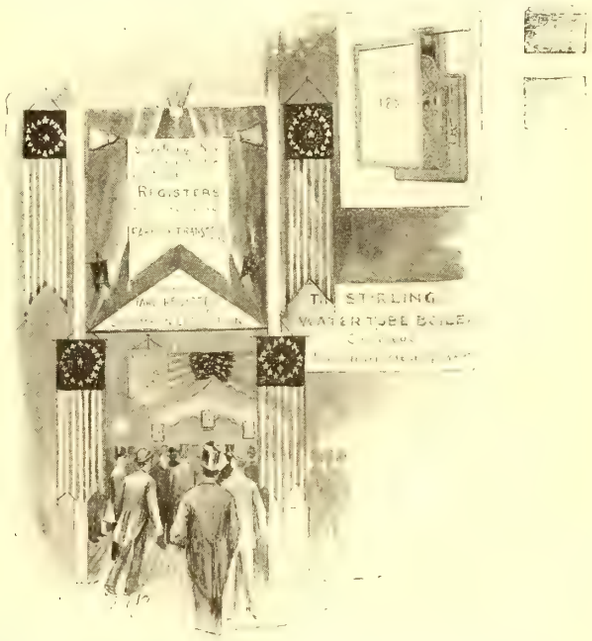


THE CREAGHEAD ENGINEERING CO.'S EXHIBIT.

sample board on which was displayed many of the company's specialties was tastefully and elegantly gotten up. The company distributed a magnificent souvenir, illustrating the various devices used in electric street railway work and manufactured solely by them. C. K. King officiated.

The Adams & Westlake Co., of Chicago, was represented by L. E. Gray, of Chicago, and Geo. A. Cushing, of New York. Samples were shown of Acme curtains for open street cars, shades for car windows, Bessemer sheet steel headlights and Emery platform gates. The curtains for car windows and open cars attracted considerable attention. It was stated that, although the patent on this style of curtain was granted only about nine months ago, more than 10,000 of them have since been sold. The principal feature of the platform gate is the ease with which it can be operated by one man only. Various styles of leather hand straps were also shown.

The Sterling Supply & Manufacturing Co., of New York City, made a very creditable exhibit of fare registers, sand boxes, and fenders, which are this company's specialties. The exhibit was very tastefully designed and contained among other decorative features, a large oil painting of Mr. Benton, who is now in the employ of the



ONE VIEW OF THE NEW HAVEN CAR REGISTER CO.'S EXHIBIT.

company, and who built the register twenty-five years ago, used on the Third Avenue road in New York, and who designed the Sterling register now used on the Broadway line. Sterling sand boxes and fenders attracted no less attention than the registers. The company was represented by J. H. Carson, John B. Benton and J. J. Kennelly.

The Young Lock Nut Co., of New York, was represented by R. D. Stewart. This company exhibited its gravity nut lock and the Brownley injector, the Wrought Iron Bridge Company's flexible bracket for trolley lines, the Brownley brake shoe and the Technic

Electrical Works' rail bond. The gravity nut lock and rail bond are well known to street railway men. The flexible bracket has been adopted by several Ohio roads. The new brake shoe is cast with recesses for the purpose of disposing of the dirt and grit. The injector possesses the novelty of having no valve, and is claimed to feed at a lower boiler pressure, and with hotter water than any injector on the market.

The Allen Electric Supply Co., Philadelphia, was represented by E. H. Allen. The company is just introducing a new trolley base,



CAR FITTED WITH GENETT AIR-BRAKE.

which possesses some good and novel features. It operates perfectly at any angle and will hug the roof of the car closely, when going under bridges and low structures, without changing the tension of the trolley springs or affecting them in any way, and consequently not increasing the pressure on the trolley wire. The springs are enclosed within metal tubing which thoroughly protects them from the weather, snow or sleet. Mr. Allen also represented the Car Equipment Company, of Philadelphia, which manufactures and handles a full line of railway supplies.

The Creaghead Engineering Co., of Cincinnati, O., exhibited overhead line material of every description, including frogs, crossovers, switches, insulators, etc. Bonds and splices were shown, and on a



THE GENETT AIR-BRAKE CO.'S EXHIBIT.

large show board were exhibited photographs of construction work in various parts of the country, which has been done by the company. Samples of Day's Kerite wire, trolley wheels, etc., were also included in the exhibit. The principal feature, however, was a flexible pole bracket, of which the Creaghead Company is now making a specialty. This bracket attracted considerable attention, and no opportunity was lost by the company's representative, G. R. Scrugham, for explaining its merits.

The Bass Foundry & Machine Works, of Fort Wayne, Ind., exhibited one pair of rubber cushioned wheels on axles, and rubber cushioned and cast iron wheels, as well as axles, both hammered iron and hammered steel. It was the intention to have a pair of rubber cushioned wheels which have been in service, and made a mileage of between 125,000 and 150,000, miles at this exhibit, but they failed to arrive in time. These wheels are still in good condition, and will add several thousand more miles to their record. The Bass Company has just opened its new foundry at Lenoir, Tenn., and will fill orders promptly for the Southern country direct from those works. P. F. Leach was the representative.

The Dorner & Dutton Manufacturing Co., Cleveland, was represented by W. A. Dutton, and John S. Pugh. The company exhibited its solid forged motor truck, No. 25, in the exhibit of the Walker Manufacturing Company. This truck was equipped with two of the company's thirty horse power, spring mounted motors connected up and operated with a device arranged to show the effect of rough track and uneven rail joints. The truck was painted a rich maroon striped in silver. This truck was equipped with the company's quick acting brakes, illustrating the action of both truck and motors, under various conditions of load. The company also showed a Shehan's patent spring car wheel of which it is the manufacturer.

The Georgia Equipment Co., Atlanta, Ga., showed the Allen line material, consisting of a full line of overhead material, trolley wheels, harps and bases. The company also showed samples of the Johnston rail bond, specialties of the R. Woodman Manufacturing & Supply Company, Boston; headlights manufactured by the Wheeler Reflector Company, Boston; the Beacon Vacuum Pump & Electric Company's incandescent lamps; the Hubley Manufacturing Company's line of goods, the Medbery overhead line material, Empire Electric Insulation Company's insulated cloths, Wood's patent platform gate, made by the Bliss Manufacturing Company, of Pawtucket, R. I., a number of Eddy motors, and several other specialties belonging to the street railway field, of which they are the agents in Atlanta.



CENTRAL ELECTRIC HEATING CO.'S EXHIBIT.

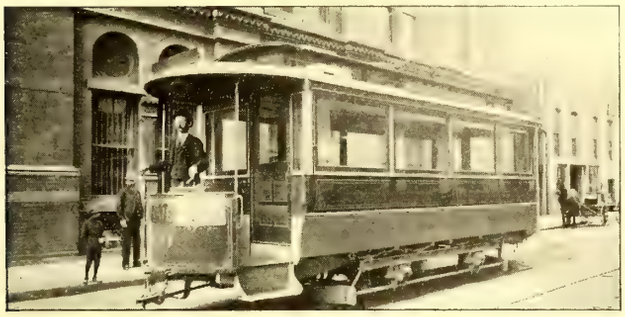
The Berlin Iron Bridge Co., of East Berlin, Conn., sent as representatives John M. Field and J. C. Murphy. The exhibit of this company was one of the most unique and striking in the exhibition hall. The company showed, on a small scale, a steel power station for electric roads, the station being 20 × 20 ft., and twenty-four feet high, the construction of this model being a miniature reproduction of the railway power house. It had a steel trussed roof covered with galvanized corrugated iron, lined with Berlin patent anti-condensation roof lining, the whole supported on steel posts. The work of construction was in charge of Mr. Murphy, and was done in a very fine manner. The exhibit attracted a good deal of attention, and received much favorable comment.

The International Register Co., of Chicago, was represented by Manager A. H. Englund, and made a very interesting and complete display of its portable and stationary register, including a specially made machine for several large street railway companies. The company also showed, for the first time, its new numeral form stationary register. This machine is an exact duplicate of the company's well-known portable register and is extremely simple and complete. One of these machines was exhibited with the mechanism exposed, showing every part entering into its construction. The company also showed samples of its stationary register dial and pointer. All of these machines were finished with aluminum tubes and presented a very fine appearance on the show board.

The R. D. Nuttall Co., of Allegheny, Pa., showed a full line of overhead material, including every variety of switches, crossovers, trolley hangers, insulators, etc., as well as trolley wheels and a complete trolley outfit, including base, pole, harp and wheel. The company was represented by its various agents, including the Standard Railway Supply Company, of which Garson Meyers is president, of Chicago; Arthur S. Partridge, of St. Louis; Chas. N. Wood, of Boston; Chas. A. Cooagna, of Cincinnati, and Chas. J. Mayer, of Philadelphia. In the same space, the Standard Railway Supply Company, of Chicago, exhibited "Standard" stoves and "Gilt Edge" steel gongs. Nuttall gears and bearings were also shown, and new catalogues were given out to street railway representatives.

The Fiberite Co. and the Mason Electric Co., Chicago, kept open house in parlor 24, Aragon Hotel. A very large and complete exhibit, particularly of the Medbery overhead material, was shipped from the

factory, but failed to reach Atlanta until after the close of the Convention. This was alike disappointing to the companies and to the delegates who were very anxious to examine the material that has been adopted by such a large majority of the leading traction companies. Mr. Mason was constantly in attendance, entertaining his many friends and in explaining the advantages of the Medbery material. A number of very satisfactory trial orders were booked, and notwithstanding the failure to make a display, the opinion of a great many managers was in favor of making the Medbery the standard for overhead construction.



BARNEY & SMITH EXHIBITION CAR.

The Pennsylvania Steel Co., of Steelton and Philadelphia, was ably represented by Edmund N. Smith, treasurer; Jno. F. Ostrom, sales agent; Chas. S. Clark, Boston agent; Mason D. Pratt, engineer; and Chas. Reinoehl. This company showed various sections of girder and T rails placed in a pyramid, embracing the principal sections or forms now in use. Also samples of the Pennsylvania Railroad steam crossing, with the improvements made by the Pennsylvania Steel Company, samples of built T and girder rail work, including frogs, switches and entire crossing, and samples of curved rails. The leading features of this company's exhibit was the solid cast steel frogs, switches and mates of nine inch construction. This work has been adopted by several of the leading roads in this country. Samples of rail braces, tie plates and brace tie plates were also shown.

The Lewis & Fowler Manufacturing Co., of Brooklyn, N. Y., made an exhibit of the Lewis & Fowler improved register in a very handsome finish of nickel and gold. The rim of the register was nickel plated. The Acme car jack was shown, and a number of orders for it were taken, among which was one from one of the Atlanta roads. In addition to these, the company exhibited the Lewis & Fowler improved pattern stoves, finished with nickel plated box. The company was represented by Geo. S. Whipp and Frank A. Morrell, of Brooklyn. Mr. Whipp stated that he had done a good business at the Convention. He reports having sold either at the Convention,or immediately preceding,three Lewis & Fowler sweepers for Carbondale, Pa.,one sweeper for Scranton, Pa., as well as sweepers for Norwalk, Waterbury, New Britain, New Haven and Hartford, Conn.

Chas L. Cornell, of Hamilton, O., made a very interesting exhibit of an electric soldering iron for street railway repair shops. The iron is adapted to be joined in series with the incandescent lamps which light the shops or car barns. This is the first time these irons have been shown in public, although they have been in use in the Hamilton car barns for some time. The device is extremely simple in construc-



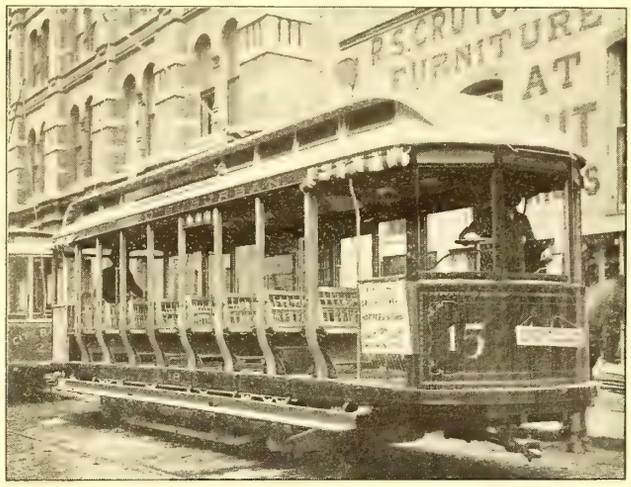
BARNEY & SMITH EXHIBITION CAR.

tion, and can be used by any ordinary employe. Mr. Cornell also exhibited an arc headlight for trolley cars, to be used in series with the main lamps which light the interior of the car. This lamp has never before been put on the market, although twenty of them have been in successful operation, by the Hamilton & Lindenwald road, for the past eighteen months. This company reports that the expense of operating them is less than the cost of chimneys for oil lamps.

The Card Electric Co., of Mansfield, O., was represented by Reid Carpenter, president, Geo. F. Card, electrician, and Jno. F. Card, superintendent. This company exhibited its thirty-five horse power. single motor equipment and its seventy horse power, double equipment designed for interurban roads, and mounted on the Fulton Truck & Foundry Company's Imperial truck. It also showed a single motor controller and a new series parallel controller with its double equipment. This company showed for the first time its pneumatic quick throw switch for heavy currents. Another special feature of this company's exhibit was a commutator turning device, for turning off commutators without removal from the machines. This is the company's first exhibit at a street railway convention, and the representatives all expressed themselves well pleased with the attention shown their display.

The Burrowes Car Shade Co., of Portland, Me., was represented by John W. Baker. The exhibit showed inside curtains for street and steam cars, as well as for use on coaches and steam boats. The company showed a cabinet with two inside curtains of very handsome design, one showing the waterproof "Oakette." The exhibit also included a cabinet containing five shades of various styles. Another, and perhaps the most important feature, was the section of an open street car showing the "Oakette" patent open car shades. This shade is claimed to be a decided improvement over the cloth shades in common use, being waterproof and much more durable. A new feature of this is the metal shield which adds considerably to the appearance as well as strengthening it. Many new features of curtain goods, of patterns controlled exclusively by this company, added interest to this very handsome exhibit.

The Graham Equipment Co., of Providence, was represented by Chas. O. Lenz, the secretary of the company. This company reserved space and had counted on making quite a display, but failed to get the equipment for its exhibit there in time. It, however, had eight trucks in service on the Atlanta Traction Company's lines. The company expected to have some of its new snow plows on exhibition, showing the improved method of keeping the track open during severe storms without extra crew or motor equipment. This new plow occupies but



JACKSON & SHARP EXHIBITION CAR.

seventeen feet in the car shed, and is always ready for service. One of these plows was in service all of last winter for the Lehigh Traction Company, of Hazleton, Pa., and a letter from its engineer, A. E. Hess, indicates conclusively that it was efficient in storms in which the snow gathered from fifteen to twenty inches in depth, working much more expeditiously than a sweeper, particularly for country lines.

The Taylor Electric Truck Co., of Troy, N. Y., was represented by Jno. Taylor, manager of the company, and exhibited its Taylor improved single truck and the Empire state radial truck, also the anti-heating Eureka metal lined bearing. The trucks shown were the Taylor Company's latest types, embodying the Master Car Builders' standard, which is universally used in steam railway practice. Mr. Taylor says that from his conversation with street railway managers at the Convention, the general opinion was that in construction, the Taylor single and double trucks were the only ones shown incorporating steam railway track construction, which has proven in practice to be the most economical and durable in electric street car service. Mr. Taylor expressed himself as very appreciative of the attention given him and his exhibit by the street railway managers. This truck is fully described and illustrated elsewhere in our columns.

The Niles Tool Works, of Hamilton, O., made a very handsome exhibit of machine tools, including a twenty-four inch engine lathe, a thirty-six inch car wheel borer and a hydrostatic car wheel press. This press, shown in the illustration, will take in wheels up to thirty-six inches in diameter. It is tested up to a pressure of 100 tons before leaving the works. The cylinder is made of the best cold-blast iron, and lined with copper, the lining being well burnished in the cylinder. The ram is eight inches in diameter, and has an eighteen inch stroke. The pump has a single plunger, three-quarters of an inch in diameter. Each machine is furnished with pressure gauge, lock-up safety valve, relief valve, returning weight, tank, etc. It is particularly adapted to pressing wheels on and off axles, such as used for street railroad cars, and it offers exceptional facilities for replacing worn wheels quickly, thereby keeping the car out of service the minimum length of time.

The Genett Air Brake Co., of New York, exhibited the first air brake made for surface roads, and the style of pump formerly operated. In addition to this, the standard pumps, which are waterproof and entirely enclosed, were shown, as well as an assortment of eccentrics. Car

No. 60, a thirty-two foot heavy car, formerly in use in steam road service, was in operation on one of the Atlanta roads, and was fully equipped with the Genett air brake system. This special car was considered a very difficult one to brake, and the hand brake had already proven insufficient. Testing gauges, showing the compression, were used, and an air whistle, which attracted considerable attention, was also a part of the Genett Company's exhibit. The company was represented by E. J. Wessels, general manager, George S. Lee, master mechanic, and O. A. Burter, assistant. The company's new catalogue, which is an unusually neat and attractive one, was distributed for the first time at the Convention.



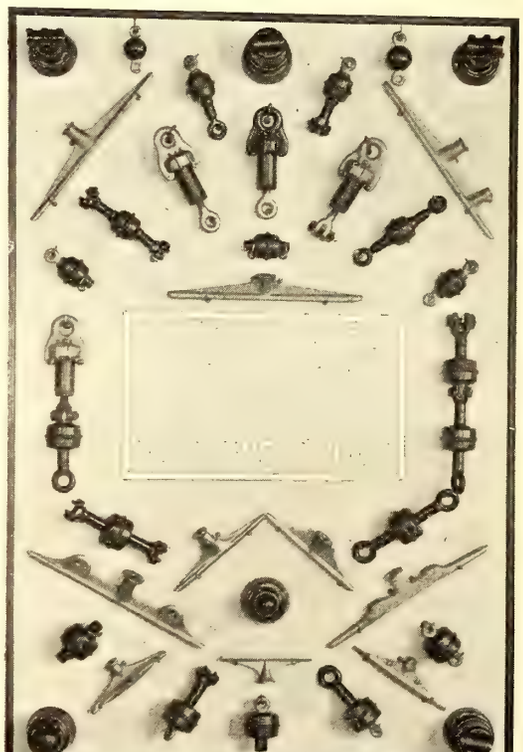
EXHIBITION BOARD OF THE H. W. JOHNS MANUFACTURING CO.

W. E. Haycox, president and general manager, and **Frank A. Rogers**, special sales agent, did the honors for the Fulton Truck & Foundry Company, of Cleveland, and Mansfield, O. This company exhibited a single steel truck "Imperial," which had an improved life guard and "Perfect" under-truss with springs over journal boxes, and improved brake rigging. The exhibit also embraced one of the company's new pattern, maximum traction, double steel trucks "Imperial," which also was equipped with the improved life guard and special swinging brake, particularly adapted for very long car bodies. An improved track cleaner was another feature of this exhibit. This cleaner will adjust itself so as to clear irregular paving next to the rail. The company also showed one of its hydraulic motor lifts for handling either motors or car bodies, particularly adapted for raising and lowering motors. The Troy sand box is another specialty of this company, and was also shown. The company had a very pretty model of its single steel truck "Imperial" on exhibition in the main reading room of the Aragon Hotel. This model perhaps attracted as much attention as anything at the exhibition.

The Falk Manufacturing Co., of Milwaukee, was represented by Albert Hoffman. This company exhibited a new patented trolley wheel and also a specimen cast rail joint. The wheel is made of a special soft cast steel and by a new process which gives the metal the malleable quality of brass or bronze, the metal being cast in this condition and not malleableized. One of the prominent features claimed for this wheel is that it will not blister, form a groove or form an arc. The company guarantees the bushings of its wheels to run 7,000 miles without any repairs. Wheels are now in use that have already run 9,000 to 10,000 miles, and are still giving satisfaction. The rail joint shown by this company is a new departure in joints, and makes a practically continuous rail. To make the joint, the company uses a portable cupola for melting the metal, which is poured in the mould around and in the joint. This metal possesses the rare quality of uniting with the rails quite the same as if welded. The company has already contracted to introduce this new process on three miles of track for the Citizens' Railway Company, of St. Louis. Mr. Hoffman did a big business at the Convention.

The Jackson & Sharp Co., of Wilmington, Del., was represented by Job H. Jackson, president of the company, and by Geo. E. Pratt, contracting agent. The company had on exhibition two cars, one open eight seat vestibule, which is an entirely new feature, Atlanta thus having the credit of first having it running in its streets. The feature of the car is the vestibule ends, and the curtains on the sides coming clear to the floor, thus forming, when closed, protection against storms. The car is mounted on the Peckham truck, and equipped with G. E. 800 motors. The closed car is an eighteen foot body finished in mahogany, plate glass, and upholstered seats covered with plush. The windows are equipped with roller curtains, with a patent device of the Jackson & Sharp Company, which permits the curtains to remain in any position desired. The car has extra wide platforms and is painted a rich maroon and cream. It is equipped with Stanwood steps, sand boxes and everything to make it complete. It is mounted on the McGuire truck, and equipped with Westinghouse apparatus. Both cars have been in the service of the railway company in Atlanta, and been used for conveying the city and railway officials to different points of interest in and about the city. The company has built nearly 300 cars within the past eight months, and duplicate orders are constantly being received.

The Johnson Co., of Johnstown, Pa., owing to the fact that it has a large Southern business, with headquarters at Atlanta, made a good showing at the Convention. The exhibit included the guarantee track construction which the company insures for a given percentage. This consists of nine inch deep special work, with frogs, switches and mates, and is intended to increase the life of the points. These plates were made of steel treated with the Harvey process, and were bedded in babbit metal, so arranged that they can be removed and new ones substituted, without disturbing the street pavement. In addition to this special work, rail sections were shown, one of which was ten and a half inches deep. Alongside of it, on the same board, were shown old specimens, which were formerly in general use, which were less than half as high as the modern types. Besides the rail exhibit, the company showed the Dupont truck. The special feature of this truck is the ease with which the wheels can be removed. The truck frame is made of solid steel bars, and, although of very massive construction, does not weigh more than other trucks of the same strength and durability. The company was represented by Daniel Coolidge and E. B. Entwisle, from Johnstown; W. W. Kingston and Eugene Thomas, of the Atlanta office; Maj. H. C. Evans, of New York; A. S. Littlefield, of Chicago; E. O. Evans, of Boston; O. C. Evans, of Cincinnati, and W. E. Boughten, of Philadelphia.

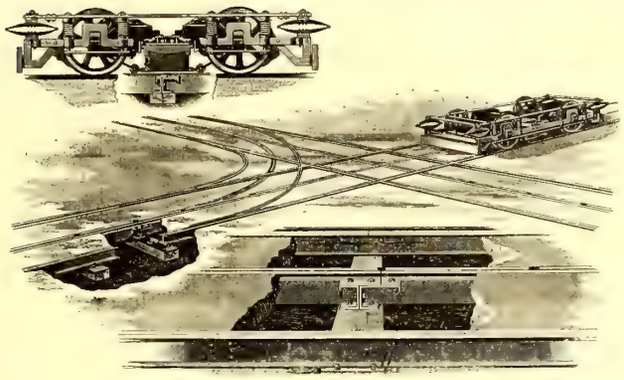


EXHIBITION BOARD OF THE H. W. JOHNS MANUFACTURING CO.

Jas. F. McLaughlin, of Philadelphia, captured every one's attention with his exhibit at the Kimball House, where he had on exhibition a large model of his newly devised method of distribution of the current for propelling street cars electrically by means of a buried conductor. The method of distribution consists of a main tube of cast iron of the same height as the rail, made in sections of fourteen feet each, which are bolted on the ties midway between the track rails. In the center of this tube is placed the main line conductor which is an iron rod, the cross section of which is dependent upon the amount of power used. This rod is continuous, and carries the current, it is insulated from the iron tube by a bituminous cement. The current is distributed to the car motor by means of the surface sectional conductors, in conjunction with a flexible controlling device mounted between the two car motors. The controller carries two collectors in the form of flat metal wheels, which are in constant contact with the sectional surface conductor. The electrical connection is made, the inventor claims, without the use of switches, magnets or automatic devices, the method as yet being kept secret, awaiting the granting of additional patents. The inventor claims that there is no possibility of "grounds" or short cir-

cuits between the rails and the surface conductor, for the reason that there is no current in the conductor except the section directly under the car. Mr. McLaughlin and his associates say they will be ready, in a short time, to equip roads with this device, at a less cost than with the overhead system.

The New Haven Car Register Co., was well represented by F. Coleman Boyd, vice-president, and John S. Bradley, secretary. Samples were shown of an entirely new idea in the line of registers, which consisted of an appliance for registering three different denominations of fares or two fares and a transfer. This machine is arranged to ring



McLAUGHLIN'S CONDUIT SYSTEM.

with the rod device arranged in a very simple and complete manner, or with cord, either in combination or by use of cords alone. In addition to registering the different denominations of fares separately, it also totalizes each of the denominations separately. The resetting of the register to 0 and of the number and direction of the train trip and also the locking of the machine so that no fares can be rung up during the conductor's absence, is all accomplished by the operation of one knob. The company also manufactures double machines on the same plan arranged for two fares or one fare and a transfer. The machines exhibited were finished in bronze, nickel and antique copper and were all handsomely designed. The Atlanta Consolidated road has just adopted this company's machines such as were shown on exhibition. They were also on exhibition cars of the Jackson & Sharp, Brill and other companies. The exhibit shown here was in part the exhibit made at the World's Fair, where this company received the highest and only reward for stationary fare registers, this exhibit having, of course, all the latest improvements added, and created universal admiration. Did you get one of those pretty inkstands they were so liberal with?

The McGuire Manufacturing Co., Chicago, exhibited in the hall one pair of adjustable traction trucks which were sold to the Atlanta Consolidated Street Railway Company and go at once into service. The Columbian car heater was shown for cars having either seats placed lengthwise or crosswise. These are of the self-feeding type, are supported above the seat without cutting or injuring the car, are of unique and ornamental design, and constructed with a ventilated jacket

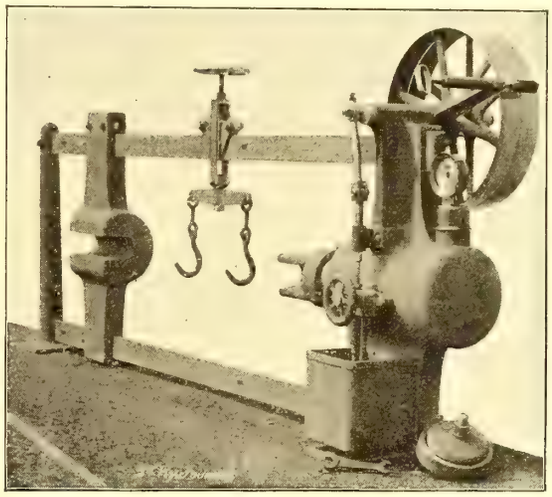


EXHIBIT OF THE NILES TOOL WORKS.

which admits of passengers sitting in actual contact with the case without burning or indeed any discomfort. The company took several orders at the Convention, and has received orders up to the time of the Convention for over 500 stoves. The company had in operation one pair of adjustable traction trucks under a thirty foot closed car body; also a Columbian truck with three-quarters elliptic springs which was equipped with the McGuire Company's new air brake for electric cars. This new air brake was in operation on one of the Atlanta Consolidated Street Railway Company's cars and is one of a lot ordered by this company. The brake was in constant use during the Convention and attracted favorable comment from the street railway men. The company also had in operation an A 1 suspension truck under the closed, eighteen foot exhibition car of the Jackson & Sharp Company, which was much admired for its simple and substantial appearance and easy riding quality. The company was represented by W. J. Cooke, vice-president, and J. A. Hanna, sales agent of the Philadelphia office.

William Wharton, Jr., & Co., Incorporated, of Philadelphia, Pa., were represented by Powell Evans, from the Philadelphia office. Their exhibit consisted of track material, showing rail sections, chairs and brace tie plates, special work on broken main line, crossovers and branch-offs, also a derailing switch for steam railway crossings. A Columbian transfer table, of the company's make, was also shown. A marked feature of this exhibit was brake shoes, representing patterns in use on various railways all over the United States, samples from manufacturers, and an exhibit of the company's own make of shoes. This company is very much interested in producing the highest and best grade of shoes as regards material, and in bringing about the general adoption of a satisfactory pattern as regards shape. It manufactures shoes of the various materials now in demand, and of all patterns to fit the various styles of trucks and wheels. One of the favorite types of shoes shown at the Convention is made of medium soft cast iron, with four wrought iron lugs inserted, representing about 20 per cent. of the frictional face of wrought iron. This type of shoe is widely used, and has an enormously increased life over all cast iron shoes, and at the same time causes no more wear on the wheel than a shoe made entirely of cast iron. Another point in connection with this type of shoe is that it holds the wheel very strongly, and makes it very safe and easy for the motorman. The company's wooden face shoes are now becoming widely known, and are at present used on over fifty railways in this couutry.

The H. W. Johns Mfg. Co's exhibit was exceptionally tasty, and attracted well merited attention. The prevailing color of the exhibit was white, thus throwing the various samples into contrast with their surroundings. The columns supporting the framework surrounding



NILES TOOL WORKS CAR WHEEL PRESS.

the space were covered with asbestos manufactured by the company. Two large, conspicuous sample boards and numerous loose samples afforded an easy examination of the display of overhead trolley line insulating materials, including the frogs, switches and rail bonds furnished by this company. A model very nicely exhibited the application of the Grauten rail bond in practice. Attention was drawn to the economical and practical qualities of the "H. W. J." "Perry" and Philadelphia mechanical clips. This material, as well as the various samples of vulcabeston controller pieces, bushings, commutator rings and field magnet spools was fully described in the new October price list, issued previous to the Convention. The vulcabeston steam packing and asbestos pipe coverings were much in evidence and contributed materially toward the decoration of the exhibit. The company presented as souvenirs buttons made of moulded mica bearing the inscription "Atlanta A. S. R. A. 1894, H. W. Johns Mfg. Company" which were worn by the delegates and others in attendance during their stay. The company was well represented by W. F. D. Crane in charge of the company's electrical department in New York, Mr. Henry G. Issertel and W. H. Gould, also of New York, and Mr. J. W. Perry, manager of the electrical department of the company's branch house in Philadelphia. These representatives were ably assisted by Mr. E. Hatch, secretary of the Johns-Pratt Company and Mr. Herbert Luscomb of Hartford. (See illustrations on page 740).

The Barney & Smith Manufacturing Co., of Dayton, O., had on exhibition two cars, both eighteen feet inside, with four windows to each side with stationary sash, polished plate glass and curtains with Burrowes fixtures. One of these cars belonged to a lot for the Cincinnati Street Railway Company. It had double automatic doors at both ends, and square vestibules of the Cincinnati pattern at motorman's end only. The interior finish of this car was natural cherry handsomely hand carved throughout. The seats and the backs were upholstered with Barney & Smith patent springs, and covered with crimson mohair plush. The exterior was painted in a pleasing light yellow, relieved with a neat ornamentation. The smoothness and beauty of the finish attracted much attention. The other car was one of a lot of forty for the City Railway Company of Dayton, O. This car had also four windows of polished plate glass on each side, and had a round vestibule of the Barney & Smith pattern at the motorman's end. This vestibule feature attracted special attention, being constructed with sliding

curved sash and glass, thoroughly protecting the motorman and giving him a clear view in every direction. This car had double automatic doors at the vestibule end, and a single door at the rear and placed to one side of the center, thus affording easy passage to and from the car without having to push through a crowd on the platform. This car was also finished in natural cherry and the carving was of special design gotten up by the designer of the Barney & Smith Company. The seats and backs of this car were constructed in a similar manner to those of the car for Cincinnati. The covering was of old green mohair plush. Both cars were mounted on Barney & Smith pattern trucks with equalizer coil springs and half elliptic body springs. These trucks have a spring base of thirteen feet, and are provided with an extension brace for long cars. These cars were used to carry the crowds to and from the circus grounds of the Barnum & Bailey circus on the first day of their arrival, and stood this severe test in a manner that reflected great credit on their construction. The cars were both equipped with Barney & Smith sand boxes, drawbars and steps. The company was represented by A. M. Kittredge, superintendent, and J. M. Hopkins, contracting agent.



Flood & Conklin, of Newark, N. J., presented delegates with a neat little stamp box.

Carleton & Kissam presented to the street railway men a very handsome paper knife, which was in great demand.

The Charles Munson Belting Co. presented a very handsome vest pocket memorandum book with a leather cover.

Charles A. Schieren & Co. gave away a handsome little memorandum book of vest pocket size, bound in leather back and edge, with celluloid cover.

The H. W. Johns Manufacturing Co. called attention to its exhibit of vulcabeston and other materials by a moulded mica button, intended for the lapel of the coat.

The Jewell Belting Co. presented delegates with a souvenir morocco case, for paper currency, similar to the one which the company has before presented as a souvenir.

The John Stephenson Co., found plenty of demand for a very serviceable steel tape, which was given away as an advertisement of its business, and as a souvenir of the Convention.

William S. Silver & Co., distributed a large number of glass fountain pens, inside the hollow glass handle of which was placed a small card calling attention to the various supplies which they handle.

The New York Electrical Works, represented by C. W. Van Fleet, gave a little button made of insulating material, such as is used in the overhead material supplied by the company for street railway use.

The Washburn & Moen Manufacturing Co., of Worcester, Mass., presented to some of those present a neat paper weight made of a section of steel rail, in the center of which was shown a joint made by the Keithley rail bond.

Arthur S. Partridge, of St. Louis, presented three blue pencils in a neat pasteboard case, for the use of street railway men in writing out orders for the street railway supplies for which Mr. Partridge is agent, and which are enumerated on the pencil case.

McNamara Brothers, of Fairhaven, Vt., presented as a souvenir a paper weight made of a sample of slate such as they furnish for switchboard purposes. On the bottom of this paper weight was also a card of the Buyers' Reference Company, of New York City.

The Sterling Supply & Manufacturing Co., of New York City, gave away a new style of blotter in the shape of a roller, on the ends of which were represented the face of the Sterling register, while the handle contained a brief mention of the other goods which the Sterling Company manufactures.

The Scarritt Car Seat Co., through Mr. Nourse, caused considerable excitement by the little "Coons in the Hole" puzzle which he distributed at the Convention Hall. It took many of the delegates several hours to find out that it was only necessary to spin the little box in order to solve the puzzle.

The Guarantors Liability & Indemnity Co., of Pennsylvania, presented a very handsome souvenir pocketbook, made of morocco, calling attention to the company's business, its various offices and agents, and the fact that the leading street railways throughout the country were insured in this company.

The Peckham Motor Truck & Wheel Company distributed a very handsome appropriate souvenir in the shape of a folded morocco book for holding paper money. On the inside, which was of light colored leather, was stamped in prominent shape an illustration of one of Mr. Peckham's street car trucks.

The New Haven Car Register Co. gave away one of the most attractive souvenirs of the occasion. It consisted of a handsome two bottle inkstand and pen tray, at the back of which was a shield containing a print of the latest type of New Haven register. In addition to this, the company also presented a very serviceable paper weight, containing on one side a bronze print of the New Haven register, and on the other side a heavy plate mirror. Both of these souvenirs were much sought after by delegates.

The Sperry Electric Railway Company's Exhibit.

"Pass C. B. Fairchild on Sperry car running between hotels and Convention Hall. This pass carries the privilege of examining equipment and electric brake of Sperry Electric Railway Company.

"By L. H. Rogers, general manager."

The above kind invitation meant an examination of a very interesting exhibit, and one which was decidedly attractive to a large number of delegates. The Sperry motor and flexible clutch have been often described, and nothing further need be said here of its peculiar advantages. The electric brake, however, deserves more than a passing mention, because of its importance to those operating electric railways. While the idea of using the stored energy of a moving car to destroy its own momentum is not new, Mr. Sperry's special application embodies many features of practical interest and value. The peculiar "feather bed" effect of electric braking was illustrated over and over again on the grades of the Consolidated Company's lines, and it was the universal verdict that, for emergency use, the Sperry electric brake certainly had many pronounced advantages over the hand brake.

Walker Manufacturing Company.

The exhibit of the Walker Manufacturing Company at the Exposition entrance, was one of the finest and most interesting that the delegates have had the good fortune to examine in the recent history of the Association. The Walker Company has, for many years past, taken prominent stand among the cable railway builders and designers of the country, and its recent electric railway work is the result of a determination on the part of its managers to acquire a reputation in this larger field equal to that gained in its cable department.

The company's factory being especially designed for the production of heavy machinery, we naturally find a large dynamo prominent in the exhibit. It is a beautifully designed machine, its curves being not only lines of beauty in themselves, but representing a high degree of mechanical strength and electrical and magnetic efficiency. The frame is cast in two parts, the lower carrying the armature bearings and an outside pulley bearing, together with one yoke and two pole pieces, while the upper half consists of a second yoke with its two pole pieces, which is firmly bolted to the body of the machine. The armature is



THE WALKER MANUFACTURING CO.'S EXHIBIT.

of large diameter and low resistance, and has a cooling surface so large as to enable the machine to stand an overload of 50 per cent. without injury. The company exhibits only belt driven generators, but builds in addition several types of direct connected steam generators.

The special point of interest to visitors was not, however, the generators, excellent though these were. The motor truck exhibited by the Walker Company embodies so many new features of value to street railway operators that their attention was concentrated upon this—one of the most promising motors of the present day. The first thing to be noticed by the spectator was the form of a burly negro, visible over the heads of the crowds surrounding the exhibit, dancing up and down apparently on air, but really on a flexibly suspended motor on the truck. This flexible suspension differs from that of other companies, in that the axles have to directly support little more than the weight of a U frame, at the ends of which the motor is swiveled at its center. The forward end of the motor is spring supported, the flexible springs resting on the truck frame, while the rear end is also supported, the flexible springs being carried in the U frame. In consequence of this peculiar method of support, it is claimed that both the "sledge hammer blow" and the "inertia blow" at the rail joint are greatly lessened, and the life of the track and of the cars prolonged. The motor itself is simple in design, many of the best features of other motors being found in its construction.

The series multiple controller was also on exhibition and is remarkably simple in design, its chief feature of novelty being the method of dividing up the destructive spark occurring at certain changes of position by means of a "series break," the result being that the most rapid movement of the controller, when current is on, fails to produce more than a slight and entirely harmless spark.

The company's printed matter was exceptionally complete. A handsome catalogue on "Direct Current Power Generators," another

on "Electric Railway Equipment," and another containing excellent "Rules and Tables on Electric Railway Work," were valuable and interesting for reference. Small pamphlets describing the fine machine shops of the company, and its Hoosick Falls railway installation, together with commendatory letters from the West Chicago Street Railroad Company, Lemuel William Serrell and others, were also distributed. The company was represented at the Convention by Professor S. H. Short, its electrician, and by Wm. H. Bone, General Manager, H. McL. Harding, Eastern agent, B. N. Barr and James Atkinson, Central agents, Frank Kohler and Edward Kohler, Western agents, and R. N. Baylis, who was in charge of the exhibit.

The Peckham Company's Exhibit.

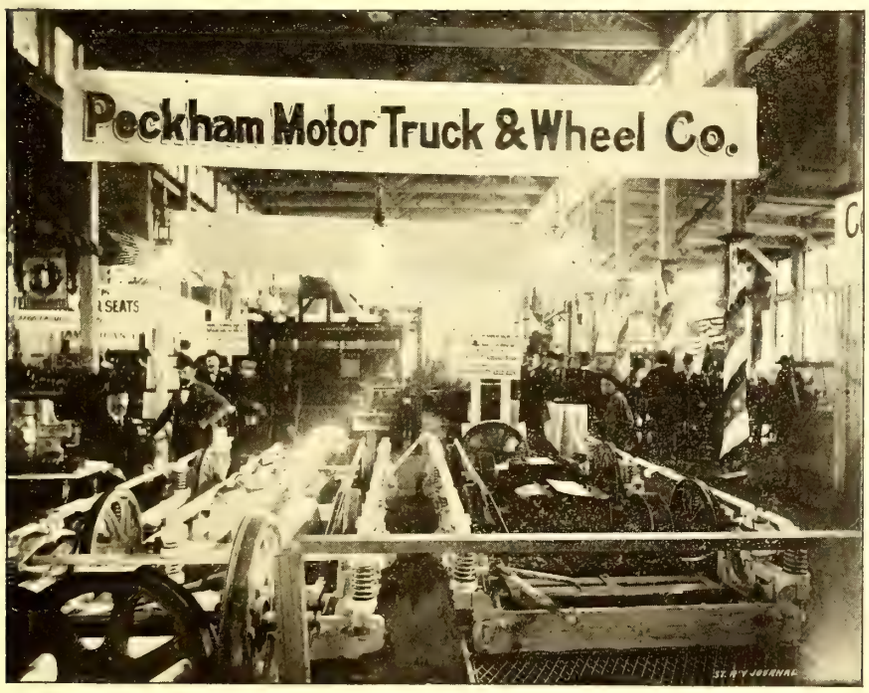
The two fine motor trucks exhibited by the Peckham Motor Truck & Wheel Company did not arrive at the Convention until Thursday, owing to unusual and most vexatious delays in transit, and many of the delegates therefore missed the opportunity of seeing this most interesting exhibit. It is not often possible to examine the General Electric and Westinghouse motors mounted on trucks of the same general type, but specially adapted for their individual peculiarities, so close together and so intimately as was the case with the Peckham exhibit.

The general impression given by the Peckam motor trucks was one of solidity and strength—a strength sufficient to carry any burdens which might be placed upon them. This impression is largely due to the use of "cantilever bridge truss" construction, by which it is claimed that great strength is gained with the least weight of material. At the same time, the Peckham trucks appear to the casual observer to be almost made up of springs, so carefully is this most important condition of "perfect flexibility" provided for.

The Westinghouse motors, which were of the latest type, were suspended from longitudinal channel bars running *over* the motor and resting on the truck frame through spiral springs—a neat and ingenious device. The General Electric motors were fastened to the truck by means of the peculiar and well known methods of support devised by the General Electric Company.

The Sperry car, exhibited at the Convention, was also mounted upon Peckham trucks which had been specially adapted by the Peckham Company for the single motor equipment advocated by the Sperry Company, including the flexible clutch, electric brake, etc. The elegant car body exhibited by the Jackson & Sharp Company was also mounted on a Peckham truck, and these two cars, in service, were fine illustrations of the smooth and easy riding possible with well devised and flexible trucks.

The company was ubiquitous at the Convention through Mr. E. Peckham, president; Mr. W. E. Cooke, engineer, and Mr. W. H. Wilkinson, superintendent.



GENERAL VIEW OF PECKHAM MOTOR TRUCK & WHEEL CO.'S EXHIBIT.

The General Electric Company.

The General Electric Company was prominently located at the Convention, and its exhibit was arranged with the taste and skill for which the company and its predecessors have always been noted. The principal exhibit was, in a sense, the street railway system of Atlanta itself, on which a large number of the company's motors and dynamos are in service. Such of the cars of the Atlanta Consolidated Street Railway Company and the Atlanta Traction Company as were equipped with the latest General Electric apparatus, were indicated by means of prominent signs on the cars.



GENERAL ELECTRIC CO'S EXHIBIT.

In the exhibition hall ample opportunity was afforded the delegate for a close and critical examination of the company's apparatus in every department of its street railway business. The G. E. 800 motor was shown, both complete and dissected, together with a partially wound armature, separate armature coils and a complete, as well as a dissected commutator, separate gears, pinions, etc. The "Form K." controller was also much in evidence, its special feature being the magnetic blowout principle, by means of which the destructive spark inside the controller box is reduced to a minimum and, in fact, almost completely destroyed. The rheostatic controller for single motor car equipment, known as "Form K R" and which has the same style of cylinder, blowout and contact fingers as the K controller, was also shown. All of the General Electric devices for the handling of electric arcs, including switches, fuses, lightning arresters etc., involve the magnetic blowout principle. The most recent form of the trolley base was exhibited, the changes from the type shown at the Milwaukee Convention being comparatively slight.

Among the most interesting exhibits, were the fine station switchboard sections in the center of the General Electric space. They included a 400 ampere generator panel, a 1,000 ampere generator panel, and a "total current" panel fitted with one 5,000 ampere Thomson recording wattmeter and one 5,000 ampere Weston ammeter, one 1,200 ampere feeder panel with lightning arrester, two 1,200 ampere feeder panels of different types, a 750 voltmeter on bracket and a 600 ampere equalizing switch pedestal. The generator and feeder panels are made of various capacities to suit different plants, and are so designed and proportioned that they may be installed side by side in any number, and readily interconnected so as to form a complete, fireproof, accessible, compact and handsome switchboard. Another illustration of the value and efficiency of the magnetic blowout principle, was shown in a 3,000 ampere fuse box, together with a fuse blown at the Kent Avenue Brooklyn, station, on 4,400 amperes at 550 volts. When the destructive effect ordinarily accompanying the blowing of fuses at 500 volts is considered, as well as the enormous current flowing in the circuit above referred to, this clearly ruptured fuse seems to be an unanswerable argument for the magnetic blowout.

Samples of underground feeder tubing, and models of junction boxes and taps clearly showing the ingenious principles first devised

by Mr. Edison for underground work, were prominent in the exhibit. The company issued a special pamphlet devoted to the application of the three wire system to street railway lines.

In the department of line appliances, the company lays special stress on the advantage of having the tongues and runways of frogs, crossing, etc., in the same horizontal plane as the trolley wire, and it has designed its material with a view to resisting the tendency to bending produced by offsetting the trolley wire below the line of the frog pans. V, right hand, left hand and drawbridge frogs and adjustable crossings were shown, the latter designed for any angle from 30 to 90 degs. In the flexible bracket suspension, the shock of the trolley striking the ears is avoided. The additional advantage of double insulation is another feature of this device. It is made for one and a half or two inch pipe, and for all sizes and forms of wooden or iron poles.

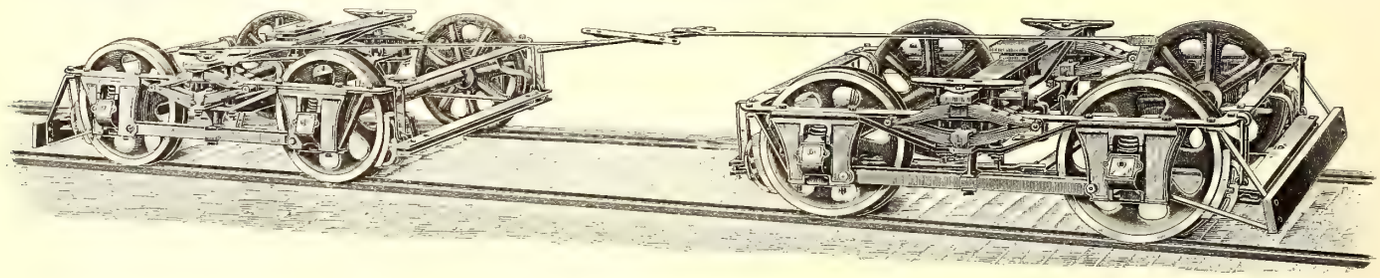
Ten "Thomson '93" arc lamps were shown, connected in series and operating from the railway lines. These lamps are especially designed for use in car houses, power houses, or wherever it is desirable to light from the 500 volt circuit. In addition to the wattmeter on the total current panel board, a portable one was shown, designed for testing a moving car, and so supported in the case that it is protected from vibrations and reads as accurately as if mounted on a solid foundation.

Pamphlets and circulars of the General Electric Company were distributed at Convention Headquarters at Machinery Hall and elsewhere, as follows: "Standard Apparatus for Electric Railway Service," "Electric Underground Tubing for Railroad Feeders," "Three Wire System for Electric Railways," "Form 'K' Generator Panels for Electric Railways," "Feeder Panels for Electric Railways," "Supply Material Catalogue No. 7,504," "Thomson '93 Railway Arc Lamps," "Thomson Recording Wattmeters."

The company was represented at the Convention by W. J. Clark, general manager railway department, and A. K. Baylor, from the New York office, J. R. Lovejoy, W. B. Potter, H. C. Wirt and G. E. Hoffman, of Schenectady, T. P. Bailey, of Chicago, H. J. Crowley, of Philadelphia, Geo. Rosenthal, of St. Louis, F. M. Kimball, of Boston, and H. H. Corson, of Nashville.

Empire State Radial Truck at the Convention.

The continual change necessary in electric street railways to meet the increased requirements of the service is exemplified in the changes made within the past few years, in the cars employed on the roads.



THE EMPIRE STATE RADIAL TRUCK.

The ordinary sixteen foot body horse cars were deemed ample at first to meet all requirements, but as travel increased eighteen foot, then twenty foot, and later twenty-one foot and twenty-two foot cars were found necessary. As the majority of electric railways have curves of from thirty-five foot to forty-five foot radius, the wheel base of the trucks could not be lengthened proportionately, with the length of the car bodies. In consequence a large number of electric street railways are to-day using cars with an overhang so great, that when the rear platform of a closed car is loaded, or the two rear seats for smokers in an open car, the strain on the motors is unevenly distributed. The rear motor endures all the weight and strain of propulsion, while the forward motor is spinning the wheels and grinding them away without moving the car.

The use of trailers gives an additional carrying capacity, but are not generally liked by street railway managers or by the public, while requiring the expense of an additional man.

For some time double trucks have been used under long cars, as a solvent for the difficulties referred to before, and various forms are now on the market. We show in the cut a new double truck for long cars made by the Taylor Electric Truck Company, of Troy, N. Y., and called by its makers the Empire State radial truck.

As can be plainly seen this truck is simple in its construction, using the old and tried principles of steam railway truck construction, having two independent sets of springs, the set over the journal boxes to overcome the shock and pound on rail joints, switches, etc., and the car body riding on full elliptic springs, thus insuring easy riding, while no shock can be transmitted to the car from the roadbed. As the frame is constructed of steel solidly riveted together, using the Master Car Builders' standard jaw and journal box, and the journals running in anti-heating bearings, they are absolutely safe to run forty to fifty miles per hour, and on large curves about 75 and 100 ft. radius, it is not necessary to slow down the speed, thus saving time and power.

The brakes are the simplest form of levers, can be adjusted in five minutes time to take up all wear, and are arranged to equalize so that the pressure is applied to all wheels at the same time; thus the car can be stopped as easy again as a single truck, as the brakes are applied uniformly on the eight wheels in place of four wheels.

In the use of these trucks it is advised that the motors be placed on the inside axles, as with any dirt or snow on the rails, the forward wheels will cut and clean it away, leaving the train clear for the rear driving wheels. With the peculiar form of attaching the motors, all the weight is put upon the driving wheels, thus obtaining such traction that a car mounted on these trucks can readily ascend a 13½ per cent. grade. The wheels are the same size, and by having all the axles turned and key seated, when the drivers are partially worn out, the idle wheels can be transferred to take the place of the drivers, thus insuring longer life for the wheels. The car body rests on a center plate and radiates from a kingbolt, and the truck can freely curve without any undue wear or strain on flanges of wheels, and with absolutely no danger of climbing the rails.

The trucks are constructed with a short wheel base, thus enabling them to curve around thirty-five foot radius curves. Any of the present form of motors can be attached, and can be examined and repaired without in any wise disturbing either the car body or any part of the truck.

The Empire State radial truck is now in practical operation on several leading roads, and giving complete satisfaction, so that it is no experiment. It is especially adapted to suburban lines, and can successfully carry double deck or observation cars. The wheels and axles and all wearing parts are interchangeable with the single trucks, made by the Taylor Electric Truck Company. The Taylor Electric Truck Company, fully warrants the Empire State radial truck, as being of the best material thoroughly and substantially built, the springs made of the best crucible spring steel, and tested to meet all requirements of the severest service, and all parts made and put together in a first class workmanlike manner.

Westinghouse Electric & Manufacturing Co.

The affairs and interests of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., were looked after at the Convention by W. C. Clark, general agent, Pittsburgh; W. F. Zimmerman, assistant general manager New York; C. A. Bragg, manager of the Philadelphia office; B. F. Stewart, manager of the Chicago office; G. Pantaleoni, manager of the St. Louis office; D. A. Tompkins, manager of the Charlotte office; A. J. Wurts, E. H. Heinrichs, J. A. Rutherford, J. R. Gordon, W. S. Brown, and other gentlemen from the home office in Pittsburgh.

There were two distinctive features of the company's representation of apparatus, an exhibit of its machinery in practical service, and a special exhibit in the company's headquarters at the Aragon Hotel, of some experiments demonstrating the principles upon which is based the Wurts system of protecting lines and apparatus against lightning.

The principal feature of the operating machinery was the great 700 H. P. generator directly connected to a compound, condensing Corliss engine in the station of the Atlanta Consolidated Street Railway. This machine, running at eighty revolutions, produces a current of about 1,000 H. P. This direct connected apparatus was started up the day before the Convention convened, in the presence of an assembly of invited guests, a baby son of Joel Hurt, president of the Consolidated Company, having technically opened the throttle to set things in motion. When young Master Hurt had performed his duty, Chief Engineer Elliott took things in hand, and under his skillful guidance, the immense machine was put into full operation without a hitch or trouble of any sort, the great fifty ton wheel gaining its momentum rapidly and smoothly. Besides the generator there were two 400 H. P., belted generators in the same station. These had been doing the work before the big machine was started.

About fifteen cars in Atlanta are equipped with Westinghouse motors and five new equipments, which had just arrived, were exhibited at the Convention Hall.

The exhibit in parlor 164 was purely technical. With the necessary apparatus, brought from Pittsburgh, A. J. Wurts made some unique experiments, illustrating the principles upon which is based his system of protection against lightning. He showed that a discharge could be made over a surface with far greater ease, and therefore over a far greater distance, than over an air space. Based upon the discovery of this fact, he has invented a lightning arrester to discharge over a surface, but so constructed that no arc can form. He also showed by experiment that the tendency of cumulative charges to discharge was more than erratic as to the location along the line where the discharge was likely to take place. Sometimes, with a tremendous charge, there are points where, nevertheless, there is little or no tendency to discharge. Therefore with one arrester that might by chance be at some neutral point a most destructive charge might not be in the least interfered with until it had destroyed a lot of apparatus and done

other damage. Mr. Wurts has devised a system, and invented a series of appliances, and has developed a knowledge of the action of cumulative charges, and by the application of all of these together it is claimed the possibility of damage is reduced to practically nothing. The importance of such a development is very much emphasized by the necessity of better protection than has been heretofore possible in cases of long distance transmission and very high pressure currents. If Mr. Wurts' appliances and system accomplishes what is claimed for them, then he has done an important service to all users of electrical apparatus. Mr. Wurts lays stress upon the statement that his appliances and system may both together be of little service unless they are intelligently applied with a knowledge of the very numerous peculiarities of the actions of disruptive discharges. It is to the task of discovering and classifying these peculiarities that Mr. Wurts has devoted his time now for several years, both in the laboratory and in the study of plants in practical operation. Some of the results of his study have been incorporated in a lecture which he delivered by invitation before the American Institute of Electrial Engineers. He has been awarded by the Franklin Institute the John Scott legacy medal for his discoveries in electrical science, and for his inventions.

Exhibit of the Paige Iron Works.

One of the largest exhibits at the Convention was that of the Paige Iron Works, of Chicago, whose exhibit occupied 1,200 ft. of space in the center of the Exhibition Hall. This company exhibited special track work, such as switches, frogs, curves and crossings made of both girder and T rail. The feature of the exhibit was a section of track using a seventy-two pound Shanghai T rail made by the Illinois Steel



EXHIBIT OF TRACK CONSTRUCTION BY THE PAIGE IRON WORKS.

Company, of Chicago, placed on Daniel steel ties with broken stone concrete foundation and brick paving, illustrating the "all-steel track" construction of the Terre Haute Electric Railway, of Terre Haute, Ind., and conclusively demonstrating the practicability of T rail for paved streets.

In connection with this Terre Haute work, the Paige Iron Works showed the Wheeler suspension rail joint, which is also used by the Terre Haute Company. A clever device for a three-way switch was also exhibited. This is a device for accomplishing the switching to any one of the three tracks without danger of derailment. Two styles of steam and street railway crossings were also shown. One of these devices was so constructed as not to disturb or affect the steam road in any way, and yet provides a perfect, easy riding crossing. The company has furnished a number of cities with this same T rail construction in various weights of thirty pounds upward. The girder rail switches shown are similar in construction to those furnished the Chicago City, Chicago General Electric, and, in fact, most of the Chicago roads.

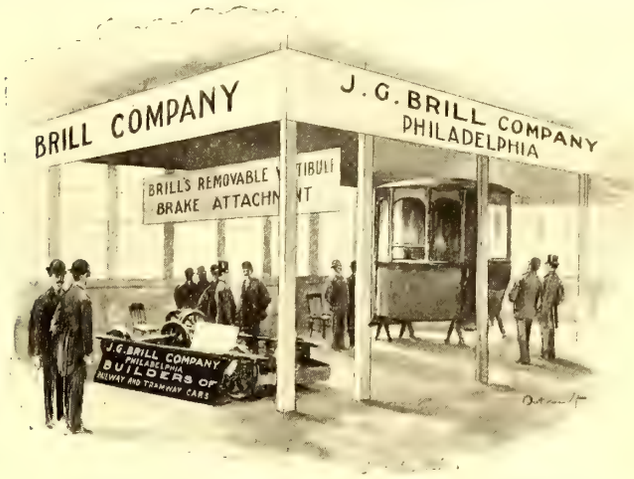
This company also showed views of cable work done for the West Chicago, one view showing a piece of special cable work recently made for the West Side Company, of Chicago, for its tracks on Washington Street near the tunnel, where they change from the West Side to the State Street cable. The company was represented by Mr. A. W. Paige, president, and Mr. E. S. Nethercut, engineer.

The Local Committee.

The thanks of the attendants at Atlanta are certainly due the local committee for the care paid by them to all present. No effort was spared by these gentlemen to make the time of all pass agreeably, and we cannot speak too highly of their work. William W. Kingston, Ernest Woodruff, Eugene P. Thomas and S. A. Trawick were particularly assiduous in attending to the wants of the delegates.

The J. G. Brill Company's Exhibit.

The J. G. Brill Company, the well known car and truck makers of Philadelphia, made one of its characteristic exhibits, both inside and outside the exhibition hall. There were in operation on the tracks of the Atlanta Consolidated Street Railway Company three elegant and



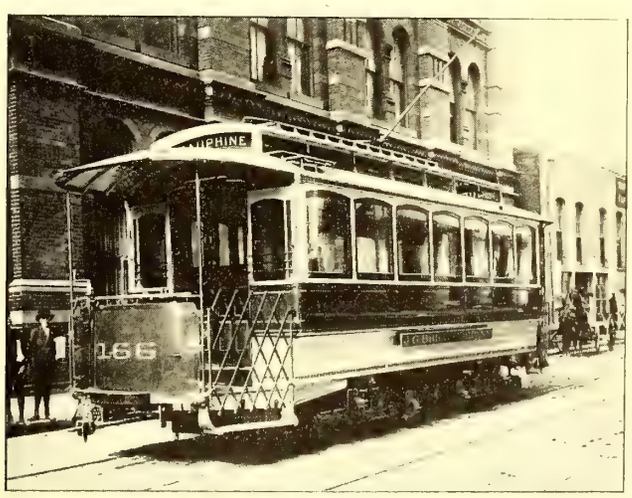
GENERAL VIEW OF J. G. BRILL CO.'S EXHIBIT.

entirely different types of motor cars. All attracted considerable attention, notably the Coronado railroad car, built by the Brill Company, for Coronado Beach, Cal., and which is shown in the accompanying illustration. This car is called a combination car, combining open and closed features. The finish is elaborate and beautiful. The woodwork is in solid mahogany, hand carved, the ceiling is decorated in transparent green, and the seats and backs are handsomely upholstered. This car attracted especial attention, and finds its place in cities where there is a uniformity of climate, like those in lower California or other Southern states.

Another car represented in operation was a twenty foot motor car, mounted on Brill's well known Eureka maximum traction trucks. The ease of riding of this car was its notable feature, and as the Brill Company is constructing some 200 odd cars of this same pattern for the New Orleans Traction Company, it is unnecessary for us to say that its type is popular and is approved by the best street railway operators. It is an unusually handsome car, and up to Brill's high standard of excellence.

Another car shown by Brill was a beautiful eighteen foot motor body, finished in mahogany and handsomely upholstered, this car being mounted on Brill No. 21 B independent rigid truck. The car carried many delegates to and from the Convention Hall, and a most favorable universal impression was created as to the style and workmanship displayed by the builders.

The Brill electric sweeper, equipped with Westinghouse motors, was on exhibition at the hall, and on the track where current could be optained to show its working qualities. The manner in which it made the dust fly from the crowded roadbed, and to about eighteen feet outside the rail line, created the impression that it would handle a snow storm and drifts to best possible advantage.



BRILL EXHIBITION CAR.

Inside the Convention and Exhibition Hall the Brill Company made a prominent and attractive display. There was on exhibition a framework consisting of an end of a car, two windows, and platform. On this framework were mounted all the appliances which could be called for by any railroad. A movable vestibule, Brill track scrapers, Brill rotary gong, Brill life guard, Brill sand box, Brill ratchet brake lever, and brake windlass, Brill gates, radiating drawbars, etc. The impor-

tance of this exhibit was brought home to the delegates with peculiar force, as they were thus able to examine in one spot all of the many improvements that can be applied to electric cars, according to the demands of service. There was also on exhibition a Brill car jack, the Eureka maximum traction truck, and the Brill No. 21 B truck, on which we will not dilate, as their many good qualities are well known.

The Brill parlor at the Aragon was an important evidence of the company's presence as it was occupied incessantly by the many friends of the Brill Company who were anxious to pay their respects to Jno A. Brill, the genial vice-president of the company, and his corps of assistants, Samuel M. Curwen, Wm. H. Heulings, Frank E. Randall, Western selling agent, Geo. M. Haskell, Eastern selling agent, and M. E. Curwen.

The Sterling Supply & Manufacturing Company.

The two most important desiderata in street railway operation, from a stockholder's standpoint, are undoubtedly as follows:

1st, to secure all the money paid as fare by passengers, and,

2d, from these receipts to keep as much as possible for dividends; in other words, not to pay out any more than is actually required for the operation of the road.

All unnecessary expenses of operation are a direct loss to the stockholders.

To assist street railway managers in securing these *sine quâ non* of success is the object of the Sterling Supply & Manufacturing Company of New York. The use of this company's register insures the former result, and the adoption of the Sterling standard fender will prevent the introduction of that often very considerable item of expenditure—the sums paid out in damage suits for accidents to persons. It is this last item that often makes the difference between a surplus and a deficiency, and decides the question as to whether a road shall be a financial failure or not to its owners.

The Sterling register has a national reputation in being the design of John B. Benton, the pioneer in the register business, whose fundamental patents for stationary registers are the property of the Sterling Company. Some of these registers have been in daily use on the Third Avenue Railway, of New York City, since 1875, showing an excellent record for durability and efficiency. The Sterling numeral registers have also been in use on the Twenty-third Street Railway for ten years, and in a slightly different form have been adopted as standards on the Broadway Cable Railway, of New York, and the New Orleans Traction Company.

Among its recent sales of registers the company mentions a large order from the Columbia Railway Company, of Washington, D. C., also one from the Metropolitan Traction Company, of New York, for the equipment of all the cars of the Columbus Avenue line of that company. The company has also received a number of additional orders from Yonkers.

The Sterling fenders have shown an equally high record in practice. The Third Avenue Railway Company, of New York, early adopted them as standard for all of its cable cars, and the results secured on that line have been of a most satisfactory character. The fender has never yet failed to do its duty in preventing a person from getting under the wheels of a car.

The investigation of the engineers of the Broadway line on the fender question covered a long period, and that the same device was adopted by them speaks volumes for its merits. The conditions on Broadway are particularly arduous, as our readers well know, and any device adopted there is only put in service after a most rigorous investigation of all existing types of apparatus.

A description of the Sterling Company's business would not be complete without mention, also, of its well known sand box. This naturally accompanies the employment of a fender, since the ability to stop a car within a specified time is almost, if not quite, as important, as to guard persons from the car wheels. The Sterling sand box is also used on the Broadway line, New York, as well as upon a number of other prominent railways, and its peculiar arrangement permits the certain delivery of sand on the track under all conditions whenever the lever is operated.

This company has recently published a handsome circular descriptive of the Sterling register, sand box, fender and other appliances which it manufactures. The catalogue is illustrated by handsome engravings, and is attractive in appearance.

Newspaper Men at the Convention.

The street railway and electrical press was well represented at the Atlanta Convention. THE STREET RAILWAY JOURNAL had a very handsome booth, tastefully decorated with bunting and potted plants, and located in the most conspicuous position on the floor of the Exhibition Hall. A view of it is given on page 733. The *Electrical Review* had a neatly arranged and attractive space, and was represented by C. W. Price and J. G. Tuckerman. The *Electrical World* representatives were W. J. Johnston and M. J. Sullivan. W. F. Collins was the only representative of the *Western Electrician*, and T. C. Martin, of the *Electrical Engineer*, both of whom, however, received a hearty welcome from their numerous friends. *Electricity* was distributed under the direction of B. E. Greene. *Electric Power* was represented by H. A. Foster, the *Electrical Age* by W. T. Hunt, and *Electrical Industries* by E. L. Powers. The *Street Railway Review* had three of its men—H. H. Windsor, H. J. Kenfield and J. Boyd—in attendance, and *The Car* was looked after by the same number, Messrs. Vandegrift, Douglass and Nagle. The representatives of the STREET RAILWAY JOURNAL were Jas. H. McGraw, C. B. Fairchild, Edward Caldwell, H. W. Pool, W. H. Taylor, J. B. Bennett and R. F. Outcault.

The Modemann Fender.

Some particulars of the Modemann fender, of which the United States Street Car Fender Company, of New York, is the manufacturer, have already been published in the STREET RAILWAY JOURNAL. This fender has recently been subjected to a number of severe tests on the line of the Atlantic Avenue Railway Company, of Brooklyn, N. Y., and it has given there the best of satisfaction. The object of the company was to subject the fender to as nearly the same conditions as would be met with in service as possible, and that the results secured proved the undoubted efficiency of the device was the unanimous opinion of the large gathering of street railway men who were present at the test.

The trials made were with persons, not dummies, and with both men and women, and the tests were made at full speed. None of the persons experimented with was connected with the company in any way, one being the reporter of a New York daily paper, and the other a man who had become interested in the operation of the fender from an examination of it.

When in operation the fender runs within two and a half inches of the ground. It consists of a light but exceedingly strong frame provided with a catch net, the end of the frame carrying a rubber roller, The fender collapses at forty pounds resistance, breaking the fall of person who is caught up by it, thus avoiding the shock which would inevitably occur if the victim should fall on a rigid fender or on the ground. As a result it has been found that persons caught by it are hardly bruised.

Another important feature of the fender is that on each side there are extensible wings which, when the fender collapses, project for nearly two feet on each side of the platform, preventing the person caught from being struck by the steps of the car or from falling from the fender. When in the ordinary position these wings hang down on either side and are entirely out of the way.

Another important feature of the fender is that if desired it can be folded up against the platform, occupying no room in the street. This is the position in which it is carried on the rear platform of the car, or when the car is in the car house. If desired, the fender can be lifted entirely from the end of the car.

The fender is so arranged that it can be easily adjusted to any make of car.

The Darrach Automatic Duplex Car Fender.

The Darrach automatic duplex car fender has been designed to pick up persons from the ground in all positions, lying as well as standing, and its operation on the line of the Consolidated Traction Company, of New Jersey, has been very satisfactory. The fender consists of three parts, viz., the fender proper, supporting frame and drop guard.

The fender proper is a strong, light frame, projecting in front of the car thirty inches, and is made of spring tempered, seamless steel tubing which supports a gang of flat steel springs. The lower bar is provided with a row of rollers to facilitate its passage over a fallen person. They ride five inches from the ground. A strong web belt passes in front of the lower turn or nose of the sofa springs, secured by an offset spring in such a manner that the belt is held with strong tension about two inches in front of the sofa springs.

The fender is attached to the supporting frame and to the car by a hook and hinge device and balance springs. It weighs about fifty pounds, and can be easily and quickly transferred by one man. The supporting frame is made of steel tubing and malleable iron castings, is attached to the car sills, and reaches from the truck frame to the front end of the sills.

The structure of the drop guard is a very important feature of the device. It is a steel frame, hinged to the supporting frame at the rear end, supported by two spring latches which hold it parallel to and about six inches above the track.

Above the drop guard, resting on the frame, are two spring levers which give it a quick impulse to the fall of the drop guard when it is unhooked, and also constitute an instantaneous lock that holds it firmly on the track. The front edge of the drop guard is a steel rope extending from track to track, locked in the ends of the steel frame. On this steel rope are a gang of flat steel springs which extend backward twenty inches to a rear portion of the frame.

The elasticity of the steel rope and the flexible steel springs cause the drop guard to slide freely over cobble stones and adapt itself to irregular surfaces, and when a body may be partly below the plane of the guard it will deflect, thus securing more ease and certainty of passing under a fallen person, without bruising or sliding him. This action is aided by the flexibility of the springs, which reduces the angle and brings the person somewhat in contact with the ground through the spaces between the springs. The balance of friction thus preserved keeps the person stationary while the drop guard is passing under him.

If a person is struck while in an upright position, the canvas belt, supplemented by the action of the springs behind it, provides such an elastic contact that it is nearly impossible to bruise or break a leg. A person so struck is thrown toward the car, and falls upon the elastic "sofa," the spring back of which protects from any hard blow on the car. If a person is struck while prostrate, the rollers cause the fender to rise and pass lightly over him, without scraping or pushing. This lifting action unlocks the rear drop guard which instantly falls to the ground and is locked, as described.

The motorman may release the drop guard by pressing a pin with his foot, without conflicting with the automatic action. The inventor is S. A. Darrach, of 693 Broad Street, Newark, N. J.

New Electric Railway Equipment.

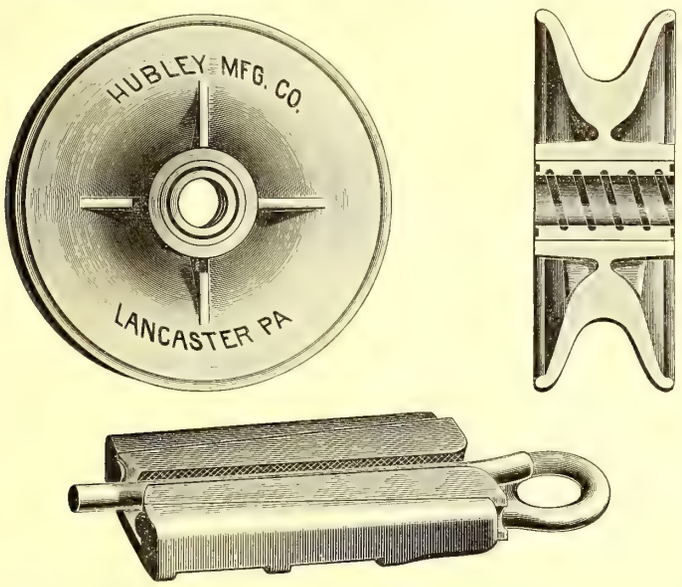
The trolley wheel shown in section in Fig. 1 on this page has recently been put on the market by the Hubley Manufacturing Company, of Lancaster, Pa., and is attracting much attention. The edges of the wheel are protected by a bead to give it greater strength and prevent it from cutting and otherwise injuring the overhead fixtures or wire. The wheels are designed to give a longer service than any other wheel on the market, are made of special high grade bearing bronze, and the metal is placed in the direction of wear. The spokes are so arranged as not to allow the edge to drop off in case it should be worn through. The hub has a large diameter, having a good contact with the springs, and is fitted with the best anti-friction bushings.

In the harps are combined the two essential qualities of lightness and strength. They are made of the best malleable iron and high grade bronze, both having steel shanks. The sides are made with the crescent section, and offer a rounded surface and prevents catching or cutting of the overhead fixtures.

The Hubley Manufacturing Company is also bringing out a full line of overhead material, using the celebrated Medbery insulation. The company's line of ears, straight line, anchor, feeder and splicing ears, are all of new design, and are all both light and strong. They are made to solder on or to hammer on, a feature which is being demanded by a number of managers on large roads.

The company is the sole manufacturer of the Cope come-along, shown in Fig. 2. This has been greatly improved, and a ring is now introduced at the end instead of a hook, as in the old form, making them much stronger. The jaws are slightly curved on their bearing surface, and have a checked grooving instead of being straight and having a filed grooving in the old form. This ensures a firmer grip on the trolley wire and is less liable to drop.

The Hubley Manufacturing Company is rapidly coming to the front, and is occupying a prominent position among its competitors in the electrical field. Its new plant is located a mile from the center of Lancaster, on the Pennsylvania Railroad, branches of which lead into the works. With the company's iron and brass foundries employing nearly 100 moulders, the machine shops, grinding, polishing and plating buildings and warehouses, all equipped with new machinery of the latest and best patterns, and employing over 300 hands, the company has one of the most complete and best appointed plants in the state. On account of the company's rapidly increasing business, however, it has been found necessary to erect at once a new foundry building which will give employment to nearly 100 more moulders, and also a large two story building for manufacturing purposes.



FIGS. 1 AND 2.—HUBLEY TROLLEY WHEEL AND COME-ALONG.

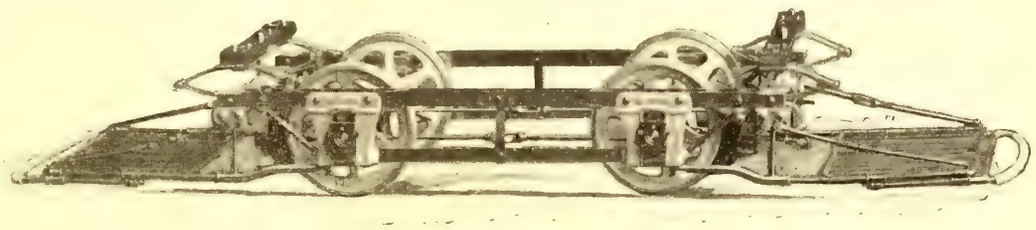
In the company's construction department several large contracts are on hand. Among the most important may be mentioned the contract for forty-three miles of electric railway for the Pennsylvania Traction Company, and a fifty mile telephone line and the equipment of an electric lighting plant of 1,000 lights capacity.

A Review of the Industrial Press.

An important department in the "Engineering Magazine," and one which promises to be of great value, was started in the October issue of that periodical. It consists in the extension of the plan of publishing an Index to Current Periodical Literature, which formed an important feature of the magazine. This is to be continued, but in addition, short abstracts of leading articles which have appeared in the technical papers during the preceding month will be given, classified under different department headings, giving in this way a review of technical progress.

The Bragg Fender.

We present herewith an engraving of a truck equipped with a new type of fender, manufactured by the Bragg Automatic Car Fender Company, of Troy, N. Y. A model of this fender was shown at Atlanta, and constituted one of the most interesting exhibits made there. The strong points of the fender are as follows: It can be attached to the truck and made independent of the car body, thus allowing it to run as close to the surface of the street as the character of the paving will permit.



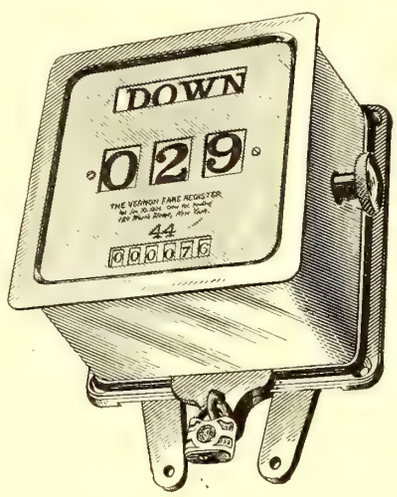
THE BRAGG FENDER.

Its action is entirely automatic, requiring no attention on the part of the motorman. The height is quickly and easily adjusted, and the fender can be quickly applied to any truck without changing anything on the latter; it can also be adjusted to extend out or in, as desired. The patent is a very broad one, and covers the basic flexible frame.

The Vernon Fare Register.

The Vernon counting register was used at Chicago at the Columbian Exposition last year at all of the gates to record the admissions, and at the Ferris wheel. Its accuracy was officially approved, and the company has testimonials from the Fair authorities in its favor.

The Vernon fare register is an adaptation of the Vernon counting register. Fifty of these registers have been in operation for some time on the line of the Consolidated Traction Company, of New Jersey, and David Young, the general manager of that company, speaks highly in its favor. The machine is accurate in operation and simple and substantial in construction. All parts are interchangeable. It is provided with double levers by which it can be actuated independently from either side. It is positive in action, and steel gearing is used. It is manufactured by S. M. Balzer, of 75–79 Center Street, New York.



THE VERNON FARE REGISTER.

Charles Scott Spring Company.

The Charles Scott Spring Company, of Philadelphia, reports a large increase in its business. To meet the demand for its products, this company has found it necessary to purchase the property adjoining its works, and is now erecting a handsome addition, having a frontage of 130 ft. on Germantown Avenue; 120 ft. on Canal Street and 43 ft. on New Market Street. This new shop will be devoted entirely to the new manufacture of elliptical springs, increasing the capacity of the company to a total of nearly 3,000 tons per annum. The capacity of the company's spiral spring plant is about 5,000 tons.

The company does not confine itself merely to the manufacture of springs for steam and street railroad cars, but is a very large manufacturer of trolley stand, brush holder, motor and sash springs.

A visit to these works is full of interest. The company has recently appointed F. A. Lawson & Company, of San Francisco, Cal., its agents for the Pacific coast.

Some New Corporations.

Baltimore, Md.—A certificate of incorporation of the Clifton Park Passenger Railway Company was recorded October 3 at the secretary of state's office at Annapolis. The incorporators are Winfield J. Taylor, Alfred J. Ulman, James H. Smith, Davies Murdoch, Frank N. Hoen, Rober S. Carswell and Eben B. Hunting. The capital stock is $50,000. The northeastern terminus of the road is on the Hartford Turnpike Road opposite the main entrance to the Clifton Park, and the southern terminus at or near the intersection of North Street with North Avenue, with the right to construct branches.

Bethlehem, Pa.—The Bethlehem & Nazareth Electric Street Railway Company was incorporated October 11, with a capital stock of $100,000. Charles Brodhead, of Bethlehem, is the president of the company, and other stockholders are A. C. Borhek, Albert Brodhead and Abraham S. Schropp, all of Bethlehem.

Fanwood, N. J.—The New York & Philadelphia Traction Company has applied for a franchise for the operation of its road. The company has also applied for similar franchises in North Plainfield, Dunellen, Bound Brook, Raritan and East Millstone.

Fort Smith, Ark.—Preliminary operations have been commenced on an electric street railway here.

Ironton, O.—The Ironton Street Railroad, Electric Light & Power Company has been incorporated, with a capital stock of $100,000.

Jersey City, N. J.—Permission has been granted to the Jersey City, Harrison & Kearny Railroad Company to lay tracks on the new bridge over the Hackensack River. The company has also been granted permission to lay a double track between Harrison & Kearny and to erect poles with overhead appliances to operate cars with electricity.

Kansas City, Kan.—The Kansas City Traction Company has been chartered to construct a street railroad in Wyandotte County. The road will be fifty miles in length. The capital stock is $1,000,000. The directors are Bird S. Colen, of Brooklyn, N. Y.; W. J. Smith and W. H. Lucas, of Kansas City, Mo.; C. W. Trickett, Frank D. Hutchings and C. F. Hutchings, of Kansas City, Kan.

Minersville, Pa.—A special committee of the Borough Council has been appointed to report on the form of an ordinance granting certain rights which will give the town an electric railway system.

Newburgh, N. Y.—Articles of incorporation for the Orange Lake & Walden Electric Railroad Company were executed in this city October 8. The incorporators are Benjamin Norton, of Brooklyn; H. R. Newkirk, also of Brooklyn, B. B. Odell, Jr., Col. William D. Hickey and Major W. H. Weston, of Newburgh. The new road will be a continuation of the Newburgh & Orange Lake Railway, and will terminate at Walden, a village twelve miles from here.

Niagara Falls, N. Y.—The construction of the Niagara Falls, Whirlpool & Northern Railroad, along Main Street to Devil's Hole, is nearly completed.

Oneonta, N. Y.—Considerable interest is being shown in the matter of building the electric railroad between Oneonta and Richfield Springs. Wm. Walker, of Carbondale, and W. B. S. Paul are interested.

Peekskill, N. Y.—Articles of incorporation have been filed for the Peekskill State Camp & Mohegan Railroad Company. The capital is $175,000. Among the directors are Frederick C. Beach, Edward B. Gallagher and George F. Kunz, of New York; John B. Westbrook, of Peekskill, and Gardner D. Hiscox, of Brooklyn.

Reimer City, Pa.—The Williams Valley Street Railway Company was incorporated October 16, with a capital stock of $100,000, to construct an electric railway from Reimer City, Schuylkill County, Pa., to Lykens, Dauphin County, Pa. Philip Porter, of Girardville, Pa., is the president of the company, and other stockholders are C. A. Barnhard, Moses Mervine and George C. Kachel, all of Girardville.

Springfield, O.—Consents and franchise have been secured for an electric railway between this city and Xenia. The power house will be located at Yellow Springs, where there will be a park of 300 acres. The line will be twenty-one miles in length. James W. Neff, of Yellow Springs, Green County, is interested.

Wilmington, Del.—The Wilmington & Gordon Heights Street Railway has been put in operation. The new road is about two miles in length, and will be operated in conjunction with the City Railway Company, of Wilmington.

Windham, N. Y.—An electric railroad project is being agitated here, to connect with one of the several railroads near.

Personals.

Mr. Frank S. DeRonde, of the Standard Paint Company, of this city, was married October 11.

Mr. David Newbold has been elected president of the Eckington & Soldiers' Home Railway Company, of Washington, D. C.

Mr. Frank Pierce, of the Pierce & Miller Engineering Company, met a sad bereavement last month through the death of his wife.

Mr. G. V. Onderdonk has taken entire charge of the affairs of the Vose Spring Company, as its general manager, Mr. Guibert having retired from the company.

Mr. E. E. Downs has resigned his position as general manager of the Kalamazoo Street Railway Company to build and operate the Battle Creek Street Railway, of Battle Creek, Mich.

Messrs. M. K. Bowen, Superintendent, and Mr. Hovey, master mechanic of the Chicago City Railway Company were in New York last month and made a pleasant call at our office.

Mr. George Kissam, of Carleton & Kissam, who has been in Europe for the past three months, has returned on the "Teutonic," and attended the Convention at Atlanta in the interest of his firm.

Mr. A. N. Connett has resigned his position of chief engineer of the Baltimore City Passenger Railway Company, and has accepted a similar position with the Metropolitan Railroad Company, of Washington, D. C.

Mr. Jno. C. N. Guibert, who was connected with the Vose Spring Company for twelve years, has retired from that company, and is about completing arrangements to represent, as manufacturers' agent, another large spring manufacturer.

Mr. W. A. H. Bogardus, has resigned as general manager of the Brooklyn Heights Railway Company, of Brooklyn, N. Y., owing to ill health, and has accepted the position of secretary and treasurer of the company. No successor has as yet been appointed.

Mr. John S. Pugh, whose face and figure are well known to street railway men throughout the South and East, has recently severed his connection with the Baltimore Car Wheel Company, in order to become the Eastern agent of the Dorner & Dutton Manufacturing Company, of Cleveland. Mr. Pugh entered the street railway field many years ago, having been apprenticed by his father to the John Stephenson Company in 1872. In 1885, he formed the firm of Pugh & Russell, manufacturers and dealers in street railway supplies, and this firm later on became the general selling agents of the Stephenson Company. A large and profitable business was built up, but the firm was dissolved in 1888, and Mr. Pugh entered the service of the Baltimore Car Wheel Company, in whose interests he has labored faithfully and with ability until this year. Messrs. Dorner & Dutton are to be congratulated on securing the services of a gentleman who has the technical ability and wide practical experience of Mr. Pugh.



JOHN S. PUGH.

Mr. Frank A. Rogers, representative of the Fulton Truck & Foundry Company, of Cleveland, O., is well known to the trade through his long connection with the street railway and electrical interests. Mr. Rogers was born in 1855, and was educated in the public schools of New York. He then entered the employ of the American Sewing Machine Company, in which he continued from 1871 to 1882, as salesman and collector, and later as general manager of the company's district office at Cleveland. In 1882 Mr. Rogers became engaged with the Brush Electric Company, of Cleveland, working in the shops as foreman of the arc lighting department until 1886. At the termination of this shop practice he was appointed sales agent of the company, and continued in this capacity until 1890, when he entered the service of the Short Electric Railway Company as sales agent. His work with this company, in whose employ he has remained until recently, has been in a high degree satisfactory, and his faithfulness and sense of personal honor have been always appreciated by his business associates. His present connection with the Fulton Truck & Foundry Company is one which can hardly fail to be advantageous to all concerned.



FRANK A. ROGERS.

New Publications.

Catalogue of Electric Railway Equipment and Supplies. Published by the Western Electric Company, of New York and Chicago.

A very handsome catalogue has recently been issued by the Western Electric Company, devoted to the electric railway department of this extensive company. The work of the Western Electric Company in electric lighting and railway service, as is well known, has been kept at a high standard, and customers are certain of securing apparatus which will give satisfaction. The list of supplies dealt in by this company is most complete, and embraces all varieties of equipment.

Equipment Notes.

W. D. Hoffman, agent of the Buckeye Engine Company, of Boston, Mass., has removed to Room 92, Hathaway Building, 620 Atlantic Avenue.

The Lodge & Davis Machine Tool Company, of Cincinnati, O., has closed a contract with the Toledo Bicycle Works for a complete equipment of machinery for new works of the latter company.

Charles J. Bogue, of New York, is making a specialty of the rewinding of street car motor armatures. He has excellent facilities for this class of work. Billings & Spencer drop forged bars are used.

The Stanley Rule & Bevel Company is installing a system of cars and tracks at its works at New Britain, Conn., and has selected for this purpose the narrow gauge system of the C. W. Hunt Company, of New York.

The Ball Engine Company, of Erie, Pa., has recently sold to the Freeport Electric Railway, of Freeport, Ill., a 150 H. P. engine, and to the Camden Horse Railway Company, of Camden, N. J., two 350 H. P., vertical compound engines.

The Mica Insulator Company, of New York, is meeting with great success in the sale of micanite for commutators. Micanite seems to avoid many of the objections met with in the use of sheet mica, and is most convenient to employ, as it is supplied in a large number of forms.

The Childs Manufacturing Company, of New York, has recently opened an office at 95 William Street, and is placing on the market insulating and preservative paints and compounds for the use of railway and electrical companies. W. H. Childs claims for these paints a superior quality.

The Scarritt Car Seat Company, of St. Louis, Mo., has established an agency in Boston, and for its agent has secured the services of the genial secretary of the New England Railroad Club, Francis M. Curtis, who will proclaim the excellence of the Scarritt seats to all inquiring friends. His office is located at 103 Milk Street, Boston.

The Sterling Supply & Manufacturing Company, of New York, has just sold 120 sets of its well-known sand boxes to the Consolidated Traction Company, of Jersey City, and seventy-five sets of Sterling fenders, seventy-five sets of sand boxes to the Broadway road, New York, as well as a complete register equipment for the new cars of the Broadway line.

The Consolidated Car Heating Company, Albany, N. Y., has recently received, as a result of competition tests, orders to equip with its electric heaters and temperature regulating switch, 100 cars belonging to the Nassau Railway, Brooklyn, N. Y., the Allentown & Lehigh Valley Traction Company, and the Yonkers Railway, all of which are operated by the well known Johnson syndicate.

The Coe Brass Manufacturing Company, of Torrington, Conn., is increasing its boiler equipment, and has almost completed a new boiler house. In this building the company is to use boilers designed by the Bigelow Boiler Company. The Coe Company will handle its coal from the storage to the boiler rooms by an equipment of narrow gauge cars and track, designed and manufactured by the C. W. Hunt Company, of New York.

The American Fuel Economizer & Engineering Company, of New York, who, as mentioned in our last issue, supplied the economizers for the Delaware Street power station, of the Electric Traction Company, of Philadelphia, was also contractor for the induced air draught used in that station, the contract including installation of stack and flues with connections. The company's economizers are four in number, each with 560 pipes.

Morris, Tasker & Company, Incorporated, of Philadelphia, Pa., have been made sole manufacturers of the Duggan patent adjustable pipe bracket. These brackets are made of wrought iron pipe, and are claimed to be the best and simplest form of bracket that is manufactured. They can be purchased direct from the manufacturers, Messrs. Morris, Tasker & Company, or from the Burnham & Duggan Railway Appliance Company, of Boston.

The Berlin Iron Bridge Company, of East Berlin, Conn., will furnish the iron roof trusses for the new city armory, at Pawtucket, R. I. The new power house for the Bridgeport Traction Company, Bridgeport, Conn., consisting of a dynamo room and a boiler room, will be of iron and brick—composite construction—and was designed and built by the same company. The dynamo room will be controlled by a traveling crane, furnished by the Berlin Company.

The Link-Belt Machinery Company, of Chicago, mentions among its recent sales for its standard water tube safety boilers, by the Link-Belt Machinery Company, Chicago, the following: To the Plainwell Church Furniture Company, Plainwell, Mich., 100 H. P.; to the Mutual Electric Light & Power Company, Chicago, 600 H. P.; the Pittsburgh High School, Pittsburgh, Pa., 250 H. P.; the Institute for Feeble Minded, Pittsburgh, Pa., 800 H. P.; and the Detroit Chamber of Commerce, Detroit, Mich., 300 H. P.

A. Langstaff Johnston, chief engineer of the Hestonville, Mantua & Fairmount Passenger Railway Company, of Philadelphia, Pa., and who was also chief engineer of the New Orleans &Carrollton Railway, of New Orleans, La., during the electrical equipment of that railway, writes us that the design of the station and car house of the latter railway was prepared by him and erected by the Berlin Iron Bridge Company, and that the work was not all done by one firm, as mentioned in our Souvenir issue. Full particulars in regard to this station and car house, as well as the novel power house hoist, were published in the STREET RAILWAY JOURNAL, for May, 1894.

The Partridge Carbon Company, of Sandusky, O., reports that its business has been excellent. The users of the well known Partridge self-lubricating brushes seem to be well satisfied with them. The company tells us that a number of improvements are being made in the brush, and that it will still continue to head the list in quality, and as a saver of time, labor and expense. In a test recently made with other brushes the Partridge, in all points, proved better, wearing one-quarter longer, kept the commutators in better condition and did not spark. The lubrication is quite an advantage, as the brushes need not be boiled in grease of any kind before being put in service.

The Siemens & Halske Electric Company's factory, in Chicago, was destroyed by the great lumber fire in that city August 1. The company made a lease with the Grant Locomotive Works August 11. It commenced moving into the new works August 15; it finished and shipped the first generator, built entirely at the new factory, October 15. Every available tool in the new works is now in operation, and many of the tools which were destroyed in the fire have been duplicated, so that from now on the company is in position to finish one direct coupled generator each day. These few simple facts indicate the dauntless spirit of the company, and it is certainly, to-day, in a better condition for competition in the electrical field than before the fire.

The Jonson Engineering & Foundry Company, of New York, has put on the market a dynamo changing switch, which is manufactured for all capacities. The blades and clips are made of tempered copper, the handle and block are of hard rubber, and the base of marble and slate. The company has recently supplied a dynamo changing switch of 300 amperes capacity, to be used with a voltage of from 1,000 to 1,500 on the circuits of the United Electric Light & Power Company, of New York. This type of switch is used exclusively on all the switchboards in the stations of this company. The company also supplies fuse blocks, short circuiting blocks, double pole jaw switches, and arc pole windlasses.

H. C. Bruner, of Pontiac, Ill., calls attention to a new brick filler which he is manufacturing. This filler takes the place of wood, and will readily commend itself to the railroad man on account of its durability, as its life is claimed to be much longer than that of any other filler. This brick in manufactured in any shape to fit the concave of any rail. By using moulded brick, a level payment can be maintained flush with the top of the rail. Low joints can be very readily got at, as it is only necessary to remove a very few bricks, whereas in using a wooden filler, a long piece of pavement has to be removed before the repairs can be made. Mr. Bruner reports the sale of 550,000 filler bricks to the Chicago City Railway Company.

The Buffalo Progressive Lumber Driers, of Buffalo, N. Y., are well and favorably known by all Americans interested in wood industries, and their sales also extend to many foreign countries. They are unsurpassed for drying lumber in any form. Special study of the different kinds and sizes of lumber to be seasoned is made by the manufacturers of these driers, and the various apparatus are designed with reference thereto. The Buffalo Forge Company, Buffalo, N. Y., recently received an order for a large outfit to be shipped to Reval, Russia, for drying veneers. The parties buying the outfit have tried various plans of seasoning this material with very unsatisfactory results, but after investigating a plant previously installed by the Buffalo Forge Company, were so well pleased with that outfit, that they found it unnecessary to look further.

The Consolidated Car Heating Company, of Albany, N. Y., in order to meet the demand for the Pope light, has added considerably to its plant, and is about to manufacture lamps for compressed oil gas and fittings on a large scale. The compressed gas plant of the latest pattern recently erected shows most excellent results, 17,600 cu. ft. of gas of fifty candle power, having been obtained from 160 gals. of oil, that is, 110 ft. per gallon, whereas the usual make is somewhat under ninety feet. The Consolidated Company is preparing to notify railway men from all over the country to witness an exhibit of Pope lighting apparatus at Albany, carrying out a similar plan to that it established in 1892 with reference to steam heating apparatus, when special trains were run hourly to Troy, and return during two days, and many prominent railway officials from all parts of the country and Canada were present to observe the operation of the Sewall coupler and commingler storage systems. The Consolidated Car Heating Company has recently closed a most important contract for heaters, and will supply the entire equipment of the Steinway (N. Y.) Railway Company. The company has closed a contract with the Fair Haven & Westville Railroad, of New Haven, Conn., for the equipment of its cars. The Union Railway Company, of Providence, R. I., which awarded a large contract to this company, has recently increased its order. The company has also closed a contract for the equipment of sixty cars with the Nassau Electric Company, of Brooklyn, N. Y.

The Laconia Car Company, will ship in a few days two twenty-foot vestibuled cars to the Paterson, Passaic & Rutherford Street Railway, Paterson, N. J., that are models in every respect in material and workmanship. Every foot of lumber used in construction of cars by this company is always thoroughly dried, and in the best possible condition. The oak used is second growth New Hampshire wood, unequaled in quality. The sills are made from Oregon pine, which by Government test shows higher tensile strength than Southern pine, while it is nearly one-third lighter. The company carries a very large stock of this timber. All parts are put together with screws, and every

joint carefully imbedded in glue. Especial attention has been given to render the support of the platforms firm and enduring. The finish is solid selected mahogany, and all trimmings are solid bronze. Especial care has also been taken in painting, with a view to produce permanent results. These cars will be a sample of the quality of work that will be turned out by the company, and no expense will be spared to make them of the highest grade in every particular. The company has had running all summer on the Brooklyn City Railroad, of Brooklyn, N. Y., four open cars, being the portion of an order for twenty-five, delivered before the fire, that show how their work stands under heavy traffic. The cars are numbered 1,600 to 1,603 inclusive. With the low manufacturing cost and excellent facilities in every department, the company can compete with all. The selling agent for the company is F. E. Huntress, whose office is at No. 8 Olive Street, Boston.

The Dreher Manufacturing Company, of New York, manufactures a railroad car grease known as Dreher's railroad car compound, which has been used extensively for the past six years on steam surface railroads for car axle lubrication, more than eighty steam surface railroads have used this grease in car axle boxes with the best of results. The company has testimonials in its possession from about forty of these railroads, the others being satisfied with the grease, but objecting to giving written testimonials. Most of these testimonials are of an extraordinary nature, the officials giving them admitting the grease to be far superior to anything of the kind they have ever used. There is probably no company in the grease business that can produce any such number and character of testimonials from steam railroads. The immense number of trolley lines that have been constructed during the past few years, decided the company to make its grease suitable for use in trolley car axle boxes, and during the past year the Dreher grease has been employed in car axle boxes with the very best of results. When the company first went into this market, the managers state that the trolley lines everywhere were having trouble with hot boxes on their fast runs, but they have yet to receive the first complaint from any company which has used the Dreher grease properly. The Dreher Company also manufactures an excellent motor grease, and a full line of cylinder, engine and dynamo oils, and will guarantee a certain per cent. saving to any company which will contract for oils. The company's grease has been used on railroads all over the United States, Canada, Mexico, and any number of foreign countries, and has always given the best of satisfaction. Although this grease has been sold to more than eighty railroads, the company has never lost the business of a railroad on account of the quality of the grease.

List of Street Railway Patents.

U. S. Street Railway Patents Issued September 11, 1894, to October 9, 1894, Inclusive.

September 11.

Electric Railway System—Charles S. Bradley, Avon, N. Y. No. 525,690.

An electric system of transmitting power, comprising a plurality of alternating current generators organized to impose on line currents of different frequency, distributing lines supplied thereby, and alternating current motors adapted to be connected with any of the several distributing lines.

Combined Brake and Electric Switch for Street Railway Cars—George Brown, Long Island City, N. Y. No. 525,782.

A combined automatic brake and electric switch adapted to gradually increase or decrease the current, and means for applying or releasing the brakes and actuating the switches successively at the same movement.

Trolley Pole Connection—Maurice R. Mahon and John M. Crane, Newark, N. J. No. 525,789.

The combination with the trolley pole and socket of an electric car, of a frame adapted to connect with said socket, and having a hollow bridge, and an arm connecting with said pole and pivotally secured to said holder and working in said bridge.

Electric Railway—Herbert E. Rider, New York, assignor to Adolph Falck, same place. No. 525,864.

A conductor comprising a tread portion of a metal having high conductivity, and a supporting portion consisting of a central web, supporting flanges extending on either side of said central web at the lower edge thereof and tread holding flanges extending on either side of said central web at the upper edge thereof, said tread holding flanges being upwardly curved so as to form a shallow groove, within which the tread portion of the conductor is supported, whereby a large contact surface for the current collector upon the highly conductive portion of the conductor is provided.

Trolley for Electric Railroads—Edward Dawson, Terre Haute, Ind. No. 525,886.

The combination, with a socket adapted to be secured to a trolley pole, of two brackets secured to the said socket and provided with screw threaded bosses at their upper ends, and a hollow pin screwed upon the said bosses and forming the bearing for the trolley wheel.

Switch Operating Device—George A. Fulford, Providence, R. I., assignor of one-half to Stephen C. Howard, same place. No. 525,892.

The combination with brackets secured to the car, of an actuating rod removably supported in said brackets and having a handle, and a wheel furnished with a thin edge rotatably mounted at the lower portion of the rod.

Fender for Street Railway Cars—Alfred J. Hollingsworth, West New Brighton, and Joseph A. Weaver, New York. No. 525,902.

This fender consists of folding side bars and detachable cross bars and detachable net.

Conduit System for Electric Railways—William G. Creighton, Chicago, Ill. No. 525,945.

A track rail, a separate plate forming a conduit therewith and having a grooved portion overhanging the rail, and a slot closer in the groove and adapted to rest upon the rail edge.

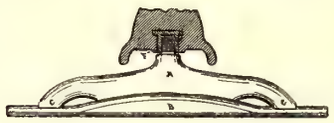
Car Fender—Samuel A. Darrach, Newark, N. J., assignor to the Darrach Car Fender Company, same place. No. 525,977.

A car fender composed of two sets of springs jointed together, of a swinging brace for keeping one set of the springs distended, and a scoop hinged to said fender.

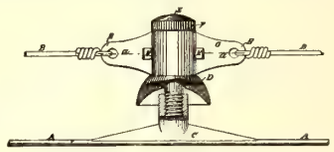
September 18.

Bond for Electric Railways—Dwight D. Book, Brooklyn, N. Y. No. 526,142.

A rail bond for electric railways comprising a bond plate electrically connected with the rail provided with upwardly extending holes to facilitate connection with the bond conductor.



NO. 526,422.



NO. 526,704.

Trolley Wire Finder—Edward Gale, Peoria, Ill. No. 526,183.

The combination of the trolley pole and wheel with a guard or finder, mounted on the pole near the wheel; said guard having mounted thereon revoluble sleeves extending laterally beyond the vertical planes of the sides of the wheel, and being movable vertically with relation to the wheel.

September 25.

Conduit for Electric Railways—David F. Graham, Springfield, O., and William P. Allen, Chicago, Ill., assignors of one-third to Oliver S. Kelley, Springfield, O. No. 526,392.

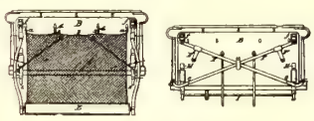
This is a slotted conduit with hinged plates below said slot, and adapted to contact in a line substantially under said slotted opening and provided with upturned corners. A moving contacting device having beveled edges is adapted to enter between said plates. Switching devices are connected to said plates, whereby a forward movement of the contacting devices elevates said plates and establishes an electrical connection from said feeding wires to the conductors.

Bracket for Trolley Wires—Leroy S. Pfouts, Canton, O. No. 526,408.

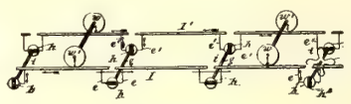
The combination of a pole, provided with a fixed right angle arm, provided with a yoke, and a pivoted trolley wire supporting arm.

Trolley and Feed Wire Bracket—Leroy S. Pfouts, Canton, O. No. 526,409.

The combination of a pole provided with a pivoted feed wire arm, having attached thereto a trolley wire supporting arm, both of the arms located at right angles to the trolley and feed wires.



NO. 525,902.



NO. 526,963.

Trolley Wire Hanger—Irvin B. Walker, Sioux City, Ia. No. 526,422.

A trolley wire hanger constructed of a single piece, and having a central lip grooved upon its upper surface for the reception of the wire, the ends of said hanger extending longitudinally beyond said lip and over said wire and being grooved upon their under edges.

Cable Car Grip Slot Brake—James T. Marlin, Kansas City, Mo., assignor of one third to Alfred Baker, Kansas City, Kan. No. 526,453.

In a cable car grip, slot brake, the combination with the grip, of levers carried by the framework, arms depending from said levers through the grip slot, and friction plates carried by said arms, so that when said center piece is elevated a sufficient distance, said friction plates will engage the slot rails.

Closed Conduit for Electric Railways—Charles D. Tisdale, Boston, Mass., assignor to himself, and John D. Gould, New York. No. 526,468.

An electrical conduit, formed of the flexible tube, the main conductor arranged at the bottom of the tube, the auxiliary sectional conductor placed on the top of the tube and provided with contact pins extending downward into the tube and provided with collars within the tube.

Register for Street Cars—William D. Forbes, Hoboken, assignor, by mesne assignments, to Horace B. Miller, trustee, Montclair, N. J. No. 526,567.

A register having a case, and a flanged rim graduated to form an annular dial in combination with a rotary disk, inclosing the front of the case and carrying a pointer to co-operate with the annular dial.

TESTING INDICATOR FOR ELECTRIC RAILWAY CARS—Theodore Stebbins, Boston, Mass. No. 526,644.

An indicator for testing electric circuits, comprising an indicating instrument, an electric switch having a series of contacts connected with the parts of the circuit or apparatus to be tested and with the terminals of the indicating appliance, and switch connections for placing the terminal of the indicating instrument, either in connection with a suitable source or current or with the ground at pleasure.

OCTOBER 2.

TROLLEY WIRE HANGER—John J. Green, Boonton, N. J., assignor to the Loando Hard Rubber Company, same place. No. 526,704.

In a trolley hanger supporting devices consisting of parts struck from sheet metal, and formed so as to be adapted to conjointly engage the trolley wire supports.

TROLLEY SPRING—Julius L. Hanson, United States Army. No. 526,705.

The trolley spring made up of two similar clasp springs having their spiral bends interlocked, and the ends of their members oppositely connected.

TROLLEY GUARD—Henry J. Tanner, Lynn, assignor of one-half to Harry Fairfield Hamilton, Boston, Mass. No. 526,756.

A trolley head, with a yoke of balls or wheels which meet above the trolley wire for the purpose of retaining the trolley wheel on the trolley wire, and which are separated by the pressure of the trolley wire upon them when the said wire enters and when it leaves the space inclosed by the retaining devices and the trolley wheel.

CONDUCTOR SWITCH—George H. Benjamin, New York, assignor to the firm of Siemens & Halske, Berlin, Germany. No. 526,850.

In an electric railway, the combination with a main track and an adjoining switch track; of working conductors for each of said tracks, one of said tracks having a sectional conductor normally out of the plane of the conductor of the other track, but adapted to be brought into line with the adjacent sections of the conductor of its own track, and close the gap therebetween.

CAR FENDER—Ambrose J. B. Berger, Higham, Mass., assignor to the Steel Cable Engineering Company, of Maine, No. 526,851.

A car fender consisting of a platform pivoted to the car and normally held above the track, combined with a hooked dog pivoted above said platform, a flexible sustaining connection secured to the platform, and adapted to be engaged by the hook of said dog, a latch to normally engage said dog, a removable pin depressible in the car floor, and connections between it and the latch, depression of said pin tripping the latch and thereby permitting the dog to turn upon its pivot and disengage its hook from said platform connection.

CAR FENDER—William L. Shockley, Colorado Springs, Colo. No. 526,949.

This is a vertically swinging, spring depressed fender hung beneath the car, with a revoluble, vertical shaft mounted on the car platform, and a cable and lever connection between said shaft and the fender, whereby the fender may be raised.

CONDUIT FOR ELECTRIC RAILWAYS—Michelangelo Cattori, Rome, Italy. No. 526,963.

In an electric railway, the combination, with two corresponding adjacent sections of each of the conductors, of a rotatable circuit closer having a surface made partly of an insulating and partly of a conducting material, and stationary contact pieces adapted for continuous sliding contact with the said surface of the circuit closer, and connected to the said adjacent sections of the conductors, the said contact pieces and the insulating and conducting portions of the circuit closer being so arranged relatively to each other that the adjacent sections of one conductor are connected when the corresponding sections of the other conductor are disconnected, and *vice versa*.

CAR FENDER—Robert Raphael, Brooklyn, N. Y., assignor to William J. McKelvey, same place. No. 527,004.

This is a car fender composed of brackets adapted to be secured to the bottom of a car, downwardly inclined guides formed on these brackets, a cradle constructed to engage the guides, and means for causing the cradle to move on the guides.

OCTOBER, 9.

CABLE STOP MECHANISM—Edwin Neil, Newark, N. J. No, 527,069.

An extra or idle cable is located in the conduit with the working cable, and is connected at the power station with means for shutting off the power from the working cable.

ELECTRIC LOCOMOTIVE—Nicolas J. Raffard, Paris, France, assignor to the Thomson-Houston Electric Company, of Connecticut. No. 527,126.

The electric motor is supported from the axle through spring supports allowing of relative movements due to vibrations of the parts. The part driven by the motor and surrounding the axle is out of direct or rigid contact therewith, and a flexible driving connection is provided between such part and the axle.

CONDUIT SYSTEM FOR ELECTRIC RAILWAYS—William A. Butler, New York, assignor to John Gilmore Boyd. No. 527,265.

In an electric railway system, a contact box consisting of an inner closed stationary shell having a conductor arranged therein, extending therefrom and adapted to be connected with the lead of an electric circuit, an exterior shell capable of rocking about the inner shell, a contact arm carried by the inner shell and adapted to be moved into contact with the conductor therein, and a conductor extending through and carried by the outer shell and mechanically and electrically connected with the contact arm of the inner shell.

LIFE SAVING GUARD FOR CARS—Louis E. Dubois, Toronto, Can. No. 527,270.

A spindle is pivotally connected to the car, a balance connected to the spindle, a framework rigidly connected to the ends of the spindle, a netting secured to the framework and to the car, a lever operates the spindle, and a switch mechanism provided adapted to cut on or off the current to the motor of the car, operated by the respective movement of the lever.

CONDUIT ELECTRIC RAILWAY—James E. Toole, Northumberland, Pa. No. 527,301.

The conduit is composed of two similar parts, each having an inwardly extending base and an inclined side, the inwardly extending base portions being spaced apart to form a drainage solt and provided at intervals with ribs which cross said slot.

TROLLEY WIRE SUPPORT OR HANGER—Sam C. Woodhead, Philadelphia, Pa. No. 527,355.

A series of revoluble supports or hangers are supported by the overhead system whereby when said trolley wire has become broken or cut, the said supports or hangers will prevent the same from falling to the ground.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. THE STREET RAILWAY PUBLISHING COMPANY, HAVEMEYER BUILDING, NEW YORK.

Some Press Comments on our "Souvenir Edition."

"The Souvenir number of the STREET RAILWAY JOURNAL, is indeed a brilliant achievement, and is printed in high class style."—*American Banker.*

"The Souvenir number of the STREET RAILWAY JOURNAL is an indication of the substantial character of trade journalism."—Providence *Sunday Journal.*

"The *Electrical Review* extends its hearty congratulations to the STREET RAILWAY JOURNAL, both for the success it has attained in its chosen field and on the production of a supurb special number."—*Electrical Review.*

"THE STREET RAILWAY JOURNAL, this city, has celebrated its tenth anniversary by issuing a beautiful Souvenir number as a supplement. It contains many portraits and illustrations of officials, etc. It certainly shows progress and enterprise."—*Empire of Finance and Trade.*

"In artistic design and execution, this Souvenir issue of the STREET RAILWAY JOURNAL, is above criticism. We have seen no such pretentious and artistically executed work, as is this in the line of trade journalism. This issue is a credit to American journalism."—*Age of Steel.*

"We are compelled to congratulate the STREET RAILWAY JOURNAL, on its Souvenir number issued this month. Its illustrations are of a high order. Everything about the JOURNAL indicates energy and success. It is a pleasure to have such well edited periodicals come into our office."—*Daily Financial News.*

"The STREET RAILWAY JOURNAL has issued a handsome Souvenir number in connection with the Thirteenth Annual Convention of the American Street Railway Association held in Atlanta, Ga., October 17, 18 and 19. The book contains 122 pages of text principally descriptive of Atlanta, Chattanooga and other large Southern cities, well illustrated by photographic reproductions and printed on heavy wood cut paper. The whole is a fine specimen of trade journalism."—*Railroad Gazette.*

"THE STREET RAILWAY JOURNAL publishes a splendid Souvenir edition this week that is a magnificent advertisement for Atlanta and the South. Atlanta, as the place of holding the Convention has, of course, the most conspicuous place in this edition. There are illustrations of men and buildings in Atlanta executed in the finest style of the engraver's art. * * The whole paper is a magnificent journalistic production, and reflects credit on the STREET RAILWAY JOURNAL."—*Atlanta Journal.*

"THE STREET RAILWAY JOURNAL this year renewed its custom of distributing to those attending the Convention a Souvenir edition which was a model of artistic and typographical excellence. Filled with interesting and appropriate matter, handsomely illustrated and printed on heavy paper, it will undoubtedly be preserved by many present as a reminder of one of the most successful and enjoyable meetings ever held by the Association. The JOURNAL is to be congratulated on the fine appearance of this souvenir number."—*Electrical World.*

"Our esteemed and always excellent contemporary the STREET RAILWAY JOURNAL has issued a beautiful decennial number, in honor of its tenth anniversary, and of the Atlanta meeting of the American Street Railway Association. It contains a sixteen page article on Atlanta, a ten page article on the Association, a thirty page article on the street railway systems of the Southern cities, and a twenty page article on the history of the street railway industry. All of these are handsomely illustrated—containing over 400 illustrations, among which are more than 125 portraits of street railway men. Altogether it is one of the finest examples of technical and trade journalism ever seen."—*Electrical Engineer.*

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by Spencer Trask & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co	100	1,000,000	Q Feb.	1½	1890	117	117½
Watervleit Turnpike & R. R. Co	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort	1865	40,000	J. & J.	5	1905	101½	.....
" " " 3d Mort	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort	1888	50,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	103½	.....
" " " Debenture	1891	200,000	M. & N.	6	1901	111	.....
Watervliet Turnpike & R. R., 1st Mort	1889	350,000	M. & N.	6	1919	112	114
Watervliet Turnpike & R. R., 2d Mort	1889	150,000	M. & N.	6	1919	111½	113

BALTIMORE STOCKS AND BONDS.—Corrected by Hambleton & Co. Bankers, 9 South Street, Baltimore, Md., Oct. 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co	25	2,500,000	Sem-an	4	.....	70¾	70½
City & Suburban Ry. Co	50	3,000,000	.....	1	.....	47	50
Central Pass. Ry. Co	50	300,000	.....	...	.....	68	70
Balto. Traction Co. (Cable)	25	5,000,000	Quart.	1	.....	15¾	16¼

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort	1892	500,000	.....	5	.....	111½	112
City & Sub. Ry. Co. gen. mort	.....	2,000,000	J. & D.	5	1922	109	109¼
Balto. Traction Co. (Cable)	1889	1,500,000	M. & N.	5	1929	109	109½
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D.	5	1942	104	104½
" " "	1891	1,250,000	M. & S.	6	1901	103	103½
City Pass. R. R. Co	1891	2,000,000	"	5	1911	113½	114

BOSTON STOCKS.—Corrected by R. L. Day & Co., 40 Water Street, Members of Boston Stock Exchange, Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref	50	$6,400,000	J. & J.	4	1887	82½	83
West End Com'n	50	9,085,000	J. & J.	3	1890-1892	53	53⅛

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. Staples & Co., 215 Montague Street, Brooklyn, O t. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broooklyn City R. R. Co	10	6,000,000	Q.—J.	2	.....	.....	167
Brooklyn Traction Co., pref	100	3,000,000	.....	...	1893	65	.....
" " common	100	6,000,000	.....	...	1893	16	.....
Coney Island & Brooklyn R. R. Co	100	500,000	Oct. 1.	4	.....	.....	150
Long Island Traction Co	100	30,000,000			1893	12	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds	.....	300,000	J. & J.	5	Jan. 1909	103	.....
Coney Island & Brooklyn R. R. Co., certificates	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st	.....	125,000	F. & A.	7	Aug. 1897	.....	107
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st	.....	3,000,000	J. & J.	5	July, 1916	112	115

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. Kaufman, Charleston, S. C., Oct. 22. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co	50	$100,000	J. & J.	0	.....	.....	73
Enterprise Ry. Co	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by William B. Wrenn, 108 LaSalle Street, Chicago, Ill., Oct. 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	318	320
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	256	257
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13.189,000	Q.—F.	1½	.....	131⅝	135½

BONDS.	Date of Issue	Amount Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	101⅝	101¾
Chicago Passenger	1883	400,000	F. & A.	6	1903	109½	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	100¾	100½
North Chicago Street 1st mort	.....	2,413,000	J. & J.	5	1906	.....	103½
West Chicago Street	.....	4,100,000	M. & N.	5	.....	102⅞	103¾
West Chicago Street, Tunnel	.....	1,500,000	F. & A.	5	.....	100	101½
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	102	102½

CINCINNATI STOCKS AND BONDS.—Corrected by Geo. Eustis & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Oct. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$8,250,000	Q.—J.	5	.....	106⅞	107⅛
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	106¾	107¼
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	60	65
" " " Pref.	100	100,000	.....	6	.....	98	99½
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....	.	.....	22½	23½

BONDS.	Date of Issue	Amount Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati St. Ry	.....	50,000	J. & J.	7	July, 1895	101⅛	104
" "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	99¼	100
	.....	150,000	J. & J.	5	.....	100¾	101¼
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	110½	111½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable	.....	280,000	M. & S.	5	Mar. 1906	105	105½
Cin. Inclined Plane Ry	.....	125,000	J. & J.	7	July, 1899	107	108
" " " "	.....	300,000	J. & J.	6	Jan. 1914	105	106
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	90
" " 5-20's 2d	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati	.....	250,000	M. & S.	6	Mar. 1912	114	115
S. Cov. & Cin. 2d Mort. gold 6's	.....	250,000	J. & J.	...	1932	113½	114½

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. Hayes & Sons, Bankers, Cleveland, O., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co.	100	12,000,000	.....	....	1893	49	50
The Cleveland City Ry. Co	100	8,000,000	.....	....	1893	58	59

BONDS.	Date of Issue	Amount Out-standing	Interest Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	100	102½
" " City " "	1893	2,349,000	.....			100	102

DETROIT STOCKS.—Corrected by CAMERON CURRIE & Co., Bankers and Brokers, 82 Griswold Street, Detroit, Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	200	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	125	150

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry. Co., pref...	100	$2,000,000	A. & O.	5	Jan. 1891	87	88
Louisville St. Ry. Co., com....	100	4,000,000	.....	...	Jan. 1891	35	36

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	102½	103½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	116	117
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	116	117
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$600,000	J. & J.	4	.....	45	47
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	...	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
New Haven Street Ry. Co.....	1894	600,000	J. & J.	5	Jan. 1919	.....	100
New Haven & W. Haven R. R. Co	1892	500.000	M. & N.	5	Nov. 1912	100	102
Winchester Ave. R. R. Co. Deb.	1894	100,000	M. & S.	6	Mar. 1909	100	.....
Bridgeport Traction Co.....	1893	2,000,000	J. & J.	5	July, 1923	95	100
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 188 Common Street, New Orleans, La., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.....	100	1,200,000	Quart.	1½	1867	121½	125
Crescent City R. Co.....	100	1,150,000	"	3	1866	72	76
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	37½	40
New Orleans City & Lake Co.	100	1,500,000	Quart.	2½	1860	106½	112
Orleans R. R. Co.....	50	185,000	"	2	1868	31	36
St. Charles Street R. R. Co..	50	600,000	"	2½	1866	55¾	57

Bonds.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	102	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	100½	.....
do do new	1886	40,000	M & N	6	1896	100½	.....
do do	1893	2,000,000	J & J	6	1943	86	.....
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	116	.....
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	88¾	90
St. Charles Street R. R. Co...	1881	105.000	J & D	6	'95-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, Oct. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (old stock)	50	$2,000,000	M. & N.	4	May, '91.	161¾	162
" " (new stock)	50	2,000,000	.....	...	May, '94.	157½	157¼

BONDS.	Date of Issue	Amount Out-standing.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by JAMES MCGOVERN & Co. 6 Wall St., New York, Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	29	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	183½	186
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	160	.....
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	159	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	136	140
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4½	.....	300	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	40	50
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	250	300
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	138	140
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	200	.....
Third Avenue.....	100	5,000,000	M.—N.	4½	.....	186	187
23d St.....	100	600,000	Q.—F.	2½	.....	290	.....
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	145	.....
Union Railway Co.....	100	2,000,000	.....	...	.....	140	160

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	110	113
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	107	109
2d mort.....	.....	500,000	J. & J.	5	July, 1914	106	109
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	109	112
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	106	109
Broadway Consolidated.....	.....	7,650,000	J. & J.	5	 1943	110¼	110¾
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	112	114
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	120	.....
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	110	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	100	101
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	45	52
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	102	106
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	105	.....
Third Avenue.....	.....	7,000,000	J. & J.	6	Jan., 1937	118½	118¾
23d Street.....	.....	250.000	M. & N.	7	May, 1893	100	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb, 1942	106	107

PHILADELPHIA SECURITIES.—Corrected by HUHN & GLENDINNING 143 South Fourth st. (Bullitt Building), Philadelphia, Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	272	274
Continental.....	50	1,000,000	J.—J.	6	1873	127	130
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	325	327
Germantown.....	50	1,500,000	Q.—J.	2¾	1858	112	113
Green & Coates...	50	500,000	Q.—J.	3	1858	124½	126
Hestonville...	50	2,050,000	.....	...	1859	58¾	60
Lombard & South.....	25	500,000	A.—O.	8	1861	90	91
People's Traction Co.....	50	10,000,000	.....	...	.....	54	54½
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	165	166
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	80	85
*Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	103½	104
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	229	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	215	216
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	229	230
Union.....	50	1,250,000	J.—J.	9½	1864	195	200
West Philadelphia...	50	750,000	J.—J.	10	1857	195	200
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	112	112½
Baltimore Traction.....	25	5,000,000	.....	1	1889	15¾	16
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co. *Ex. Allotments.	50	3,000,000	J.—J.	...	.....	12½	12¾

BONDS.	Date of Issue	Amount Out-standing	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	107½	108¾
" " Imp.	1892	1,250,000	M.—S.	6	1901	101	102
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100¾	102
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	103½	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort..... ...	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by Richard C. Patterson, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by John B. Barbour, Jr., 306 Times Bldg., Pittsburgh, Pa., Oct. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	...	.....	20¾	21¾
Citizens' Traction R. R. Co.	50	3,000,000	J. & J.	3	.....	59¾	60
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	14	14½
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	...	63½
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	...	.....	21⅝	22
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	38½	39
West End R. R. Co.	50	1,000,000	J. & J.	1	.....	16	20
Second Avenue R. R. Co.	50	1,000,000	J. & J.	2	.....	50	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	...	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.	100	100,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	27½	28

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O.	5	1927	106	.....
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	105	106
Pitts. & Birmingham Traction Co.	1892	.....	.....	5	.....	95	95½
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	.....	100
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	104½	104⅝
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	101¾	102
Second Ave. Electric R. R. Co		500,000	J. & J.	5	1923	.....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.		500,000	J. & J.	5	1922	102	.....
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	.....	.....
Suburban Rapid Transit.	.....	.....	.....	6	.....	.....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	.....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incl'e PlaneCo. 1st Mort	1883	125,000	.....	6	1903	.....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.	1889	200,000	J. & J.	6	1910–19	.....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by Chace & Butts Bankers, Providence, Oct. 19.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	..	.....

BONDS.	Date of Issue	Amo'nt Out-stand'g	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	95	100
Newport St. Ry. Co.	.....	50,000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. Clark & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Oct. 19.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	30	31
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	58	60
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	12	18
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	47	49
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	77	80
do do Common.	100	4,000,000	.....	...	1892	19½	20½
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	80	82
do do Common.	100	3,000,000	.....	...	1892	14	18
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	32	34

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	96	99
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	100	102
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	95
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	101	101¼
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	91½	93
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	89	90

SAN FRANCISCO STOCKS AND BONDS.—Corrected by Philip Barth, Broker, 440 California Street, San Francisco, Cal., Oct. 11.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	...	.....	.....	101
Geary St., Park & Ocean R.R.Co	100	1,000,000	Monthly	...	.....	.....	100
Market Street Cable Co.	.....	18,750,000	.....	...	.....	41½	42
Metropolitan Electric	.....	1,000,000	Monthly	...	.....	27	.....
Oakland, S. L. & Haywards	.....	.....	.....	...	.....	.....	100
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	12	.....
Sutter St. R. R. Co.	.....	2,000,000	Quart'ly	...	.....	.....	100

Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	J. & J.	5	.....	106½	.....
Ferries & Cliff House.	.....	650,000	M. & S.	6	1914	.....	110
Geary St., Park & Ocean	.....	671,000	A. & O.	5	.....	103	105½
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	119½	.....
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	114½	117
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	112	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	.....	101
Powell Street R. R.	.....	700,000	M. & S.	6	1912	106½	110
Sutter St. Cable Co.	.....	900,000	M. & N.	5	.....	.....	106½

ST. LOUIS STOCKS AND BONDS.—Corrected by James Campbell, Broker, Rialto Building, 218 N. 4th St., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	60	62
Citizens'	100	1,500,000	Oct. '93	4	1887	80	85
Jefferson Avenue.	100	112,000	Dec. '88	2	1885	125	135
Lindell	100	2,500,000	.....	...	1890	99½	101
Missouri.	100	2,000,000	Q.—J.	2	1891	200	210
People's	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis	100	2,000,000	J. & J.	3½	1890	147	150
Fourth Street & Arsenal	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban	100	2,500,000	...	...	1891	20	21
Southern, Pfd.	.....	800,000	Jan. '94	3	.....	80	85
" Com.	.....	700,000	.....	...	.....	15	25

BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	98	100
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	105	107
Fourth St. & Arsenal	1888	50,000	J. & J.	6	1898–1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895–1910	101½	103
Missouri Cable	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	99	100
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable	1889	800,000	J. & J.	6	1889–1914	90	95
St. Louis Cable	1890	1,500,000	M. & N.	5	1900–1910	101	103
Union Depot	1890	4,000,000	A. & O.	6	1900–1910	105	106
Southern	1884	200,000	M. & N.	6	1904	103	105
Southern	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban	1891	1,400,000	F. & A.	5	1921	85	87
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	70	80

WASHINGTON STOCKS AND BONDS.—Corrected by Crane, Parris & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	280	310
Metropolitan R. R.	50	750,000	Q. J.	2	1864	80	90
Columbia R. R.	50	400,000	Q. M.	1	1870	57	.....
Belt R.R.	50	500,000	Q. J.	...	1875	25	.....
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	30	.....
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	85

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'tn & Geo'tn conv't. 1st.	'83–'99	3,000,000	J. & J.	6	1899-1929	125	135
" " " 2d.	.....	500,000	J. & J.	6	1903–1943	125	135
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	101	105
Belt.	.....	500,000	J. & J.	6	1921	80	86¼
Metropolitan R. R. convert.	.....	200,000	J. & J.	5	1901	102½	104¾
Columbia R. R. 1914.	.....	500,000	A. & O.	6	.....	107	110

Financial.

The issue of $1,700,000 bonds by the Metropolitan Railway Company, of Washington, D. C., has been authorized by the stockholders of that company.

$ $ $

The Northwestern Elevated Railroad Company, of Chicago, has filed a mortgage to the Illinois Trust & Savings Bank, trustees, the amount being $15,000,000. The principal is due August 1, 1944.

THE Massachusetts railroad commissioners have approved the issue of additional capital stock to the amount of $264,000 by the Brockton Street Railway Company.

$ $ $

IT is stated that arrangements for consolidating the Morrisse system of electric railways, in Paterson and vicinity, under the title of the New Jersey Electric Railway Company, are progressing rapidly.

$ $ $

CONTROL of the Union Railway Company, of New Bedford, has been secured, it is said, by a syndicate of New York, Rochester, Boston and Fall River capitalists. The new syndicate has acquired 1,350 out of 2,600 shares. The price paid is said to have been $169 per share.

$ $ $

THE annual meeting of the Mornington Tramway Company, of Dunedin, New Zealand, was held July 19. The line is operated by cable, and in the year ending June 30, 1894, the cars ran 57,881 miles, carrying 542,161 passengers. Receipts £4,840, working expenses £3,178. A dividend of 7 per cent. was declared.

$ $ $

THE annual meeting of the Melbourne Tramway & Omnibus Company, of Melbourne, N. S. W., was held August 9. The report showed passengers carried by the sixteen cable and three horse tramway lines 34,054,145, a decrease of 1,557,781 under last year; miles run 7,968,738 or 321,621 less than last year. There are forty-three and a half miles of double track (cable), and four and a half miles of double track (horse). The falling off of traffic was attributed to the continued hard times. A dividend of 5 per cent. or £18,056 was declared.

$ $ $

The Syracuse (N. Y.) Consolidated Street Railway Company, having made default on the coupons of its 5 per cent. first mortgage bonds, due January 1 and July 1 last, and foreclosure proceedings having been begun by the trustee, Simon Wormser, Casimir Tag, Clarence H. Wildes and Isaac N. Seligman, representing more than a majority of the bonds, have been constituted a committee for the protection of the bondholders. These are requested to deposit their holdings with the Central Trust Company, of New York, receiving negotiable certificates therefor.

$ $ $

THE Metropolitan Electric Company, which recently leased the plant and franchises of the Reading (Pa.) Electric Light & Power Company for ninety-nine years, with the privilege to buy at the end of the lease, has given a mortgage to the Pennsylvania Trust Company for $150,000. Coupon bonds are to be issued by the company, covering the amount payable October 1, 1909, with interest at 6 per cent. payable semi-annually. Another mortgage for $75,000 was also given by the Reading & Temple Electric Railway Company to the Reading Trust Company for the issue of 5 per cent. bonds, redeemable in fifteen years and payable in thirty.

$ $ $

THE following is a comparative statement of the operations of the Columbus (O.) Street Railway Company for the month of September: Gross earnings, 1894, $59,013.71; 1893, $47,161.44; increase, $11,852.27. Operating expenses, 1894, $23,474.38; 1893, $29,618.14; decrease, $6,143.76. Net earnings, 1894, $35,539.33; 1893, $17,543.30; increase, $17,996.03.

For the nine months ending September 30, 1894, the company presents the following report: Gross earnings, 1894, $421,166.96; 1893, $406,652.61; increase, $14,514.35. Operating expenses, 1894, $197,781.56; 1893, $255,518; decrease, $57,736.44. Net earnings, 1894, $223,385.40; 1893, $151,134.61; increase, $72,250.79.

$ $ $

THE annual meeting of the Pittsburgh (Pa.) & Birmingham Traction Company, was held October 9, and the following were elected directors: Dr. John M. Duff, C. M. Clark, A. C. Wettengel, Harry Moore, E. H. Jennings, W. R. Ford and Henry J. Lotz. President J. M. Duff read the following statement for the year ending July 1, 1894: Receipts from all sources except inclines, $297,497.96; receipts from inclines, $60,491.67; total, $357,989.63. Expenses: Expenses and taxes, $183,420.35; bond interest, $110,450; total, $293,870.35; incline expenses, $75,653.43; less dividend received from Mt. Oliver incline, $3,714; total, $71,714; total expenses, $365,809.78; less for the year, $7,820.15. The railways carried 5,862,024 passengers during the year, and were operated at the expense rate of 45½ per cent. of their gross receipts, and at 10¾ cents per car mile, exclusive of bridge tolls.

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LINE CONSTRUCTION MATERIAL.

Annual Meeting of the Cleveland Electric Club.

At the annual meeting of the Electric Club, of Cleveland, held at its club rooms, Oct. 3, 1894, the following officers were elected: President, Chas. W. Wason; first vice-president, B. M. Barr; second vice-president, T. E. Adams; secretary, H. J. Davies; treasurer, E. W. Moore. Board of managers: Chas. W. Wason, H. J. Davies, R. M. Fuller, E. W. Moore, Geo. W. Cleveland.

Experiments With Fuses for 500 Volt Circuits.

Some interesting experiments with fuses for 500 volt circuits have been made recently by W. E. Harrington, superintendent of the Camden Horse Railroad Company, of Camden, N. J., in addition to those described in the paper by him on this subject read at the Atlanta Convention. The object of making the tests was to determine the value of recent rules adopted by the Underwriters' International Electric Association on the use of 500 volt fuses, reference to which is made in Mr. Harrington's paper.

The experiments were made with fuses of No. 8 B. & S. gauge copper wire, and with currents of from ten to fifty amperes, in ten ampere steps in each instance, note being taken of the ohmic resistance of the arc following the melting of the fuse. It was found that the ohmic resistance of the arc dropped off very rapidly as the current increased, the decrease being attributed to the greater volume, and consequently greater cross section of the gas formed, showing that under conditions of a short circuit on a railway system this resistance is negligible. It is interesting to note that a slight movement of air in the vicinity of the arc caused a variation in the resistance. The foregoing, Mr. Harrington believes, establishes the truth of the statement that if a given fuse protects for one maximum current, it may not for greater currents.

Different sections of No. 30 B. & S. gauge copper wire were tested in series with a C.-S. circuit breaker across the 500 volt bus bars of the switchboard of the Camden Horse Railroad Company, and it was found that with each length of the No. 30 B. & S. wire, ranging from one inch to eight inches, the circuit breaker which was set for 400 amperes was opened when a short circuit was made. Experiments were made with and without bridges. In other words, it was shown a copper wire which will fuse upon the passage of two amperes will allow about 400 amperes to pass on a short circuit. The reason for this given by Mr. Harrington is that the excessive current flows not through the fuse, but through the arc maintained at the expense of the terminals, the fuse simply playing the role of establishing a condition. In many instances, fuses made of No. 22 B. & S. gauge copper wire, six inches in length, have opened circuit breakers requiring 800 amperes to open. According to Mr. Harrington there exists a popular misconception of the action of bridges. A bridge is an additional protection, as it increases the length of the arc, other conditions remaining the same, but in short circuits the little additional length due to the bridge does not seem to have much effect, and the ideal fuse block for the protection of 500 volt circuits is one with protected terminals.

Do You Like Comfort When You Travel?

During the period covered by the World's Fair, the Lake Shore & Michigan Southern Railway came into great prominence as the route of the Exposition Flyers. These were the fastest long distance trains ever placed in service on any line of railway. They made the run from Chicago to New York in the remarkable time of twenty hours. Great importance attached to this event. The eyes of the railroad and the traveling world watched the performance of these trains; newspapers devoted columns to, and poetry and stories were written about them. They were recognized as one of the leading features in connection with the great Columbian Exposition. They aptly and powerfully illustrated the merits of this great line as a passenger route.

Long ago the United States Government recognized and selected the Lake Shore as the best route over which to run the famous White Mail Trains, the fastest service of this nature in the world.

A vigilant management, a perfect roadbed, double tracks, and absence of grades and curves have made possible the operation of this high class of service.

Thus it comes about that the Lake Shore takes rank among travelers as the most comfortable of American railways. It is a line used by persons desiring a prompt and reliable service, and who like comfort and elegance in their travels.

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THE STREET RAILWAY JOURNAL

Vol. X. *NEW YORK & CHICAGO, DECEMBER.* *No. 12.*

THE STREET RAILWAYS OF WASHINGTON, D. C.

All the principal street railway lines operating in the city of Washington are at present undergoing important changes. Some are extending their present limits, while others are being rebuilt, one for cable traction and another for an underground electric system. In studying the street railway situation of Washington, it must be remembered that all the street railway lines of the District of Columbia are under the direct supervision of Congress, and none of them can effect a change of motive power without a special act, and this has been secured in the case of the Columbia Railroad Company and other roads, which will be noted below. It should also be borne in mind that an act of Congress, passed some years since, prohibits the use of overhead wires for the operation of any of the street railway lines within the city limits.



FIG. 1.—CABLE CURVE AT PEACE MONUMENT, FOOT OF PENNSYLVANIA AVENUE—WASHINGTON, D. C.

Washington & Georgetown Railroad Company.

All the lines controlled by this company are now operated by cable, and are run in three divisions known as the Pennsylvania Avenue or Georgetown division, 7th and 14th Streets divisions. The Georgetown terminal of the Pennsylvania Avenue section is to be extended a distance of 1,500 ft. to the Aqueduct Bridge, where a new car house and station will be erected, through which, to the right of the street, the track will make a loop, by means of which the cable trains will be turned. This will be a gravity loop, and the cable will not follow the line of the track, but will encircle a terminal sheave located in the street. The present car house in Georgetown will be abandoned and devoted to other purposes. The present length of rope, which operates the Georgetown division from the central power station, is 2,350 ft., but it will be correspondingly increased to operate the extension. The length of the rope which operates the Navy Yard end of the line is 31,500 ft., that on 14th Street division is 27,700 ft., and on 7th Street division 33,250 ft.

All the ropes now employed on this line are one and ¼ a quarter inches in diameter, are of the Lang lay type, and were manufactured by Roebling and Broderick & Bascom. The lay of these ropes is eight and a half inches, somewhat shorter than the lay usually employed by foreign manufacturers.

On the Georgetown line the average life of the cable is about 120 days or about 20,000 miles, while the 7th Street line being nearly straight, the rope in that division has an unusually long life. The rope which is now run-

ning was put in on July 2, 1893, and is still in fair condition.

During the early history of the Pennsylvania Avenue line, the traffic was interrupted quite frequently by the breaking or stranding of the ropes, but since Peter Moar was engaged as splicer and rope superintendent in February, 1893, there have been very few delays and only one serious one during the present year. Such a record is

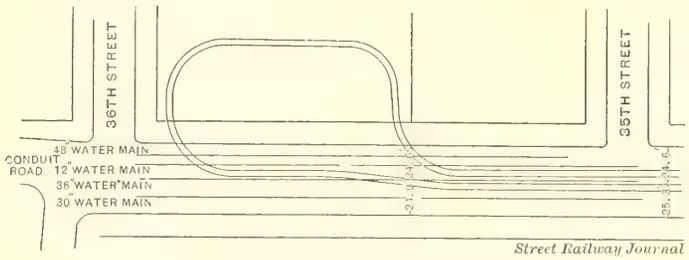


FIG. 2.—LOOP AT 35TH STREET—WASHINGTON.

evidence of the skill of the rope splicer and the care which is given to the ropes. Mr. Moar employs a rope dressing which he has originated, the material in which is known only to himself and to the officials of the company, and this is giving most excellent satisfaction, being very cheap and not liable to drop out in cold or wet weather. We do not know of a cable railway where the expense for rope dressing is maintained at so low a figure as on this system, as the following data will show:

CENTRAL POWER STATION.

3 cables=82,500 ft. of rope.
Material for coating and dressing, cost for nine months ending September 30, 1894, $151.86.
During this six new cables were put in and filled.

SEVENTH STREET POWER HOUSE.

1 cable=33,250 ft.
Material used for dressing, cost for nine months ending September 30, 1894, $11.88.

It will be noted that the expense on one of the ropes is less than five cents a day, and of all the ropes only about sixty cents per day. We are told of roads where a less number of miles of cable are operated, on which the average expense for rope dressing is nearly $15 a day. The proportion of ingredients employed in the rope dressing is varied to suit the conditions of the weather, and great care is exercised in applying it so that it is not too oily or too dry; in other words, a little "brain oil" is employed as one of the ingredients.

As we have before described in detail the equipment of the power stations of this system, it will not be necessary to repeat it in this connection, except to say that the method of rope drive employed in the central power station, in which both winding drums are driven from the same pinion, is giving most excellent satisfaction. The machinery is noiseless in operation, and the manilla ropes are making an excellent record, as well as the engines and boilers. The station, it will be remembered, is a large six story brick building, and the various floors are rented for offices and manufacturing purposes where power is employed, the shafting of the different floors being operated by an independent engine. All the apartments have not yet been leased, but the scheme is proving a paying one. The principal grip repair shop is on the ground floor, and this is equipped with a number of first class iron working tools. To this shop the grips of the entire system are brought every day for inspection, when they are cleaned and nuts and bolts tightened up. A raised iron platform in the middle of the shop is provided, on which the grips are overhauled, so that the oil and dirt are prevented from being scattered about the floor. We noted at the time of our visit that one of the five foot elevating sheaves was being repaired by lining the groove with cast steel segments which are held in place by steel bolts inserted on the inner side of the rim, thus prolonging the life of the sheave indefinitely. In the splicing room adjoining the tension runs, extra ropes are mounted in position on their spools ready to be run in when it becomes necessary to renew the rope.

The machinery in the 7th Street power station is also standing up exceedingly well under the long service, the line having been in operation nearly five years. This station is operated by compound engines, and the drums are operated by means of gear wheels, the main gears having wooden teeth which mesh with iron teeth on the pinion. After these wooden gears had been running about two years, they showed some sign of failing, and a new set was made, but the original teeth, with one or two exceptions, are still running, and seem to be in fair condition. The wooden keys, however, have all been renewed. It is proposed, in case it is found possible to change to the rope drive without interfering with the traffic, to replace the gear with a system of rope drive modeled after that in the central station.

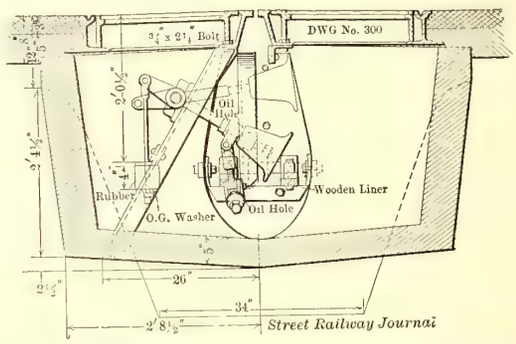


FIG. 4.—CROSS SECTION OF AUTOMATIC PICK-UP—WASHINGTON.

CAR SERVICE.

All the trains on this entire system consist of an open grip car and one or more trailers, open trailers being run in summer and closed cars in winter. The grips are operated by levers, and the gripman is stationed in the middle of the grip car. This method of operating the grip in the center of the car has been criticized somewhat in Washington, but, in our opinion, where the streets are as wide as they are here, and where the conditions are all favorable, there can be no more liability to accident with the gripman in the center of the car than when he is stationed on the front platform. In crowded streets like Broadway and Third Avenue, New York, the conditions are different. With open grip cars and the gripman in the center, accidents to people getting on or off are often prevented by the ability of the gripman to overlook the entire car. It is also claimed for the lever grip that it is more quickly operated, consequently the rope can be released and the car stopped quicker, with less danger of the gripman falling to release the rope in time at let-goes, than with the wheel grip. Should the grip be damaged en route, and require to be taken up out of the conduit, it can be done without disturbing the passengers where an open car is employed, while with a wheel grip operated from the front platform of a closed car, it is necessary to have the passengers leave the car in order to remove the grip. In this connection it may be stated that the prac-

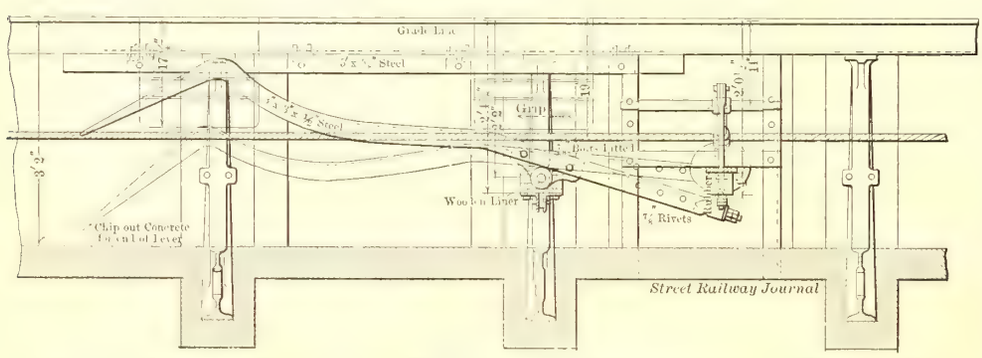


FIG. 3.—SIDE ELEVATION OF AUTOMATIC PICK-UP—WASHINGTON & GEORGETOWN RAILROAD.

tice of these roads sustains the claim that traffic is increased by the employment of open grip cars. Passengers will frequently jump on and ride for a short distance when they would not think of entering a closed car. It is very apparent that the dividends of a company running as many cars as are operated by this system will be materially affected by the gain or loss of only two or three passengers per trip.

Three pick-ups, similar to that shown in Figs. 3 and 4, have been in continuous service for over two years on the Pennsylvania Avenue line, namely, two at the 7th Street cable crossing and one at the Peace Monument junction. They are very satisfactory and reliable, the expense for maintaining being even less than that of elevating wheels. Each pick-up is required to throw the rope into the grip about 800 times per day or nearly 300,000 times per year, which represents nearly 2,000,000 pick-ups, as made by all three since the time they were installed. The operation is very simple and the work is done without any pounding or jerk, no matter what the speed of the car may be. The operation is as follows:



FIG. 5.—TRANSFER STATION NEAR TREASURY BUILDING—WASHINGTON & GEORGETOWN RAILROAD.

The car running by momentum brings the bottom of the grip into contact with the gooseneck or trip lever, which gradually throws the gypsy spool upward and carries the cable into the grip. As will be seen from the engraving, this lever swings on a shaft forming a counter-lever. On the extreme end of the lever is a universal connection provided with adjustment which raises the spool arm and accommodates itself to any position required.

After the grip has passed over the gooseneck lever, the weight of the spool and connections overbalances the trip lever and so automatically the device resets itself. The shape of the trip lever is such that the grip leaves it gradually. The spool arm also has the drop cushioned, as shown, by means of rubber springs attached to a short lever on the opposite side of the supporting shaft. A guide bar is located in the conduit parallel to the trip lever to prevent the grip glancing off to one side. The gypsy was invented by W. B. Upton.

FARES AND TRANSFERS.

The fare on the lines of this system is five cents, with six tickets for twenty-five cents, transfers issued on all the company's connecting lines, and with the Eckington & Soldiers' Home line at G Street. The transfer tickets are issued by agents stationed at the transfer points, the two principal stations being at 15th Street and New York Avenue, near the corner of the Treasury Building, and the other on Pennsylvania Avenue corner of 7th Street. At the 15th Street station (Fig. 5) the company has erected a neat, iron roofed shed for the accommodation of the passengers, extending the entire width of the sidewalk. On the curb line is a small house for the protection of the transfer agent who issues the tickets to the passengers as they alight from one car and pass to the connecting line. In this station a Keller dating machine is employed, by means of which the month, day, hour and minute of issue are printed on the ticket. The machine is arranged for very rapid work and a boy is employed to turn the crank, when the tickets are delivered in the form of a notched ribbon, so that they are easily torn up into proper lengths. The type for printing the dates and time is readily changed, a change being made every fifteen minutes. The company employs two of these machines at each of the principal transfer stations.

Near the 15th Street transfer station is located a switchman's booth, where a man is stationed to throw the switch for the cars that branch to the 14th Street line, as they turn into New York Avenue and run to 14th Street.

During the absence of Henry Hurt, president of this company, who is making a tour of the world, the management of the system is in the hands of G. T. Dunlop, vice-president, who is acting president. The control of the car men is under the supervision of C. C. Sailer, while D. S. Carll is engineer and has a general oversight of all the mechanical affairs.

Columbia Railroad Company.

This company is now engaged in reconstructing its entire system, aggregating three miles of double track for cable traction, and it is expected that the work will be completed and the lines in operation by cable power during the early spring months. The route of this system is principally on H Street, but passes through a portion of Massachusetts and New York Avenues. Wm. B. Upton, of Washington, D. C., is the chief engineer.



FIG. 6.—CABLE CONSTRUCTION, SHOWING TEMPORARY HIGHWAY BRIDGES—COLUMBIA RAILROAD.

In the new construction the cable conduit is of about the same depth and the yokes of about the same weight as were employed in the Washington & Georgetown lines. The rail is of the grooved girder type, weighing eighty-six pounds per yard, is six inches in depth and has a six inch base or flange. The slot is Z shaped, seven inches in depth, and weighs sixty-seven pounds per yard. The track rails, slot rails, curves and conduit crossings are made by the

Johnson Company, of Johnstown, Pa., the steam crossings by the Weir Frog Company, and the surface crossings by the Indianapolis Switch & Frog Company. The yokes, which support the carrying pulleys, are provided with chambered lugs on their inner faces, to which the journal pulley boxes are fastened by means of T bolts. The city end of the line terminates on New York Avenue near the Treasury Building, beside the tracks of the Fourteenth Street line of the Washington & Georgetown system, where an ordinary crossover switch will be provided for the transfer of the cars from one track to the other. The suburban terminal of the line will be on H Street near 15th Street East, at which point the company's offices and stables are now located, and near which the new power station is being erected.

The new station is to be of brick, 80 × 200 ft. in dimensions, and office and car house building 128 × 200 ft., a portion of it two stories in height. The engine room will occupy the front portion adjoining the street, in rear of which is the boiler room, and alongside will be the tension run. The smokestack is of brick and 100 ft. in height. W. B. Wood, of Washington, D. C., was the architect. The contractors for the power station were Richardson & Burgess, of Washington.

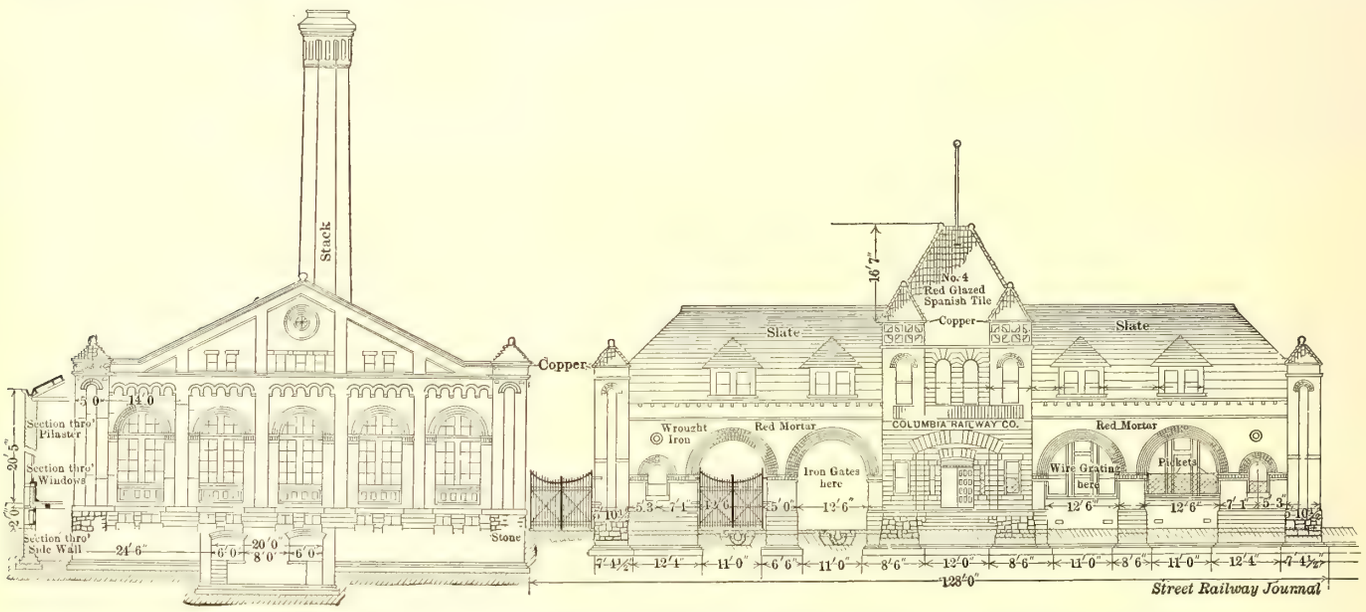


FIG. 7.—EXTERIOR OF NEW POWER STATION AND CAR HOUSE—COLUMBIA RAILROAD.

The power equipment of the station will consist of Campbell & Zell boilers, and engines manufactured by the E. P. Allis Company. The driving machinery will be similar to that employed in the Washington & Georgetown central power station, and will consist of a rope drive, both winding drums being driven from the same pulley, and the Walker differential rings will be employed. The tension carriage will be provided with the automatic weight attachment, designed by the chief engineer of the road, and will be an improvement over this type of carriage, which is already employed on other lines in the city. The cable machinery is being built by the Walker Manufacturing Company, of Cleveland, O.

The street construction, with the exception of the paving, is being done under contract by E. Saxton, the well known railway contractor of Washington, who furnishes all material, special work, etc., and the work is being done rapidly and in a first class manner in every particular. We do not remember to have found an equipment for cable railway construction so complete and perfect in every particular, nor so systematic a method of doing business, down to the minutest details, as is found in the construction plant and organization belonging to Mr. Saxton. In the present work, when material can be had, the organization and equipment are equal to the regular daily completion of 600 ft. of double track ready for paving. The work is assigned to different gangs, which are named and lettered from A to V. One takes up the paving, another does the excavating over the full width of the double track to the depth of ten inches, when the trenching gang follows, and another cuts out the chambers across the trench for the yokes, and then, in order, the other gangs place the rails, concrete, etc. Each gang is provided with a complete set of tools for its particular work, which are kept ready for use in mounted boxes which may run on rails after the track is down. These boxes or chests are lettered to indicate the gang to which they belong, and are painted and kept in a cleanly condition. There are also provided wooden water tanks with a capacity of about eighty gallons each, which are mounted on car wheels and connected with the fire plugs by two lines of rubber hose. The tanks are provided with float valves which automatically close the inlets when the tank is full. Each tank is also provided with two sections of two and a half inch armored or suction hose in ten foot lengths, through which water is quickly run into the concrete mixing boxes. The latter are of wood, mounted on centrally flanged rollers which run on the slot rails, and in front and rear of the mixing boxes are T iron slides covering the slots, which prevent the material from being dropped into the conduit in the operation of putting it in place. "Iron cars" are also provided for holding the bolts, nuts, lock washers, liners, etc., which are provided with chambers having hopper outlets at the base so that the material from each box may be readily removed and conveyed to the workmen.

Vehicle and foot bridges (see Fig. 6) are also provided which are built in interlocking sections, and are readily moved from place to place as the work progresses. At night guard ropes are put up on each side of the work in progress, and at street crossings. These ropes are supported on posts placed about fifty feet apart, and lanterns are hung on all posts along this guard, so that even after the work is stopped the line has an animated appearance. The temporary track, together with the necessary crossings and switches, are also provided by the contractor. The switches employed with the temporary track are of peculiar design, and were invented by Mr. Saxton. Switches, mates and frogs are so arranged that they can work either right or left. In the present case a temporary double track is laid along the work directly on the asphalt paving, the rails being kept to gauge by flat tie bars placed under them at intervals of fifteen feet. The material is stored in a centrally located yard where the contractor has also erected temporary buildings and sheds for the clerical forces, and for the blacksmith shop and storing bins. Here are draughting rooms and time keepers' offices, with all the necessary books and cards for keeping record of the work of the different gangs. A comptometer is provided as

one part of the equipment of the accounting department, by means of which long lines of figures are added and other computations are made. This device was manufactured by Felt & Tarrant, of Chicago. The paving is to be done under a special contract. The material between the rails and on each side is vitrified brick, but between the tracks there will be a strip of asphalt to correspond with the asphalt paving on the remainder of the street. The combination of asphalt and brick paving between the tracks is used to comply with the requirements of the district commissioners.

The closed cars to be placed in service on this line when completed are modeled after those of the Broadway, New York, cable road, except that they will be about two feet shorter. They will be built by the John Stephenson Company, of New York, which company will also build the open cars. The grip will be operated from the front platform.

FARE AND TRANSFERS.

The fare on the Columbia Railroad is at present five cents, with six tickets for twenty-five cents and school tickets thirty-three for $1. Transfers are made with one or two other lines, but school tickets do not allow of transfer. Employes are provided with passes, on which their name and date of issue are placed and each employe is provided with two tickets a day. A very simple and efficient system of bookkeeping is employed by James B. Adams, secretary and treasurer of the company, who has also designed a very complete system of report blanks for use by the different departments.



FIG. 8.—CABLE CONSTRUCTION ON COLUMBIA RAILROAD, SHOWING PORTABLE TOOL BOXES EMPLOYED.

In the superintendent's office an automatic receiving safe is provided, which was invented by the former superintendent of the road. This safe is so arranged that each conductor can deposit his returns in a separate compartment within the safe.

The Columbia Railroad was for a number of years operated under the direction of the late Wm. J. Stephenson, and in his administration and that of President R. F. Baker, the change from animal to mechanical traction has been carried out. Another interesting feature in connection with the operation of this line is the practice adopted a year or two since of splicing together two of the short one horse cars formerly employed, and making a long car. This method of splicing was devised by Theodore J. King, the former superintendent, and differs from the method ordinarily employed, in that instead of placing a new sill beneath the two parts, the body is strengthened by a modified form of a steel bridge truss, which has proved very efficient and safe under heavy loads and a year or more of service. The road is being operated under the immediate supervision of Wm. C. Bateler, superintendent.

Metropolitan Railroad Company.

This company, of which the late Wm. J. Stephenson was president, is about to install an underground electric system on all its lines, which are at present operated by horses. S. L. Phillips, formerly president of the Third Avenue Railway Company, of New York, has been recently elected president of this company, and under his supervision, assisted by A. N. Connett, chief engineer, the change is to be made from horses to electric traction. Mr. Connett, it will be remembered, was formerly chief engineer and superintendent of the Baltimore City Passenger Railway Company, and designed and superintended the construction of the cable and electric lines of this company. He is now engaged in making the designs for conduit and station equipment for the Metropolitan Company's lines. It will be remembered that this company some years since, while George W. Pearson was president, made a thorough and extensive trial of the storage battery system, large stations having been erected and about twenty cars equipped with motors and batteries. The result of the experiment is already familiar to our readers.

By act of Congress, the company is now obliged to install an underground electric system.

The company proposes to construct the 9th Street line as soon as possible, street work to begin as soon as the weather will permit in the early spring. In the meantime, the plans are being prepared and the special work ordered, so that it will be possible to have the 9th Street line running by August 2 next, as is required in the bill. The conduit to be employed is a modified form of cable conduit with yokes and concrete walls, the interior being twenty-five inches deep and eighteen inches wide, with drains at suitable intervals connecting with the sewers. The slot rails will be deep on their inner faces, so as to prevent the drip falling on the current conductors. The conductors are to consist of tee bars four inches deep, set edgewise and about six inches apart. These are to be supported in lengths of thirteen feet six inches, by dependent rods, supported from double porcelain corrugated insulators with lead filling. These are mounted on cast iron boxes, and suitable provision is made to allow for the expansion and contraction of the tee bars.

A plow with a sliding contact is to be used, and is to be supported from the car by shank plates in the customary manner. The motor equipment will be of the General Electric type, and the generators are also to be of the same manufacture. Direct coupled engines and generators are to be employed. The power will be supplied from the 4½ Street station, which was erected when the storage battery experiment was made. This station is a large brick building occupying nearly a square, and stands just back of the 7th Street cable station of the Washington & Georgetown line. The engine and generator equipment of the second power station, which was erected adjoining the company's offices on P Street, will not be used. The engines, which consist of three 200 H. P. machines, manufactured by Wm. Wright, of Newburgh, are to be sold, as it is proposed to purchase condensing engines for the new plant. The type of car has not yet been fully decided, but it is probable the line will be operated by an open motor car with trailer. The contract for the street construction has not yet been let.

The Eckington & Soldiers' Home Railway Company and the Belt Railway Company.

The lines of these companies are virtually under the control of the same persons, the president being D. M. Newbold, and W. K. Schoepf, vice-president and general manager. H. K. Gray, formerly with the Belt line, is secretary and treasurer of both companies. The line known as the Eckington & Soldiers' Home is chiefly operated by electric

power, the overhead system being employed, and terminates at 7th Street. An experiment is being made on North Capitol Street with a closed conduit system which has been in operation about four months, the Electro-Magnetic Company being the promoter.

The car is of the ordinary type used on electric lines,

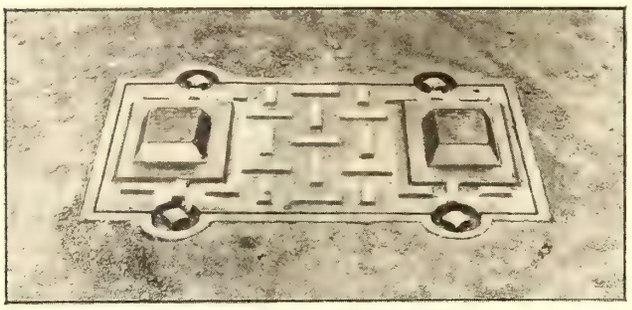


FIG. 9.—SURFACE CONTACT BOX.

except that, in lieu of a trolley stand upon the roof, it has suspended from the under side of its truck, as shown in Fig. 11, two iron bars. These are the same length as the car, are hung upon light springs and adjustable by means of screws, and are known as the energizing and collecting bars respectively. Beneath one of the seats of the car is a small storage battery, consisting of six cells which are arranged to discharge a low potential current at a pressure of about eight volts, and are connected by means of suitable wiring to the energizing bar.

In the center of the track are placed, at intervals of about fifteen feet, hermetically sealed cast iron boxes, upon the lids of which, properly insulated, are two raised surfaces, known as the energizing and collecting plates respectively.

Securely attached to the under side of the lid of each cast iron box is a simple electro-magnet, as shown in Fig. 10, wound with a fine copper wire, one end of which

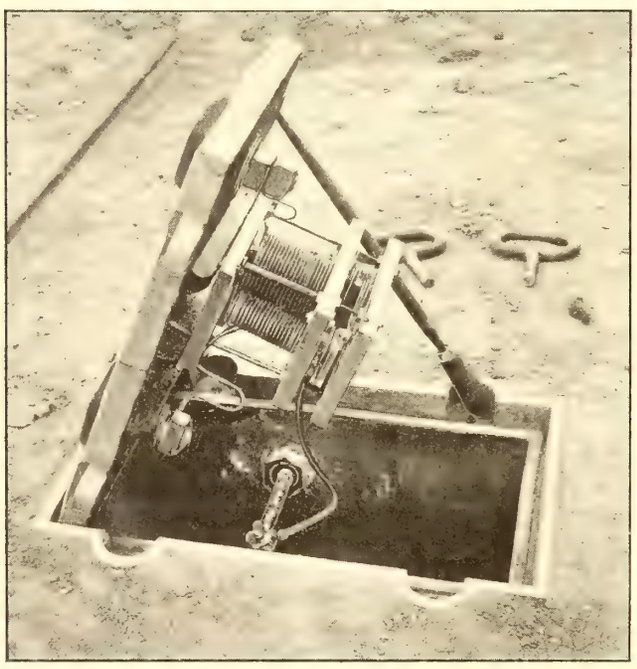


FIG. 10.—CONTACT BOX WITH COVER RAISED.

is connected to the energizing plate. The free poles of the magnet hang down vertically, and work in connection with an armature attached to a bridge piece, upon which are two carbon faces, directly above each of which is a corresponding carbon face fixed to the slate bed of the magnet. One of the fixed carbon faces is directly connected to the main cable which conveys the 500 volt current from the generators at the power house, and which runs in an iron pipe through all the boxes, as shown in Fig. 12. The other carbon face is connected to the collecting plate upon the box lid.

The operation of the car is then as follows: The battery discharges its low pressure current along the energizing bar through the corresponding plate upon the box lid to the electro-magnet which, upon becoming energized, instantly attracts the armature and bridge piece, thus bringing all four carbon faces into close contact and completing the circuit. This allows the current to flow from the main cable up through the collecting plate to its corresponding bar upon the car, whence it is admitted to the motors in the usual manner. Where there is a double track the arrangement is somewhat modified, and in the new roads now under construction a metallic return is introduced by adding a third or return circuit bar to the car, and connecting a third contact plate with a cable laid in the same trench with the main cable.

The difference between the length of the collecting bars and the centers of the boxes insures good contact with the forward plate before the rear one is left. To obtain a shock from the contact plate is impossible, as, should any part of the electro-magnetic switch fail, the pins



FIG. 11.—CAR EQUIPPED WITH ELECTRO-MAGNETIC SYSTEM.

are dead, and the car has to drift by its own momentum to the next box.

During the three months that the current has been on the existing road, the inventors claim that nothing in the shape of trouble has been experienced. They also state that from tests applied by the Wheatstone bridge and tangent galvanometer, after flooding certain boxes with water, with the car keeping the switches closed, the leakage was found to be less than one-half of 1 per cent. of the power required per car. The contact plates stand only about seven-eighths of an inch above the pavement, and offer little or no obstruction to vehicular traffic.

The cost of installing this system is said to be about $35,000 per mile of double track, including the metallic return and all the cables, feeders and conduit.

EXTENSIONS.

The company is now extending its lines within the city, the new construction consisting of four miles of double track. This extension is on 5th Street and Louisiana Avenue, along 6th Street, along B to 7th Street, crossing the Pennsylvania Avenue cable line at 6th Street, where a new substantial crossing is being put in. From this point the line extends past the Pennsylvania Railroad depot and Central Market, insuring a large patronage from these points.

The new construction is being done in a very substantial manner. The street excavation is made to the depth of twenty-one inches, and very heavy ties are being employed, which are placed two and a half feet centers, resting on a concrete or gravel foundation. A ninety-five pound, eight inch, grooved girder rail is employed, having a six inch base, which is laid on tie plates. The joints are connected by means of heavy twelve-bolt fish plates, and the ends are drilled for bond wires, should it ever be necessary to bond the track for electric traction. Thirty new cars have been ordered from the Laclede Car Com-

pany, of St. Louis, and other improvements are being made. A new car home and stable is being erected on the East Washington line.

Rock Creek Railway, of the District of Columbia.

The lines of this system, which embrace about eight miles of double track, lie mostly outside of the city limits, and are operated by electric power. The extension within the city limits is one and five-eighths miles, and this portion is operated by the Love electric conduit system. The trolley wires of the remainder of the line are supported on center iron poles for the most of the distance, wooden poles being employed on the suburban extension. The present suburban terminal of the line is at Chevy Chase, Md., but an extension of two and a half miles is now being constructed to Kingston on the Baltimore & Ohio Railroad. About twenty cars are regularly operated, and these are run on a fifteen minute headway. On Sundays and holidays the headway is reduced to seven minutes. The

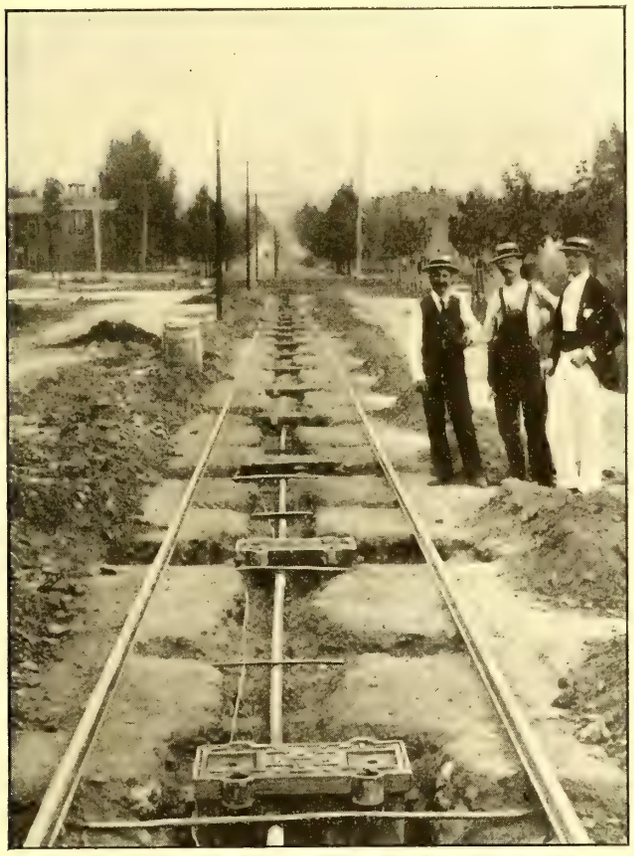


FIG. 12.—SECTION OF TRACK EQUIPPED WITH ELECTRO-MAGNETIC SYSTEM IN COURSE OF CONSTRUCTION.

cars are equipped with trolley poles and are also provided with mechanism for operating over the conduit section. At the junction of the overhead with the underground section pits are provided in each track in which an attendant takes position as the car approaches from either direction. In changing from overhead to underground the trolley pole is pulled down and fastened, and the attendant inserts the underground trolley in a socket provided for it in the truck. This trolley or plow consists of two flat metal plates bolted together. It is half an inch in thickness, four inches wide and two in length, and to its lower portion are two underrunning trolley wheels elastically attached. The conductors in the plow consist of insulated copper ribbons enclosed between the plates and terminating in two copper bars sunk flush with the edges of an insulating cap on the plow at its upper extremity. As the upper end of the plow is inserted in an inverted insulating box with end contacts, suspended under the truck, the contact is made with the motor connections, and the adjustment of a bolt holds the plow in position. The car starts by gravity and carries the trolley into the end of the conduit and in contact with the trolley wires which are supported from the yokes. At the 7th Street terminal of the line, where there is no grade, the trolley wires are extended across the hatch and are under the control of the attendant. The conductors consist of No. 0000 copper wires attached by means of sliding insulated bearings, and are held taut in sections by means of spiral springs. The conduit is about eighteen inches in depth and fourteen inches wide, with drainage pipes provided at suitable intervals. The construction is very thorough, and is standing up exceedingly well under the traffic, the line having been in operation since a year ago last March. On the return trip the plow is removed and the trolley pole is placed in contact with the overhead wire. It is said that the change can be made from the overhead to the underground ordinarily in half a minute, and frequently is done in twelve seconds. The plow is removed from the car on the outgoing trip, and is adjusted to the next car as described above. A tension of 500 volts is employed.

Six of the trucks operated on this system are of the Robinson radial type. The motors were manufactured by the General Electric Company. The fare for the through trip is ten cents; within the District limits, five cents.

One of the cars is equipped with the Palar fender, which consists of large leather cushions covering the front of the dash, and extending for a considerable distance in front of the platform.

The conduit portion is said to be operating with excellent results, giving less trouble, in proportion to the distance, than the overhead section.

The power for operating the system is generated in two stations, one near the city limits, and the other at the terminal of the line, well in the country. C. B. F.

The Annual Meeting of the Connecticut Street Railway Association.

The annual meeting of the Connecticut Street Railway Association occurred in New Haven, Wednesday, November 21. The meeting was held in the offices of the Winchester Avenue Railway Company in West Haven.

The following companies were represented: The Winchester Avenue Railway Company, of New Haven; the New Haven Street Railway Company, of New Haven; the Fair Haven & Westville Street Railway Company, of New Haven; the Hartford Street Railway Company, of Hartford; the Waterbury Traction Company, of Waterbury; the Stamford Street Railway Company, of Stamford; the Norwalk Street Railway Company, of Norwalk, and the Derby Street Railway Company, of Derby.

This was the first annual meeting after the organization of the association, and it was largely devoted to a discussion of future work, and the possibility of interesting other companies of the state in the association and including all as members. At present the association includes ten railway companies. The session lasted two hours and a half.

The officers elected for the following year are: president, H. H. Wood, of Derby; vice-president, H. S. Parmelee, of New Haven; secretary, R. A. Fosdick, of Stamford; treasurer, E. S. Goodrich, of Hartford; executive committee, the officers and I. A. Kelsey, of New Haven; A. M. Young, of Waterbury, and G. A. W. Dodge, of New Haven.

A CONDUCTOR on the Orange Division of the Consolidated Traction Company, of New Jersey, recently sued the company for the amount of the deposit which he had made with the company on entering its employ, and for wages withheld. The company claimed in rebuttal that he had failed to account for $20 in fares collected, as shown by the register, 450 fares having been left out in a single day. The plaintiff was non-suited, the judge holding that he could not recover his deposit until he could account for the missing fares.

The Wyoming Valley Interurban Railway.

The Wyoming Valley, extending from the junction of the Susquehanna and Lackawanna Rivers at Pittston to Nanticoke, a distance of about twenty-two miles, is celebrated for its rich and extensive anthracite coal deposits. The valley has an average width of about five miles, and contains about 160,000 inhabitants. The largest city is Wilkesbarre, located on the east bank of the Susquehanna River, about midway between Pittston and Nanticoke. It has a population of from 45,000 to 50,000 inhabitants. Directly opposite Wilkesbarre, as shown on the map (Fig. 1), is located the borough of Kingston which, with the neighboring villages of Edwardsville, Larksville, Pringleville, Broderick, Luzerne and Fort Fort, has a population of about 17,000. The other principal towns are Plymouth, with a population of 20,000, Nanticoke, 19,000 and Pittston 16,000 inhabitants, including the townships of which these towns are the centers.

There are a number of manufactories in Wilkesbarre, including large iron and steel workers, the largest Nottingham lace factory in the country, and other manufactures. The main industry of the valley, however, is that of coal mining, and during the last year 30 per cent. of all the anthracite coal produced in Pennsylvania was mined here. Most of the mines are located between Pittston and Nanticoke, Wilkesbarre being in the center of the coal field. The region between Wilkesbarre and Nanticoke, which belongs largely to the Delaware, Lackawanna & Western Railroad Company, the Lehigh & Wilkesbarre and Susquehanna Coal Company, is as yet undeveloped, but contains, it is estimated, 50 per cent. of the virgin anthracite coal left in Pennsylvania. The small settlements in the valley are inhabited in large part by Huns, Poles and other foreign laborers; the more wealthy class lives mainly between West Pittston and Kingston on the west side of the river, and in the city of Wilkesbarre.

The valley was seemingly well provided with transportation facilities before the introduction of electric traction, there being six steam railroads extending its entire length, the Delaware, Lackawanna & Western, the Central of New Jersey, the Lehigh Valley, the Pennsylvania, Delaware & Hudson, and the New York, Susquehanna & Western, all of which take coal from this region, but steam railway service has become wholly inadequate in these days of electricity.

The entire electric railway system between Nanticoke and Pittston, consisting of fifty-five miles, is now operated by the Wilkesbarre & Wyoming Valley Traction Company (see map, Fig. 1). This railway company was chartered February 9, 1891, and now controls and operates the lines of nine original companies, the Wilkesbarre & Kingston Railway Company, Wilkesbarre & Suburban Street Railway Company, Coalville Passenger Railway Company, Wilkesbarre & West Side Railway Company, Plymouth Street Railway Company, Pittston Street Car Company, Pittston, Moosic & Pleasant Valley Street Railway Company, West Pittston & Wyoming Street Car Company, and the Nanticoke Street Railway Company. The mileage operated is shown on the map by solid lines, and that proposed by dotted lines.

TRACK.

Of the fifty-five miles of track, all but five is single track with turnouts. Of the mileage under construction, five miles will be built as soon as the girder rails can be secured. The company is using for its new work fifty-six pound T and sixty-six pound girder rails. These are spiked directly to ties which are laid twenty inches between centers. The return circuit is provided for by double bonding the joints with No. o riveted bonds. In addition the company has about one mile of overhead return feeders.

There are about two and a half miles of center pole construction, and three miles of bracket construction. For the rest of the distance span wires are used. Some of the spans are quite long, the roadway for a considerable distance being 100 ft. in width, with the track near the center of the street. The company is using a variety

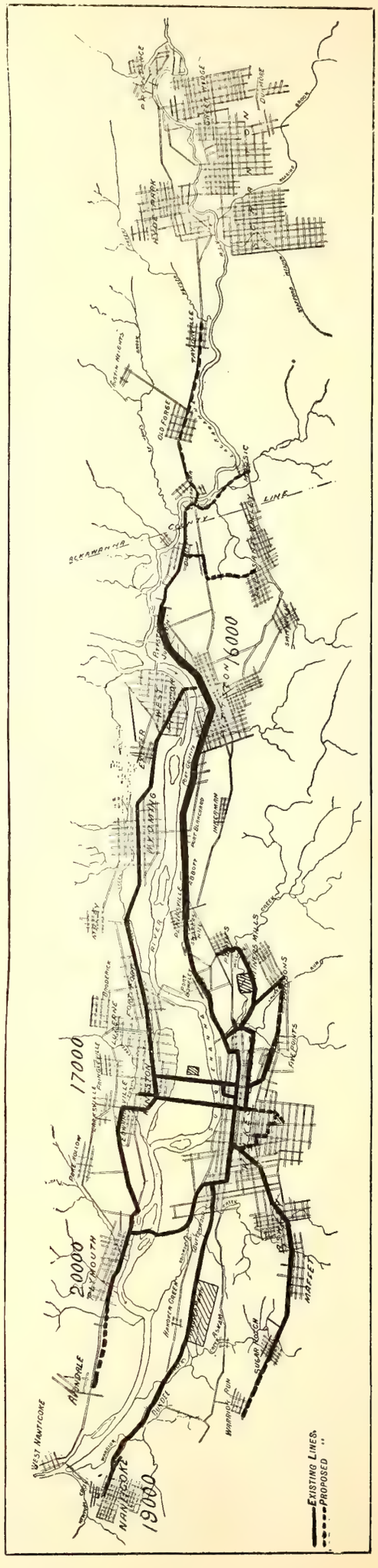


FIG. 1.—MAP SHOWING LINES OF THE WILKESBARRE & WYOMING VALLEY TRACTION CO.—WILKESBARRE, PA.

of overhead material, that provided by the H. W. Johns Manufacturing Company and the Western Electric Company predominating. Roebling wire is used largely, but that of Holmes, Booth & Hayden, and Washburn & Moen is also employed.

A very considerable portion of the company's mileage is through its own right of way.

T RAIL CONSTRUCTION.

The company claims to be the first to use a six inch T rail, its first rails of this dimension having been made especially for use here. In brick paving the rail is laid as shown in the accompanying sketch (Fig. 4), the vitrified brick being laid on sand which is tamped close to the rail. When laid in macadam or dirt a 2½ × 6 in. plank is placed on both sides of the rail, a space being left on the inside for the wheel flange.

POWER HOUSES.

The company has at present two power houses. A view of the main, or South Wilkesbarre station, wtth one of the car houses of the company, is shown in Fig. 3, and an interior view of this station is given in Fig. 2. It is a substantial brick structure located close to a spur of one of the railroads so that coal can be dumped directly in front of the boilers. It is commodious and well lighted, and ventilated by windows on all sides, so that even in the warmest days of summer both boiler and engine room are comfortably cool. It has two iron stacks ninety feet high.

The present engine equipment consists of four Ideal compound engines, cylinder dimensions 17 and 28 × 18 ins. stroke, running at 187 revolutions per minute. These are belted to the same number of 200 K. W., bipolar General Electric generators. Two of the belts were supplied by the Shultz Belting Company and two by the Page Belting Company. The engines run non-condensing.

The station is equipped with a lubricating system supplied by a reservoir under the floor, the oil being filtered by an Acme filter. Metallic packing has been used in the engine cylinders for over a year with good satisfaction. A pressure of about 530 volts is maintained at the station, and this has been found sufficient to maintain the potential at the terminals of the divisions, which in some instances are from nine to ten miles from the power station.

Steam is supplied from six return tubular boilers manufactured by the Harrisburg Foundry & Machine Company, and fitted with the Weitmeyer setting. The draught in this furnace, instead of coming in at the front, is led in at the back of the furnace, the air becoming heated before it passes through the coal. Each boiler is fifteen feet long by seventy-two inches in diameter, and contains 114 three-inch tubes. A Webster feedwater heater supplies water to the boilers at an average temperature of 200 degs. Worthington pumps and a Locke damper regulator are employed. The switchboard is located at the eastern end of the engine room, and is of the General Electric panel type. The company will probably increase its power station capacity in the spring by the erection of a second station immediately to the north of that just described. Larger units with multipolar generators will be employed. At the same time the present type of generator has given very good satisfaction, and during the two years in which those in use have been in operation they have cost only about $25 for repairs. The general manager is in favor of belted generators in preference to the direct connected type.

The West Side station has at present in operation a Wheelock-Corliss 300 H. P. engine, belted to a 200 K. W.

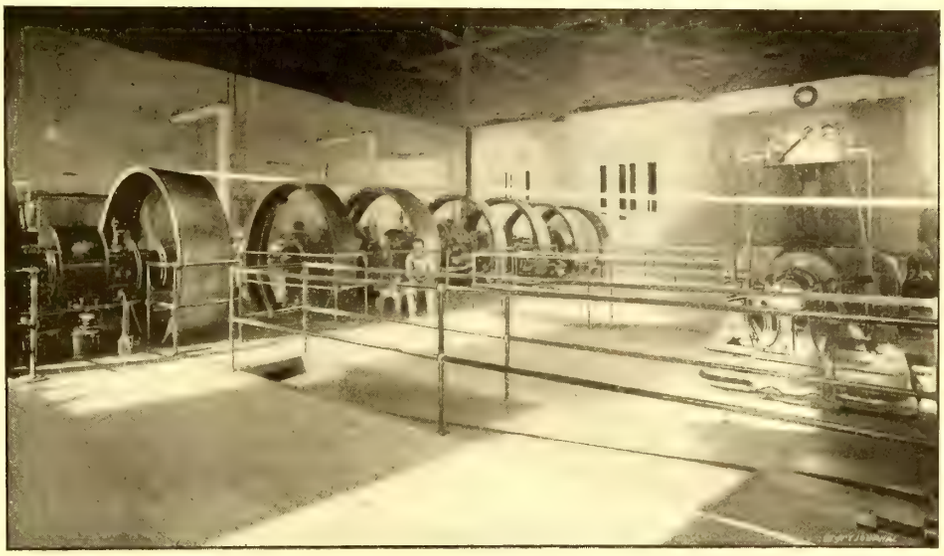


FIG. 2.—INTERIOR OF POWER STATION—WILKESBARRE & WYOMING VALLEY TRACTION CO



FIG. 3.—MAIN POWER STATION AND CAR HOUSE—WILKESBARRE & WYOMING VALLEY TRACTION CO.

Short generator, and two Ide simple engines, with cylinder dimensions 20 × 24 ins., belted to two 150 K. W. Short generators. Shultz belts are used throughout this station, and the boiler equipment is similar to that of the South Wilkesbarre station. This station was built to operate the Wilkesbarre & West Side Street Railway before its absorption by the Wilkesbarre & Wyoming Valley Traction Company, and its use as a power station



FIG. 4.—METHOD OF PAVING TO T RAIL—WILKESBARRE.

will be discontinued as soon as the necessary power for operating the entire system can be concentrated at one point.

FUEL, COST OF POWER, ETC.

Buckwheat anthracite coal, costing ninety cents per ton, delivered at the boilers, is used as fuel. The low price of coal, combined with the fact that two shifts, of only two men each, are required for operating the main power station of the company, results in the production of power at a very low price. The records of the company show that the cost of a horse power hour delivered to the line, including all power house expenses, was six and two-thirds mills ($.00667) per car mile.

ROLLING STOCK.

The rolling stock of the company consists of 105 passenger cars, two freight cars and two Lewis & Fowler snow sweepers which have just been delivered. Of the passenger cars, fifty-one are closed and all are vestibuled. The cars are from the works of a large number of companies, those of Brill's manufacture predominating. The company has seventy-four double motor equipments. Of these forty-seven are Short, seven Edison, two Baxter, four Westinghouse and fourteen General Electric. Of the latter number, six are of the G. E. 800 type.

occasions. It is handsomely fitted up inside in mahogany, with birdseye maple ceiling. The seats are of rattan covered with damask, and the curtains are of plush. The exterior of the car is painted a Pullman dark green, with gold striping, and presents a very striking appearance.

CAR HOUSES.

The company has three car houses, all of brick. The main car house is located on Northampton Street, and measures, with the machine shop of the company, 252 × 110 ft. A portion of this house is partitioned off by brick walls for a supply department, and another for the steam heating plant. A third room is for oil storage, and measures about 18 × 18 ft. This room has no inside opening into the car house, and its walls, which are of brick, are carried above the roof to reduce the risk of fire.

The company performs all its own repairs, and its machine shop is equipped with a J. T. Schaffer wheel press; two lathes, manufactured by the Sebastian May Company, of Cincinnati, and F. E. Reed & Company, of Worcester, Mass.; a Harrington wheel mill, and a Bickford drill. This machinery is operated by a Short single reduction motor which has been rewound so as to give a constant speed. The wood working department, which is adjoining the machine shop, is operated by an old type of Sprague railway motor shunt wound. This shop contains a J. A. Fay & Egan thirty-six inch band saw, a Universal wood working machine, manufactured by Cordman, Myer & Company, of Cincinnati, and a circular saw. The company employs in its shops two machinists, four painters and four carpenters.

The company has also a car house on Main Street, shown in Fig. 3, adjoining the power station. This car house measures 60 × 200 ft. A third car house, measuring 200 × 54 ft., is located on Pierce Street, adjoining the West Side station of the company.

BRIDGES.

As shown on the map, the tracks of the company at present cross the Susquehanna River at two points near Wilkesbarre. A third line to Plymouth will cross the

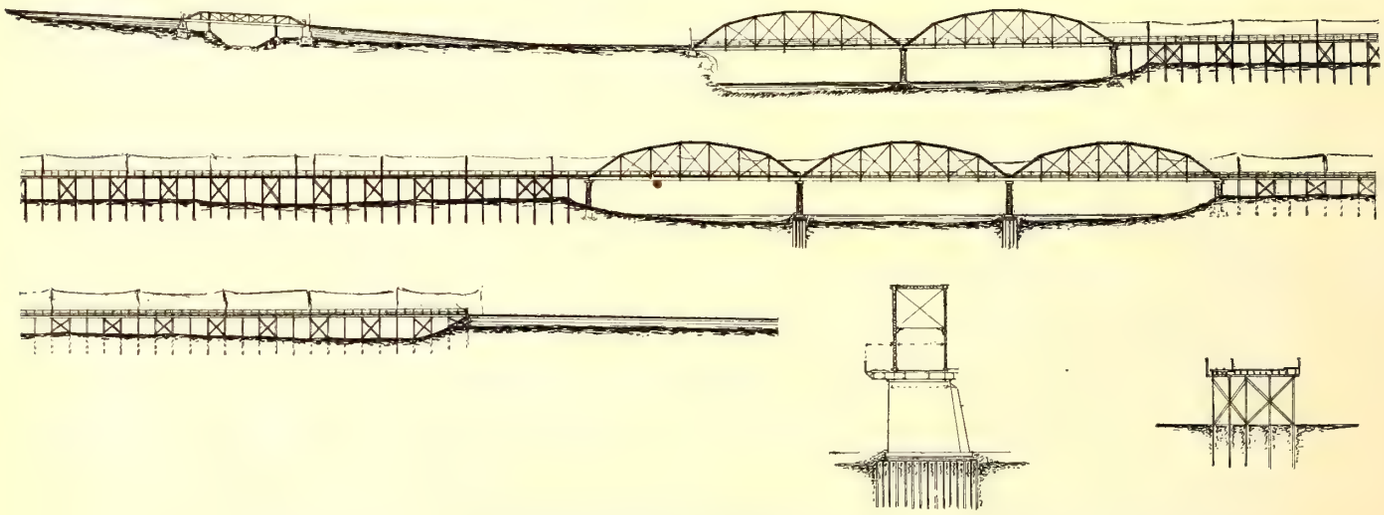


FIG. 5.—SIDE VIEW AND SECTIONS OF BRIDGE AT PLYMOUTH, BEING BUILT FOR THE WILKESBARRE & WYOMING VALLEY TRACTION CO.

The cars are sixteen, eighteen and twenty-five feet in length, and are equipped with Boston, General Electric, Nuttall and Short trolleys. The Lewis & Fowler and New Haven registers and Spear car stoves are employed. Philadelphia car wheels are in use, with a special type of compound brake shoe, shown in Fig. 7. This shoe consists of two parts the wearing portion being cast iron and quickly renewable. It is held in place by pins, as shown in the engraving. This form of shoe was devised by the company's electrical and mechanical engineer, James Fagan.

PARLOR CAR.

The company has also a handsome parlor car, built by the St. Louis Car Company, and used on special

river on a new bridge now being built by the Penn Bridge Company, of Beaver Falls, Pa., and which will reduce the distance from Wilkesbarre to Plymouth by nearly a mile. The new bridge with approaches will be about 6,000 ft. in length and will carry a roadway twenty feet in width, and a sidewalk five feet wide. The electric railway tracks will be carried at the side of the roadway. The bridge being the private property of the company, a toll will be charged for its use as a highway. There are five spans using the ordinary parabolic truss, and measuring each 217 ft. from center to center of end pins, or 220 ft. from center to center of piers. There will be in addition a short lattice bridge 125 ft. in length, where a steam railroad track is crossed and about 1,500 ft. of pile trestling. Fig. 5 gives a side elevation and cross sections of the bridge.

PARKS.

Two parks, owned by the Wilkesbarre & Wyoming Valley Traction Company, are located on its lines; one, entitled the Suburban Park, comprises twenty acres and contains a race track; the other is Hanover Park and contains fifty-three acres. At this latter point are located picnic grounds, ball field, rifle range, running track, dancing pavilion, toboggan slide and an artificial lake, which is used in the summer for boating, and in winter for skating. The company is very enthusiastic on the subject of parks, and believes that the $5,000 or $6,000, which Hanover Park cost, was one of the best investments it ever made. It is the custom of the company to lease this park to the representatives of responsible societies and social clubs at a nominal fee of $20 a day, and as the only entrance to the park is by the cars of the company, to look to its car receipts for returns. Restaurant privileges go with the lease of the park, and at the beginning of summer the company usually has all the dates filled for the season.

HEADWAY, TRAFFIC, ETC.

Most of the business of the company is an interurban one. Forty cars are the regular number in daily service, and of these only three operate entirely within the city limits of Wilkesbarre. On the West Pittston & Wilkesbarre line a twenty minute headway is maintained from 6.20 A. M. to 10.40 P. M. and the schedule time for making the distance, which is 8.66 miles, is forty minutes. Late cars are run at intervals after 11.40 P. M. The same headway is maintained on the Wilkesbarre & Nanticoke line, and the same on the Wilkesbarre & Pittston line on the east side of the river. A fifteen minute service is maintained between Wilkesbarre & Ashley and Wilkesbarre and Plymouth. The fares charged are fifteen cents between Wilkesbarre and West Pittston, ten cents between Wilkesbarre and Nanticoke, Sugar Notch or Plymouth, and five cents for the shorter distances. No transfers are issued, but commutation books, good for 100 rides, are issued for $4. The fifteen cent and ten cent fares are registered on the regular register as three or two fares. The average fare is thought to be about seven cents.



FIG. 6.—NORTHAMPTON STREET CAR HOUSE—WILKESBARRE & WYOMING VALLEY TRACTION CO.

The cars of the company are well patronized, and seem to indicate that an interurban road of this character will attract travel. In fact the service is so much cheaper and more popular than that formerly provided by the steam railway companies that the latter have almost entirely gone out of the local traffic business. In the morning and evening the cars are crowded by miners and others going to and from their work, while in the afternoon they are filled with women and others who go to Wilkesbarre to make their purchases. It is interesting to notice that large numbers of the foreign miners patronize the cars, and are as liberal with their nickels as, if not more so than, the native population. On Sundays, especially, the cars carry many of these people to and from the only Greek church in the valley, while the pleasure traffic is also considerable.

For the nine months ending September 30, 1894, the company's cars averaged 136,399 car miles per month. During this time, the receipts per car mile amounted to 24.57 cents, and the operating expenses, including all disbursements, except insurance, taxes and interest, amounted to 10.521 cents. The gross earnings for the seven months ending January, 1894, were $207,258.83, and operating expenses, $90,287.61. The lines now operated by the company average $22 per mile per day, and about $28 per car per day.

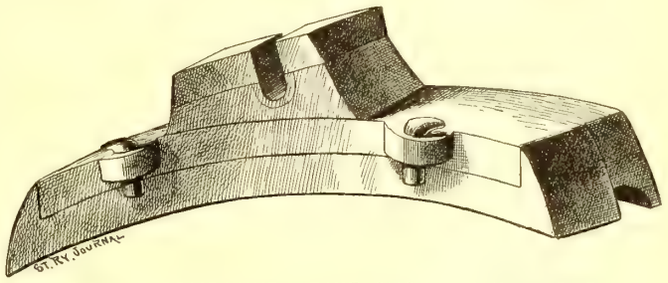


FIG. 7.—COMPOUND BRAKE SHOE—WILKESBARRE.

The company received, during the last year, 6,300,000 nickel fares, equal, as already stated, to about 4,400,000 passengers, and present indications point to a traffic of 8,000,000 five cent fares per year before 1896.

The officers of the Wilkesbarre & Wyoming Valley Traction Company are: President, B. F. Myers, of Harrisburg; secretary, W. G. Eno; treasurer and general manager, John Graham; electrical engineer, James Fagan; superintendents, J. C. Meixell and John Clifford. The success of the road is largely due to the energy and push of the general manager who was one of the incorporators of the company, and has been prominently identified with it since its organization.

SOME interesting observations on road traffic were made recently, according to an English paper, by the London municipal authorities. These observations extended over fifty days of twelve hours each day, namely, from 8 A. M. to 8 P. M., and granite, asphalt, and wood pavements were considered. In one day of twelve hours no fewer than 12,366 horses and vehicles passed along Cheapside, and 5,350 along Cannon Street. During the fifty days upon which observations were taken, 542 accidents took place on wood pavement, 719 on granite, and 1,066 on asphalt. From these figures it was estimated that a horse could travel 330 miles on wood pavement during fifty days without meeting with an accident, 191 on granite, and 132 on asphalt; therefore the great superiority of wood pavement over all others—at least, where horses are concerned—is at once apparent. Altogether, 1,054 falls were recorded, and an analysis of this number affords some curious information. On asphalt, 247 partial and 190 complete falls took place; on wood 326—only 39 complete falls. Roughly, for every fall on wood pavement, four took place on granite and asphalt.

THE Skowhegan & Norridgewock Street Railway & Power Company, of Skowhegan, Me., put its line in operation during October.

Some Details of the Electrical Railway Work of the New Orleans Traction Company.

By W. Nelson Smith.

The accompanying illustrations will give an idea of the electrical railway engineering work that has been in progress in the city of New Orleans during the past six or seven months under the supervision of Ben Willard, electrical engineer of the New Orleans Traction Company. The company rents its power from the Louisiana Electric Company, whose plant is situated about a mile and a half from the business center of the city. These conditions necessitated the construction of a heavy feeder trunk line, some details of which are shown herewith.

Not the least interesting feature of this pole line is the terminal pole in front of the power station. It is built of two sawed yellow pine poles, 15 × 15 in. butts and 12 × 12 in. tops, set in concrete, one pole being seven feet eight inches in rear of the other. The cables terminate in specially designed connectors, to which the strain insulators are fastened; and these in turn are attached to eyebolts in the crossarms (which are 5 × 6 ins.) on the front of the forward pole. On the rear side of each pole, at heights corresponding to the crossarms, are bolted what may be termed strain crossarms of 4 × 4 × ½ in. angle iron, five on each pole. The strains from the wooden arms in front are transmitted directly to these iron arms, by three-quarters inch tie rods, four to each tier of arms. The two poles are also rigidly connected by longitudinal tie beams, 4 × 5 ins., which are bolted to the ends of angle iron arms. The total height of the poles is thirty feet.

The main cables are "dead ended," where they are attached to the pole, and the station connections are tapped to them by inserting the cable ends into sockets cast in the end connectors. The cables turn a square corner and leave the pole at a right angle in order to enter the station. In each tier of arms is a diagonal tie beam, bored for pins, and running diagonally from the street end of the rear arm to the station end of the front arm. The cables are drawn around on the pins in these diagonals, and are supported where they leave the pole by pins set in the longitudinal arms.

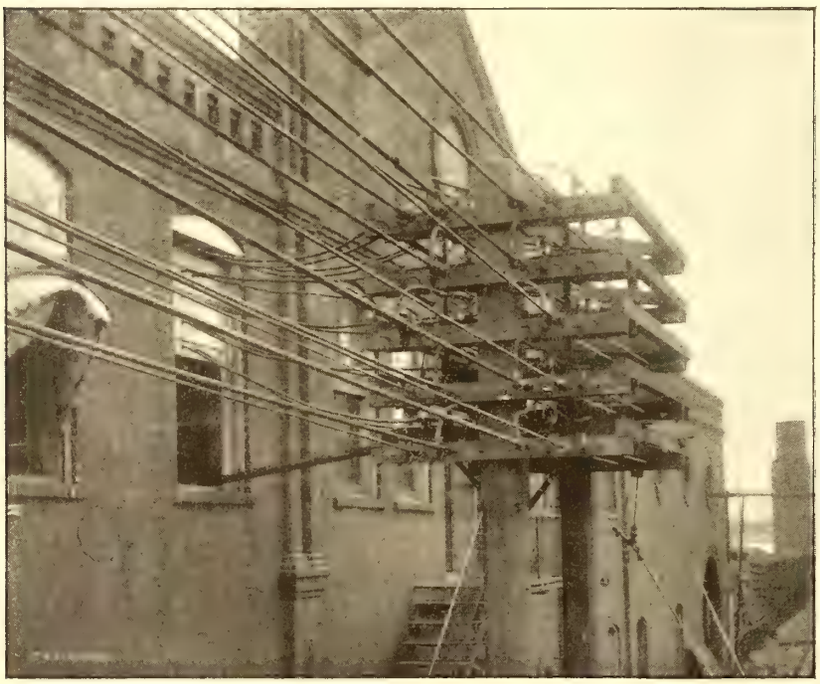


FIG. 1.—TERMINAL POLE IN FRONT OF POWER STATION—NEW ORLEANS.

The guys are fastened to two vertical planks set edgeways between the wooden and iron arms on the rear pole, there being one on each side of the pole. The strain of the whole five arms is thus concentrated on these equalizing braces, and the guys, of one inch galvanized iron cable, are attached to the equalizers by heavy iron clevises. One V guy has its branches attached to the upper ends of these equalizers and the other to the lower ends. The branches of the V's unite about eight feet from the pole.



FIG. 2.—MAIN FEEDER POLE LINE AND SECTION FEEDERS—NEW ORLEANS.

There are two guy stubs, each made by cutting in half a thirty foot, 100 lb., center bearing girder rail, placing the halves side by side close together, and setting this fifteen foot stub in eight feet of solid concrete. The rails pull against their bottom flanges, and a pin through the two webs near the top carries the eye of the turnbuckle that tightens the guy. They are also braced backwards at the ground level by one and a half inch anchor rods, as shown in the accompanying engraving. A detailed plan and elevation of the crossarms and iron work of the terminal pole are also given in Figs. 3 and 4.

The poles on Market Street extending from the terminal poles are sawed hard pine, butts 15 × 15 ins., tops 10 × 10 ins., forty-five feet long, with corners chamfered, and with five double crossarms, six pins to each, measuring 3½ × 5 ins. × 6 ft. The heavy cables are supported by Columbia top-groove insulators. This trunk line carries the feeders for the Prytania Street, Canal Street and Peters Avenue lines, and part of the Esplanade feeders. It will also carry feeders for the Magazine and Annunciation lines when those are equipped. There are now carried on this pole line ten 500,000 C. M. cables, two 250,000 C. M. cables, and four No. 0000 wires, the trolley feeders for the different lines. Besides these trolley feeders, the top arm carries four 500,000 C. M. cables, which complete the return circuit from the tracks of the different lines, connection being made at the points where the trunk line crosses the tracks. At these points two or three No. 0000 wires are fastened to each rail by a specially designed connection, and run up the poles, where they are tapped into the return feeders. Two more of these feeders are now being added to those at present on the poles, making six altogether.

At the principal feeding points where the trunk line intersects the trolley lines, the crossarms are replaced by

special frames designed for sustaining the mechanical stresses due to the tremendous tension of the cables, and also for convenience in electrical distribution. The frame is of 4 × 5 in. pine, supported on 4 × 4 in. angle iron, and the stresses are transmitted from the frame to the angles by tie bolts reinforced by gas pipe. The frame is five feet square, and is fastened together by angle irons bolted on at the corners. A seven-eighths inch copper bus rod is carried around the frame on insulators, and the dead ended feeders are tapped on to it, and the railway line feeders led out from it on whichsoever side may be most convenient. The pole shown in Fig. 2 is at the intersection of the trunk line with the Prytania Street line, and in this particular case two heavy cables connect the bus rod with the Prytania Street mains, which run along the railway poles on the opposite side of the street. On this pole is also shown one of the standard section boxes, one of which is placed at the end of each section. Each one of these boxes has its own separate feeder running to it from the principal junction point. At every section box there is a sectional insulator in each trolley wire. The feeder, before it enters the box, is divided into two branches, each of which is connected to the trolley wire on opposite sides of the sectional insulator. The box contains a single pole switch and fuse block for each branch. It is thus evident that every feeder feeds into two adjacent sections, which are thus made continuous

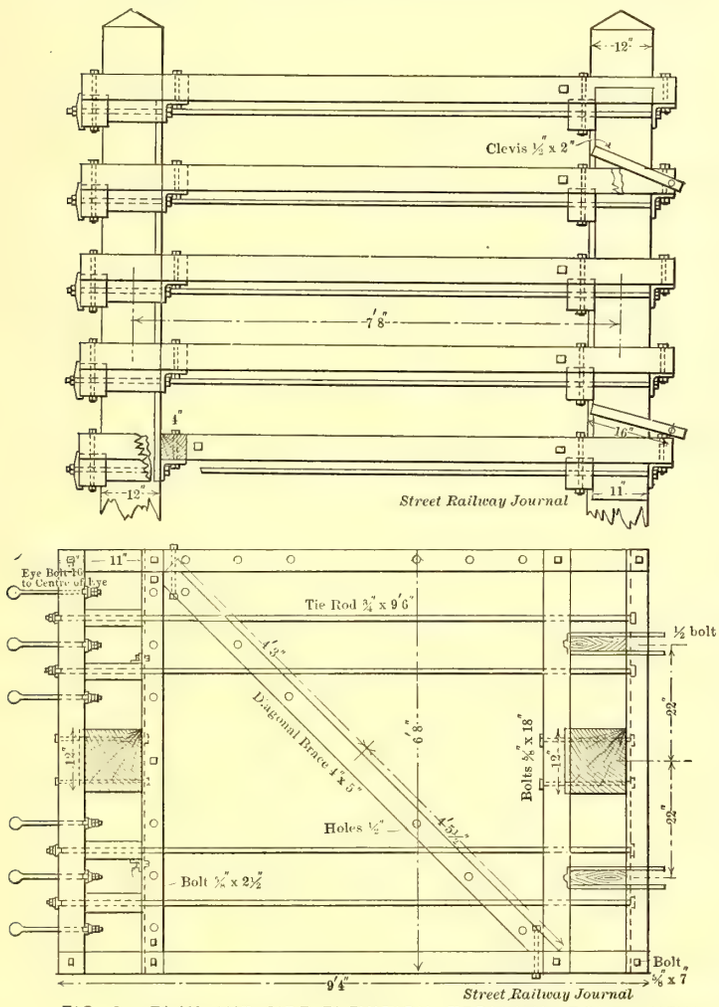


FIG. 3.—PLAN AND SIDE ELEVATION, TERMINAL POLE.—NEW ORLEANS.

unless one of the switches in the box be opened or the fuse blown, so that the conductivity of the trolley wire is added to that of the feeders throughout the entire length of any particular railway line. The illustration of the junction pole shows also quite clearly the relative arrangement of the section box and the trolley insulators.

Special devices had to be designed for splicing cables and for the various kinds of connections that had to be made to them. Owing to the nature of the soil, which consists largely of water, the setting of poles was attended with unusual difficulty and expense. All the poles are set eight feet in the ground, and in concrete. From one to the other there are some twenty guy stubs at points where there are turns in the line, or where the strain of a branch lead has to be balanced. The entire length of the trunk line up Market to Felicity, thence to Dryades, thence to Canal Street, is about two and a half miles. As one line after another is passed the entire weight of copper is, of course, gradually diminished. The amount of copper

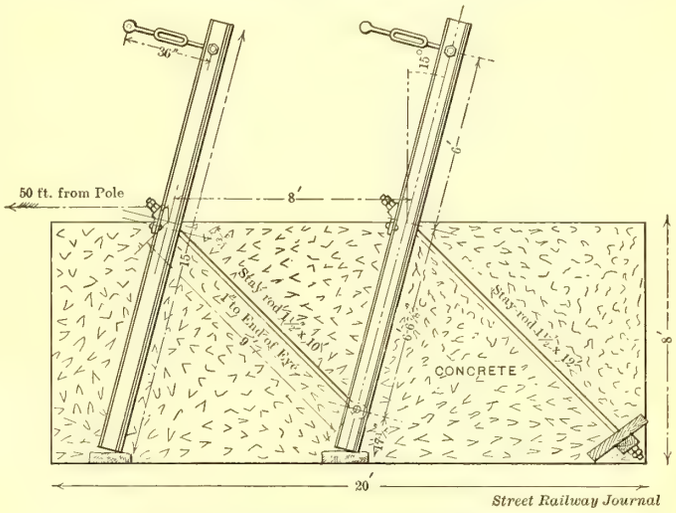


FIG. 4.—GUY STUB, TERMINAL POLE—NEW ORLEANS.

carried through to Canal Street consists of four 500,000 C. M. and two 250,000 C. M. cables. Two of the former go on through to Esplanade Street on a similarly constructed line of forty and forty-five foot poles, this extension being about seven-eighths of a mile long.

The return circuit of any one of the railway lines is entirely through the rails up to the intersection of the trunk line, whence the track feeders, carried on the top of the arms of the trunk line, complete the return to the station. The tracks are all double bonded with No. 0 copper, except in some outlying portions of the lines, where they are single bonded. The Peters Avenue line is treble bonded from Canal Street to its intersection with the feeder trunk line, as it is obliged to carry the return from the Canal Street line as well as its own. All the lines above Canal Street intersect the trunk line at points not greatly distant from the power station, so that all of them will have a first class return connection.

The trolley wire construction has all been done with two tower wagons, built in New Orleans, after the designs of Mr. Willard. When not in use the platform can be lowered, and it then forms the driver's seat, the supports being doubled up something like a jack knife. By means of a windlass, which can be easily operated by one man, the supporting legs are opened out and the platform raised to the proper height at the same time. In order to work on the wire, and at the same time allow cars to pass, an extra platform is provided, which is hinged to the main platform, and when in use projects sideways from it, out over the track, with its outer end supported by chains. When not in use this hinged platform is simply swung over on top of the other. All these changes can be made in a few minutes, and with very little trouble. The wagon is heavy enough for ordinary construction work, and at the same time light enough to be used for emergency purposes. It is probably one of the best all-around trolley wagons that has ever been devised.

The conditions prevailing in New Orleans have made the work considerably more difficult than is usually the case with most large cities. The unstable nature of the soil has already been alluded to. The city is at long distances from the principal markets, which results in delaying the delivery of material. As electric railway construction was a comparatively new business in the city, most of the lighter materials, as well as all the heavier, and all the skilled labor, had to be imported. Notwithstand-

ing these difficulties, there is now standing in New Orleans electrical railway construction which is second to none in the country, both for good appearance and durability.

The lines now in operation are the Canal Street, Prytania Street and the Dryades Street & Peters Avenue. By the time this gets into print, the Esplanade Street and Dauphine Street lines will have been started.

Underground Electric Railways in London.

By Alex. McCallum.

In the early part of this year I gave in the Street Railway Journal a general account of the system of underground electric railways about to be developed in London. Since then some little progress has been made in the matter, but all the parties concerned seem to go on the principle of "hasten slowly." Things are, however, now in such a position that a few details about the various projects, along with a glance at similar proposals on the continent of Europe, may be useful. It will be remembered that all these railways are to be constructed on the Greathead deep tunnel system, a method which presents enormous advantages in crowded cities both as to cost and convenience.

Since writing previously, work has been commenced on the Waterloo & City Railway, and this, therefore, is the first of the group to get under way. In spite of financial depression, the whole of the stock was at once taken up by the stockholders of the London & Southwestern Railway Company, from whose great terminus, Waterloo Station, the new railway is to run underground and across beneath the Thames to the Bank of England, a distance of a mile and a half. The estimated cost is about half a million sterling, say, $2,500,000, while an elevated railway between the same points, on the very lowest estimate, would have cost $15,000,000, owing to the immense value of the property which would have had to be purchased. About midsummer the work of sinking two shafts in the bed of the Thames was begun, and in September—the work having been carried on from a staging erected on piles in the river—this operation was practically completed. In October two of the cutting shields for driving the tunnels were got into position, and the work commenced. Soon afterwards other two shields for driving the tunnels in the opposite direction were set going. In this way the whole of the driving will be done from the river, and all the excavated material will be brought out there and taken away on barges. There will be no street interference and no carting through the busy thoroughfares, two most valuable considerations. The whole work is expected to occupy two years and a half. There will be no intermediate station, and as in the case of the other lines of the kind, electricity is to be the motive power. A through speed of twenty-two miles an hour will be obtained, and as the line will be graded downwards from each end to the center the traction expenses are to be very low. Indeed, the impetus obtained on the down grade will be nearly sufficient to carry the train to the terminus on the up grade. The engineers of the line are Mr. Galbraith and Mr. Greathead.

During the past summer an attempt was made to raise capital for starting another of these lines, the Hampstead, St. Pancras & Charing Cross Railway, but the movement was premature and the subscriptions were not obtained. A better considered attempt is expected shortly, but in the present stagnation of the money market and the widespread distrust caused by such disasters as that of the Liberator Building Society, it is difficult to raise capital for any purpose whatever. The financial prophets, however, think that there will soon be an improvement.

One change of importance has been made since the beginning of the year in the proposals for working this Hampstead & Charing Cross Railway. Owing to the gradients it was intended to work the line by cables, but this has now been abandoned in favor of electricity.

Among the various schemes the line which will probably carry the greatest traffic will be the Central London Railway. This road will start from beneath Liverpool Street Station, the huge terminus of the Great Eastern Railway, and will run past the Bank of England westwards under the great traffic artery formed by Cheapside, Oxford Street and other thoroughfares, to Shepherd's Bush in the western suburbs, a distance of about six miles. Stations will be about half a mile apart. Each train will seat about 340 passengers, and a three minute headway is contemplated. The company is not yet in a position to begin the work of construction, but expects soon to be so.

It is not necessary now to refer again to the other schemes, for none of them are as yet started, though the underground extension of the Great Northern Railway to the city district promises soon to begin under an arrangement with the Great Northern Railway Company. The tunnels here, as in the case of the Walthamstow & Epping Forest line are to be made wide enough to admit the ordinary rolling stock of the steam lines, so that through trains can be run to and from the country. The steam locomotive will, of course, give place to the electric on entering the tunnels. The various railways will be of immense service in relieving congestion on the streets, and in providing rapid transit through crowded districts which are at present served by no railway.

A unique arrangement is to be put into effect at the Bank of England, one of the most congested spots, so far as street traffic is concerned, in the world. The Central London and Waterloo & City Railways are to have stations in the ground beneath all this turmoil overhead, and so will the existing City & South London Railway when its extension northward is carried out. The stations will not be at the same level, but they will be in close proximity, and subways will enable passengers to change from one to another with the greatest ease. Besides this, a subway of an elliptical course just below the street surface will run round the open space in front of the bank, and enable the public, whether using the railways or not, to avoid the street traffic in crossing from one side to the other. Elevators will descend from this subway to the various stations. The usefulness and convenience of this arrangement, which has been designed by Mr. Greathead, can only be thoroughly appreciated by those who have personal experience of the difficulties of the pedestrian in the neighborhood of the bank. At every point in the metropolis where one of the new railways is close to an existing steam railway station, subways will be provided to allow passengers to pass easily from the one line to the other.

The experience gained on the existing City & South London electric underground railway and on the Liverpool elevated electric railway has shown that there will be no difficulty in carrying the traffic on the new lines by electric power. The watchword of the promoters is short trains and a very frequent service. The latter is now practicable without a large number of signal boxes and signal men, as the experience at Liverpool with automatic electric signaling has been thoroughly satisfactory, and enables such railways to be worked in very short block sections with the greatest economy and safety. Economy of working will be further secured by Mr. Greathead's method of grading the lines, so that every station has a down grade in each direction leading from it. As to cost of construction, the work on an average, including stations, land, tunnels and equipment, will run from $1,500,000 to $2,000,000 per double mile, against more than $5,000,000 per mile for shallow tunnel or elevated lines. In the latter case all the land and property along the route have to be bought, while on the deep tunnel system the only land to be purchased is that for the entrance to stations and for the power houses.

In many of the large cities of Europe attention has been directed to the great advantages of the Greathead tunnel. In Berlin a project of the kind is being discussed, and Mr. Greathead has recently been in communication with the authorities there on the subject. This is in spite of the fact that very efficient elevated steam lines already exist. In Brussels there is a proposal for a deep tunnel railway taking a circular route. This will be an

extremely useful line, as the streets of Brussels are characterized by very steep inclines, rendering ordinary vehicular traffic difficult. It is expected that the underground line in Brussels will be very cheap to construct. Antwerp proposes to go forward vigorously with a Greathead tunnel scheme under the River Scheldt, to be used for general traffic. The case of Antwerp is, perhaps, one of the most extraordinary in the annals of nineteenth century civilization. At present the city is confined to one side of the river, which is here about a quarter of a mile broad. The town is surrounded and hemmed in by its semicircle of walls and forts, for, like many European towns, Antwerp has to live armed to the teeth. The diameter of the semicircle is the River Scheldt. A great amount of shipping passes up and down the river, and in consequence no bridge has ever been built across it. The further shore is at present almost wholly unoccupied except by farmers. The scheme of an electric railway in a deep tunnel under the river is accordingly finding immense favor. It is intended that the railway shall serve local requirements in the city, and then pass under the river to the opposite shore, whence it can be continued should occasion require. The immediate effect will be to give a city value to land which now has only agricultural value. The people of Antwerp propose to construct new docks, and at first the idea was that these should be within the present city. This was to involve a cost of about $15,000,000. Mr. Greathead, however, suggested some time ago that the docks might be located on the other side of the river for a mere fraction of that sum, even including the price of the proposed railway under the river. The railway in this case would carry freight as well as passengers. The idea was taken up strongly in the city during the past summer, and very elaborate designs have been made, not only for new docks, but practically another town on the opposite bank of the river. At the Antwerp Exhibition there was an exhibit showing an actual section of the iron lined tunnels proposed for the electric railways at Antwerp and Brussels, and also a large number of drawings giving details of the work. It is expected that a concession will soon be granted, and then the work of construction will begin.

In Paris there is a proposal for an underground electric railway, and this will receive encouragement from the fact that a tunnel has recently been constructed on the Greathead system under the River Seine in connection with drainage works. The French Government is now taking an interest in the question of rapid local transit, and the French Minister recently visited London and Liverpool, where he inspected the City & South London and the Liverpool electric railways. In Vienna there is a prospect of a system of deep tunnel electric railways being carried out.

That people in New York interested in the local transit problem are beginning to appreciate the merits of the deep tunnel scheme is evidenced by the fact that during the past summer the engineer of the Rapid Transit Commissioners, of New York, came to London and investigated both the method of constructing and of operating the existing city & South London Electric Railway. I believe the deep tunnels in New York would have to be cut for the most part through rock, though in part sand would be the medium. There would be very little difference, however, in the cost, as though rock is more expensive to cut than sand or clay the costly iron and concrete lining of the tunnels in the latter media would for the most part not be required in the tunnels through the solid rock. In the latter, also, there would be no necessity for the expensive compressed air working necessary during excavation in water-bearing strata. The Rapid Transit Commissioners' engineer has recently reported in favor of constructing the tunnels as near the surface as possible. In Europe this could not be done without buying immense quantities of land and house property. Whether any special arrangement to avoid this expenditure is possible in New York remains to be seen. If not, deep tunnels seem the only alternative.

Distribution of Elevated Railway Traffic in New York.

In a recent number of the *Railroad Gazette*, J. J. R. Croes presents interesting diagrams showing the distribution of the daily traffic on the lines of the Manhattan Railway Company, of New York. We reproduce these diagrams for the benefit of our readers, with the following brief explanation of their meaning:

The entire city served by the four elevated lines is divided into twenty sections, each one-half mile in length. The shaded portions on each diagram represent the tickets taken at all the stations in the different sections on the down and up trips respectively, each half mile square representing 5,000 trips. The distribution of the traffic between the east and west sides is also indicated on the diagrams.



DIAGRAM SHOWING DAILY TRAFFIC ON THE MANHATTAN ELEVATED RAILWAY, NEW YORK.

By comparison of these two diagrams, the average distance traveled per passenger may be inferred, with some approach to accuracy. We quote from Mr. Croes' article:

"Looking at the traffic on all lines, 59 per cent of the up travel comes from the three sections (a mile and a half) at the lower end, and 59 per cent. of the down traffic comes from the upper ten sections (five miles), so that the mean journey of 59 per cent. of the passengers appears to be six and three-quarters miles. * * * There are two main lines independent of each other, one on the west side of the city, carrying 47 per cent. of all the passengers the other on the east side, carrying 53 per cent."

These diagrams will repay careful study in view of the problems of traffic to be passed upon by the Rapid Transit Commissioners in laying out the new through

system from the Battery to the northern limits of the city. Mr. Croes believes that the present plans of the Commissioners are defective in that they do not sufficiently take into account the necessities of the traffic of the city. He says: "Indeed, the whole study of the Commissioners seems to have been to provide speedy communication, by the most expensive methods, between Whitehall Street and Washington Heights, without considering the fact that from the West Side, above 122 Street, there now comes less than 10 per cent. of the passengers who go down on rapid transit trains, and that for three miles further down the road there are fewer passengers carried than on any other three lines north of Bleecker Street."

Suggestions for an Index of Engineering Literature.*

BY PROF. GEORGE D. SHEPARDSON.

To save the time of busy people, and to call attention to a mass of material that would otherwise be available to comparatively few, attempts have been made at different times to compile indices of literature. Perhaps the greatest of these is the "Royal Society Catalogue of Scientific Papers," consisting of eight quarto volumes of about 1,000 pages each. This was compiled under the auspices of the Royal Society of England, and was printed by the English Government at public expense. It gives alphabetical lists of titles and authors of scientific papers published in every civilized country, between the years 1800 and 1873, but exclusive of technical and professional papers.

Next to this stands "Poole's Index of Current Literature," published in this country by private enterprise. The first volume, compiled with the co-operation of fifty-two libraries, indexed 6,200 volumes which were published during the period from 1803 to 1882, and contains about 1,000 references to articles on electrical subjects that appeared in popular and scientific journals. The second volume, to which ninety-seven libraries contributed, covers the period from 1882 to 1887, and contains about 600 references to articles on electrical subjects. The third volume, compiled with the co-operation of 122 libraries, covers the period from 1887 to 1892, and gives about 500 references to electrical papers. The volume for 1893 gives about 100 such references. In "Poole's Index" there is some attempt at classification of electrical papers, and there are a few cross references.

The "Descriptive Index of Current Engineering Literature," compiled from the monthly summaries in the *Journal of the Association of Engineering Societies*, gives an excellent résumé of engineering literature between 1884 and 1891. This is devoted principally to civil engineering, but gives about thirty pages, with 700 references, to electrical papers. Most of the references indicate the character of the papers. The cross references are excellent. The index in the *Journal of the Association of Engineering Societies* is commendable in that it prints the indices on only one side of the leaf, so that they may be cut and re-arranged according to the ideas of the individual. The *Journal* for each December contains a summary of the monthly indices of the year.

The American Institute of Electrical Engineers published in its Transactions for about three years, 1886 to 1888, an excellent index of current electrical literature, compiled gratuitously by a gentleman too modest to have his name appear. Volume V of the Transactions contains about 5,100 references, Volume VI about 5,800, and the first few numbers of Volume VII contain about 1,500 references. Some of these are accompanied by descriptive notes.

The first volume of "Galloupe's Engineering Index," compiled and published by private enterprise, gives about twenty-eight pages, with 1,500 references, to articles on electrical subjects appearing in the years 1883 to 1887. The second volume, 1888 to 1892, gives sixty-one pages, with about 3,300 references, titles and authors being given.

Excellent indices have appeared in the *Engineering Magazine* and in *Electrical Engineering*, the figures for which are not at hand. Recently *Electric Power* has launched out into this field. The digest of foreign literature in the *Electrical World* is commendable, but confessedly incomplete. Extended indices are published at intervals by the French and Germans. A universal index, published weekly at Leipzig, aims to give tables of contents of a number of journals arranged in the alphabetical order of their places of publication. Doubtless there are other indices not known to the present writer.

A commendable custom of *La Lumière Électrique*, that might well be imitated by other periodicals, was to publish at intervals complete lists of articles that had previously appeared in the paper bearing upon particular subjects.

To the mind of the writer, the most ideal index yet attempted was that published at first in connection with *Electrical Engineering*, and later as a too short lived publication by itself under the name of *Electrical Literature*. The printing of the indices on separate sheets, perforated and tied together, each sheet being devoted to a single subject, combines the advantage of flexible classification of subjects with ease of arranging the sheets from month to month, so as to make the bibliography of each subject consecutive and up to date. Having the sheets loose and perforated for binding with brass clips or cords, allows each individual to supplement the printed sheet by his own notes or additional references. The publisher is also able to add sheets descriptive of later or earlier memoirs, without impairing the integrity of previous work. It should be, and doubtless is, a matter of sincere regret by the electrical and mechanical engineering professions that this publication was forced to suspend on account of lack of financial support.

* * * * *

In view of the present state of the case, as imperfectly outlined above, what seems to be the best method of securing the publication of an index that shall avoid the failings of those already existent? One of the first considerations is that the compilation of an index which will be an improvement upon all existing ones, must be the result of the co-operation of a large number of people, as "Poole's Index," to which over 122 libraries contributed. It will require the expenditure of a considerable amount of money, and will probably not be self-supporting. Such work could probably be done best under the auspices of some society or societies, as was the "Royal Society Catalogue." Since the index might well include the subjects of interest to electrical, mechanical, hydraulic and civil engineers, it seems reasonable that the various national engineering societies might combine forces to maintain the publication of an index that would be of lasting value to the engineering profession of the entire world. Since the headquarters of four of the national societies are in the same city, two of them being in the same building, such co-operation would not seem difficult. A joint committee might be appointed which would receive the confidence and co-operation of all. They could draw upon a large constituency for co-operation and subscriptions. The committee might outline the plan for the work, and prepare preliminary lists of subjects which might be published and submitted to the members for suggestions. The committee could then call upon different members for contributions from their private index files. The committee should have authority to edit the contributions thus received. Doubtless a number of publishing houses would contribute complete files of their publications for such indexing. Indeed, some of them have already made such offers to a private enterprise for such purpose. Incidentally the material thus received would make a valuable addition to the libraries which are being gathered at the headquarters of the societies. Such a committee would certainly compile an index that would be far in advance of the imperfect ones now published. The vast amount of duplicate labor now expended by the papers and by individuals could then be turned to more efficient work.

In conclusion the writer begs to add some suggestions as to the style of such an index. It should include subjects relating to electrical, mechanical, hydraulic and civil, and perhaps mining engineering. It should index books as well as periodicals. The references should be descriptive so far as practicable. Each subject should have a page by itself. Digests and simple references might be on separate sheets. References and sheets on each subject might be numbered consecutively for convenience in adding later notes from other files or from later publications of the same articles. Abbreviations or other symbols should indicate whether the reference is to the original paper or to a reprint, whether the paper is in full or abstract, whether accompanied by discussion and by plates or illustrations. The separate sheets should be perforated for rearranging and rebinding and should be printed on one side only. It might be preferable to print the whole index on cards similar to those used in the card catalogues of libraries.

In this way it would be practicable to begin publication at an early date and to issue parts at frequent intervals. The indices to current publications could be issued without delay, and those of completed files and historical works could appear as the work proceeded. Publishing the work in sections would allow each engineer or student to purchase or subscribe for only such subjects as were of importance or interest to him. Indeed, the work, if carried out properly, would result in so massive a catalogue that few outside of libraries or other public institutions could afford to obtain the entire work.

* * * * *

After this paper was prepared, the writer learned, in looking over some periodicals that accumulated during the summer, that the Royal Society recognizes the defects of its admirable catalogue, and is taking steps to revise and bring it down to date with the co-operation of learned societies in various parts of the world. (*London Electrician*, XXXIII, 268, July 6, 1894.)

* Abstract of a paper read before the American Institute of Electrical Engineers on November 21.

American Institute of Electrical Engineers: Removal Notice.

The office of the American Institute of Electrical Engineers, which has been at 12 West 31st Street since May, 1890, has been removed to rooms 1009 and 1010 Havemeyer Building, 26 Cortlandt Street (tenth floor), New York City.

This change has been decided upon by Council, after careful consideration during the past three months, by a committee composed of James Hamblet, chairman, Prof. F. B. Crocker and H. A. Foster. The inconvenience of the uptown location has long been apparent to officers and members in the city, as well as visitors from a distance.

The choice of the Havemeyer Building was due to its central location in the electrical district, and its convenience to various lines of travel. It has entrances on Cortlandt, Church and Dey Streets. It is immediately adjacent to the Sixth Avenue Elevated Railroad station, one block from the Ninth Avenue station and the Broadway cable line; two blocks from the Pennsylvania Railroad ferry, and three from that of the Central Railroad of New Jersey.

The Institute meetings will be held at 12 West 31st Street, as heretofore, until further notice.

The office will be open from 9 A. M. to 5 P. M. It is equipped with a long distance telephone, and direct messenger service. Over

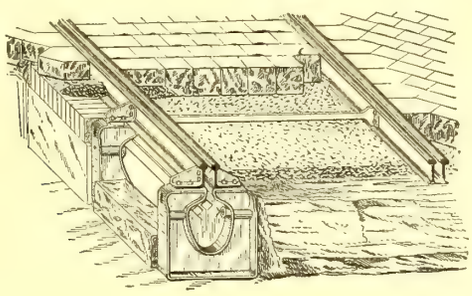
100 electrical, mechanical and engineering periodicals will be found on file. The rooms front west, and command a fine view of the Hudson River. Members visiting New York will find the rooms as convenient for their accommodation as were those at the World's Fair.

Is There a Solution of the Electric Conduit Railway Problem.*

BY JOSEPH SACHS.

It is scarcely a dozen years ago when we did not even have a single inch, I may say, of electric railway in existence. To-day there are hundreds of miles in this country alone; but, strange to say, although its advance has been most phenomenal and the success of the so-called "deadly trolley" has been very great, there has existed a most extensive demand for a substitute for the trolley, which should be free from the various objections which are inherent in the overhead wire. The main objection that exists is the overhead wire, and although we have advanced in the construction and operating of motors and gearing and power house machinery, we still remain at the same point that we did at the very beginning in the method of distributing the power to the motor on the car, namely, by means of an overhead bare wire. Now two substitutes have appeared to solve this problem; one has been the storage battery and the other has been the underground or conduit system. The storage battery car does not need to be explained; you are all familiar with it, and I need only say that although the storage battery has proved a failure in the past, and a severe loss to many of those who have invested money in enterprises of that kind, recent successes in that direction lead us to believe that it is more than a possibility, in fact a very great probability, that we may have a very successful storage battery system in the very near future. But the point that I have under consideration to-night is not to solve the problem in that way, but to solve it by a center of distribution method, or a central station method, and the way to solve the problem in that way is by the conduit system.

Hundreds of conduits have been tried; thousands of them, I may say. And I may also say that perhaps no other branch of electrical engineering can boast of the vast variety of systems and plans that



THE BUDA-PESTH CONDUIT.

have been developed by various promoters as the class of conduit electric railways; in fact, of all the electric railway patents in the Patent Office to-day, over one-half are conduit railway systems; that includes locomotives, storage batteries and everything else that appertains to electric railways. It may seem strange, but perhaps the first thing the novice in electrical engineering goes at is a conduit electric railway. Perhaps that is the very reason why so many have not been successful.

Why is it that success has not been obtained? One reason I have perhaps given you; the other is perhaps on account of some inherent difficulties, and another still is perhaps the extreme large cost of construction and maintenance, although the maintenance would seem to be less than the trolley.

From the fact that there are in operation to-day two electric conduit systems, it would appear that we could build other systems of similar character and somewhat similar construction and have them work successfully; but up to date nothing that has been successful, on a commercial basis, has been forthcoming. I think that in order to bring forth a successful system, we must first study the problem most thoroughly and the real question to be solved.

I have taken up the various systems that have been devised and divided them into six classes, and have selected some which I shall describe to you in their classes, and show you their points of advantage and disadvantage.

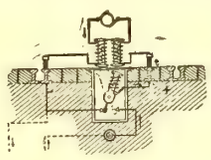
We shall first take up the open slot, continuous wire conduits.

The first system which I shall consider will be the well known Bentley-Knight system, which was, as you all well know, one of the first attempts ever made in this country to solve the rapid transit problem by means of electricity. It consisted of a very small, open slotted conduit with two wires suspended therein. The conduit was exceedingly small and, although this road was operated for some time, it was at last abandoned. The road was opened in 1884, about ten years ago, and, as I say, was the first attempt at electric traction on a commercial operative basis in this country.

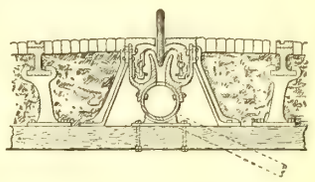
The Bentley-Knight people, however, were not satisfied with that attempt and got out another system. It had also a very small conduit, but instead of placing it in the middle of the track, it was located at the side of the rail. Two wires were located therein, and the plow coming down from the car came in contact with the wires, one on each side.

Another conduit was installed as early as 1885, and although the apparent conditions would be against its successful operation, strange to say it is operating to-day and paying dividends. I have reference to the Blackpool system or Blackpool conduit, which is operated in Blackpool, England, to-day. The conduit is exceedingly small, and the two wires are supported nearly directly below the slot, yet as I say, the conduit is in daily operation.

The next system to be described is the far famed Siemens-Halske system, which is being operated to day at Buda-Pesth. The conduit is a peculiar one. It is located directly beneath the rail. The car wheel is very dissimilar from that used in this country. It is a central flange one, the flange running between the two rails, the object being to keep the slot open at all times. Two wires are used, one each side of the slot, and the whole space around the conduit is filled up and protected by cement. Strange to say, this conduit has been in daily operation, since 1889; dividends are paid by the road, and sixty cars are operating on six miles of double track. But I doubt very much whether a conduit of that size would operate in this country.



SIEMENS SURFACE CONTACT SYSTEM.



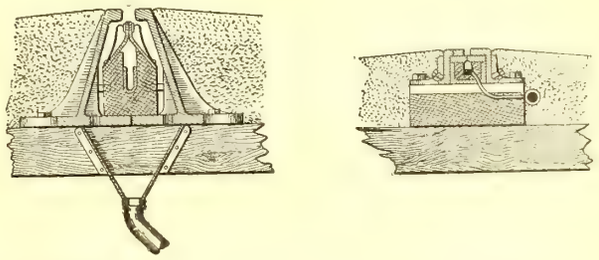
THE ZELL SYSTEM.

Now we come to the latest addition to open slot conduits, which is proving more or less successful. I have reference to what is called the Love conduit. The yoke is a construction adopted at Chicago, where this system was first introduced. You see the promoters of this system had a better idea of the problem to be solved. We have here a large conduit and the wire placed high and dry; and furthermore, about the most important thing of the system is that the wire is accessible by placing above the wire a detachable slot rail or cover which can be raised at any time, so that the wire can be inspected. But apparently it did not prove satisfactory for some reason or other, and when the same system was introduced in Washington, they adopted another form of construction. One reason, no doubt, was that a cheap conduit was wanted, which seemed to be the underlying principle of this whole matter, and for that reason the heavy yoke was replaced by a simple trough located between the tracks. The conduit, I understand, is to-day in operation in Washington; whether fully successful or not I do not know.

Now we come to some of the possibilities and suggestions. One is the Griffin conduit, the only feature of which consists in the fact that the conduit is divided into two compartments, one for the wire and the other for drainage. The advantage of the last form of construction you can readily see for yourself is also borne out in the form of construction which is called the Zell conduit, in which we have a drainage tube in the center beneath the slot, and the wire is supported in two separate compartments, one on each side of the drainage tube. Both of these systems, as I say, are suggestions.

Here are some more suggestions, one of which is very similar to the Bentley-Knight construction. A very complete and well designed conduit is that devised by Elias Ries as far back as 1887. The other is an oddity. The wire is simply loosely supported on insulators, and the trolley wheels pass under the wire and raise it up as it comes along, and after the collector has passed the wire drops back into its support.

Now you will please take notice that most of these various forms of open slot conduit possess several points of disadvantage. In nearly all the forms which have been tried the conduit has been extremely small; the wires have been unprotected and poorly located; they have



TWO FORMS OF VAN DEPOELE'S FLEXIBLE LIP CONDUIT.

been placed low instead of high; the insulators have been poor and inaccessible, and the problem seems to have been attacked from the wrong standpoint, namely, to get a cheap system to compete with the trolley.

We will leave the open slot conduit for a while and take up what we call the movable lip or cover conduit. In this form of construction the aim has been to protect the wire, and in order to do that several inventors have attempted to cover up the slot to keep the slush and mud dirt out, except when the trolley is passing. One of the best known of this kind is the Van Depoele conduit, and the invention of the late well known electrician, Mr. Van Depoele. He devised a form of con-

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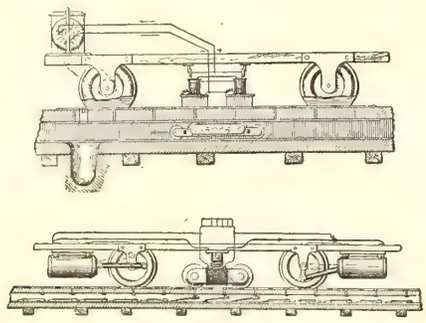
struction having flexible lips, which cover the slot of the conduit containing the wire. The conduit is very small, and there are two lips which press together over the slot and which are pushed aside by the plow of the car as it comes along, but close again after the car has passed.

In another form which Mr. Van Depoele has devised he puts the same construction inside of a somewhat larger conduit, and there the same thing goes on.

In another form the wire is located in a trough within the slotted conduit and covered by two shutters, which are pushed aside by the plow. These shutters are made in short sections, and cover up again after the plow has passed.

Now we come to another system which has recently been exploited in this country, which is called the Peterson system. The conduit is very small and divided into two compartments. The wires are located in one compartment, and there is a cover which is pushed aside by the plow.

The difficulty with these open slot, flexible cover or movable cover conduits is practically the same as the previous class, and possesses

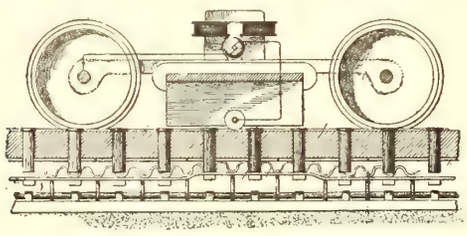


VAN DEPOELE MAGNETIC SURFACE CONTACT SYSTEM.

the additional disadvantage that we have not got the flexible material that will stand the strain of every day railway traffic, and the shutters when made of metal cause a great deal of noise and do not seem to afford a great deal of protection against injury to the wire.

The next class we come to is known as the surface contact system. It holds forth certain alluring attractions in the way of cheap first cost and dispensing with the open slot, and has therefore received a great deal of attention. The Lineff system of this class has been tried experimentally. It contains a sectional iron contact rail which is flush with the street surface. It is made in sections of six to ten feet, placed on top of the conduit, which is entirely closed, and is composed of some insulating material, in which is laid a strip of copper, attached to the bottom of which is a strip of iron, and this composite strip is connected with the source of supply. Upon the car is a magnet having a wheel at each end, and is placed longitudinally with the track. When the magnet is energized the composite strip is attracted up against the rail and naturally connects that section of the rail with the dynamo; and as the car moves along the magnet pulls up the strips in succession, and connects each successive section of the contact rail with the source of supply. I will not dwell any longer on this system, as I have a number of others to describe.

There is another surface contact system devised by Mr. Van Depoele which is practically the same in principle. The contact conductor consists of a number of sections on the surface of the street; the contact device, or collecting plow, consists of a magnet, the poles of which are brushes. The switching device is a small car which runs upon rails in the conduit and directly beneath the sectional con-



LIEUT. F. JARVIS PATTEN'S SURFACE CONTACT SYSTEM.

tacts. The lower rails form the supply conductor, and the car acts as a connection between it and the section above. As the motor car runs along, the magnet beneath pulls the little car through the conduit, and thereby connects each successive section with the supply wire.

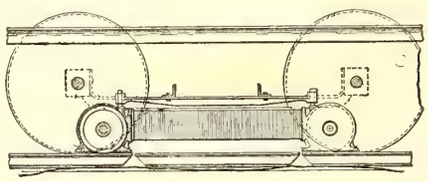
In another system of Mr. Van Depoele's there are a number of levers inside of the conduit beneath the sectional conductor, and as the magnet moves along the switch levers are pulled up against the respective sections, and in that way the contact is made all along the line in each section of surface contact conductor. After the car has passed and the magnet passed the section the lever beneath will drop back and disconnect.

Lieutenant Patten's system is very much the same as the Lineff system. It consists of a band of iron, and upon the car is mounted a magnet, the difference being that this magnet is placed transversely instead of longitudinally to the track. The band is pulled up against the rail by the magnet, which forms the magnetic switching medium, and also against a central contact, which forms the sectional conductor.

Messrs. McElroy, Nicholson and McTighe have devised a system in which, instead of using a sectional rail contact, plates are used which are located between the track on boxes in which the switch mechanism is located. The poles of the magnet are very long and project from the plate on one box to the next. In the box a small lever is pivoted and connected to the supply wire. When a magnet on the car is over the box the lever is attracted up against the contact plate and connects it with the supply wire, and the current is taken off by the long bar which forms the pole of the magnet. As will be understood, the long bar is long enough to span two contact plates.

Another system, in which the boxes are located in the center of the track, was devised by the same inventors. Instead of having a lever, an electro-magnet is used, and the current is sent down through each successive contact head and through the magnet and the connection made between the contact plate and supply wire, just as it would be in the magnetic switch by the magnetic plow. Instead of using a magnet at the bottom of the car a brush or contact bar is used. The current is sent down through the head into the magnet which then pulls up the switching device at the bottom, instead of it being directly operated by the magnet on the car.

There is a system which I have had a little experience with, and which has made me a little doubtful respecting the ultimate success of



THE LINEFF SYSTEM.

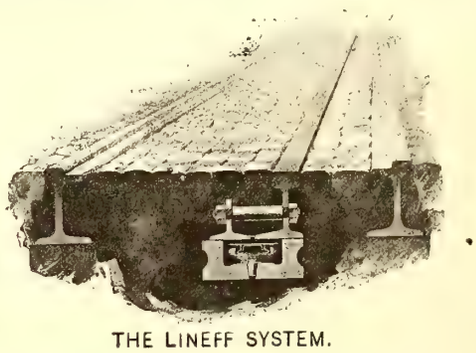
the surface contact system. It is a system in which very much the same methods were adopted as in the McElroy, Nicholson and McTighe system. As in the last system described contact plates are used, but the electro-magnets are not placed under the plates, but in accessible manholes, or placed upon posts along the road. A number of them controlling a section were grouped together. The brush, which is under the car, is always in contact with two or more heads. One head is energized, and when that has been energized, why, the last one is dropped. The conduit really consists merely of a small trough in which the wires were run to the various switching magnets which were all located together. The system was originally an invention of G. T. Woods.

There is another class or system, in fact, it might be called a combination of systems, combining the magnetic arrangement of surface contact with the electro-magnetic. One of these is the Siemens system. Contact plates are used, and the switching mechanism therein consists of a pivoted lever which is first attracted by the magnet on the car, and after the plate has been connected the current passes around a coil of wire on the lever and magnetizes it.

There is another system, devised by Lieutenant Patten, in which practically the same method is adopted. The switching device is so arranged as to improve the magnetic circuit. A separate contact rail is used as the contact conductor.

What is perhaps the latest attempt, in the surface contact system of the Johnson-Lundell type, is very similar to the system in which the magnetic switches are all grouped together. A sectional rail is used instead of contact plates.

The peculiarities of this system are that the car is also equipped



THE LINEFF SYSTEM.

with a storage battery, so that in case the brush under the car loses contact with any section of the contact rail, the car is simply operated by the storage battery. The battery is also used to actuate the magnetic switch if it should be de-energized.

Other surface contact systems have also been devised by Gorden, Pollak and Binswanger, Schuckert and others. In the last named system iron fillings are used as the switching medium in the same way as the levers are used in one of the systems described.

I will not dwell on the advantage or disadvantage of the surface contact systems. The claim put forth by their promoters is that they dispense with the open slot, and can be installed cheaper than any such system. However, on the other side, we have the difficulty of keeping down the leakage of the section that may be alive; the complicated mechanism and the many parts, and the uncertainty of action

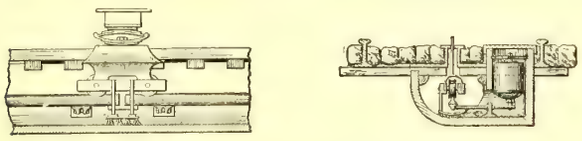
which always attends the operation of a number of small mechanisms, would seem to seriously defer the ultimate success of such systems.

In addition, there is the open conduit class in which, instead of having a continuous wire, a sectional conductor is used: that is, only a section of the contact conductor is connected with the supply wire, and magnetic, electro-magnetic or mechanical switches may be used. We could, for instance, take any of the sectional conductor systems and place the contact rail or plate within a slotted conduit.

The switching of the various sections, plates or contact points can, however, also be accomplished by mechanical devices operated by the moving car.

The Lawrence system has mechanical switch boxes. The contact rail is composed of small T rails supported on a pivoted lever, one end of which is conneeted with the switch piston. The trolley comes down upon the conductor, and by depressing one end of the lever supporting the rail, shoves up the other, and pushes in the switch rod, making connection with the main wire. After the collector has passed the bar springs up again, and connection is broken in the switch box for that section.

The Muncie-Coles system was experimentally tried some time ago at New Haven. Instead of using a continually depressed rail, a number of switch boxes are used and the contact points are depressed. The conduit is very small and simply covers up the boxes.



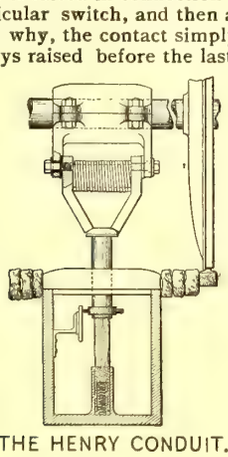
THE LAWRENCE CONDUIT.

A system which was recently exploited at Coney Island is rather a combination of ideas, but as far as I can understand, it is also fundamentally due to the very fertile brain of G. T. Woods; it is practically the same as the Muncie-Coles, but the very great advantage of this is that the switching mechanism, instead of moving up and down, moves on a pivot.

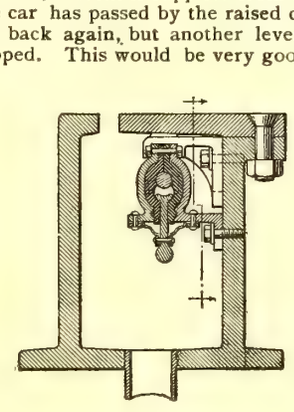
A system devised by Frank M. Ashley, very much the same as the Lawrence or any of the sectional conductor systems operated mechanically, consists of a conduit, a sectional flexible rail and the supply conductor inside of a jacket. As the connector comes along it presses up that section of the conductor and throws it in connection with the supply wire.

Now, these various forms of sectional conductor, open slot conduit systems possess, in my mind, very little advantage over the continuous wire conduit. You have the open conduit, the chance for getting mud, slush and dirt therein, and you have got to have a fairly large conduit.

Now, we come to a very peculiar system. Here the inventor has attempted to bring the conductor, not in the conduit, not on the surface, but he has gone to the other extreme and says, let me bring it above the surface, and I will have it clear and sure. So he constructs a slot parallel to the rail, along the roadbed, and places adjacent to that slot a number of switch boxes, having long arms, the contact points at the end of which run across the slot. On the car is a plow which projects down into the slot, and a similar plow at the other end, and a connection or contact bar between the two plows. The plow goes down in the slot, catches one of the arms and raises it up. While the lever is raised in connection with the bar, current is supplied from that particular switch, and then after the car has passed by the raised contact, why, the contact simply drops back again, but another lever is always raised before the last is dropped. This would be very good if



THE HENRY CONDUIT.



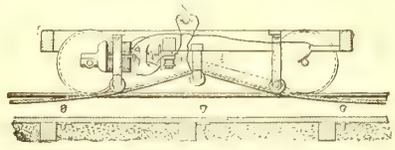
THE ASHLEY CONDUIT.

we always had clean and clear streets, and no mud, slush, dirt or snow; but inasmuch as the system has not yet been tried, I cannot say whether it will be able to operate against these or not.

In another form of raised, sectional contact system, devised by Mr. Henry, the contact device is located in a box in the roadbed, and instead of having a mechanical device, you have an electro-magnetic device. A long magnet under the car attracts a plug in the box to it and makes contact therewith. After the car has passed, the plug drops back and out of connection. The raising and lowering of the plug causes it to be connected and disconnected with the supply wire. The same points hold good with this system.

Now we come to another form of raised contact system which is an exceedingly odd thing. This invention has a slotted conduit, and puts therein a flexible cable which is supported on crossbars. As the car goes along it raises up the flexible cable out of the slot and over rollers under the car, and after the car has passed it drops back.

The last class to be considered is what is called the induction system, in which a number of primary coils are located at regular points along the line, and upon the car is located a secondary coil, brought into such relation to the primary that a current is induced in the secondary from the primary. Although we may have the alternating current motor, the system would be very inefficient and costly. The primaries are wound upon "U" shaped cores, imbedded in the roadbed with the two ends up. The long core on the car is also "U" shaped; each end is a long brush which comes into intimate contact with the ends of the "U" in the street. As you see, the brush makes

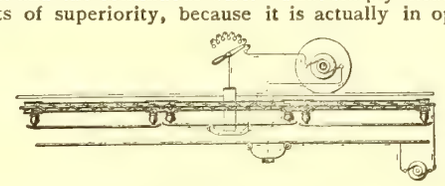


THE FELTROW CONDUIT.

contact with one primary core before it leaves the last, and in that way a continuous alternating current is induced and the car is supposed to move; it has not as yet, though.

What is, perhaps, the first surface contact system installed in the country was put in by the Baltimore Traction Company in 1885. The road was equipped with Daft motors, installed by the Daft Company, but instead of an overhead wire it had a T rail in the center of the track supported by suitable insulators. The car was operated through streets in which there was not much traffic, but there was only 250 to 300 volts. This system is not in operation at present.

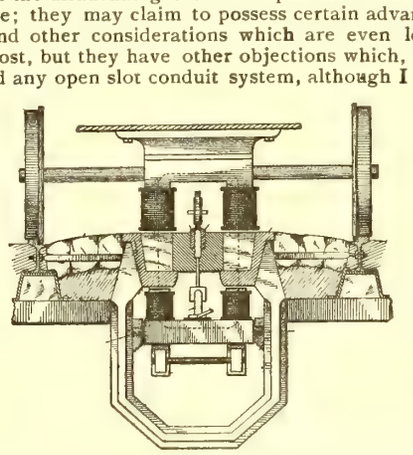
Now, as you see from the variety of possibilities and probabilities that I have shown, the solution of the conduit electric railway problem is not at all limited, and all you have got to do is to pay your money and take your choice; but the peculiar part of it all is that there is not much choice to make, because apparently nothing has ever been evolved—nothing commercially practical—except the plain, everyday open conduit and the continuous wire. That simply means that it has many points of superiority, because it is actually in operation and



THE ASHLEY CONDUIT.

nothing else has ever been operated. We have such a system in operation at Buda-Pesth and at Blackpool, England; but it is doubtful whether either of these systems can be made operative in this country. The climatic conditions are different, and it is doubtful whether our American streets are quite up to some, at least, of the streets in Buda-Pesth, in which one of the systems is in operation.

Various advantages are claimed for the different systems that have been suggested as a substitute for the open slot conduit. They may obviate some of the disadvantages of the open slot conduit with the continuous wire; they may claim to possess certain advantages in the way of costs and other considerations which are even less apparent than that of cost, but they have other objections which, I think, put them far behind any open slot conduit system, although I do not mean

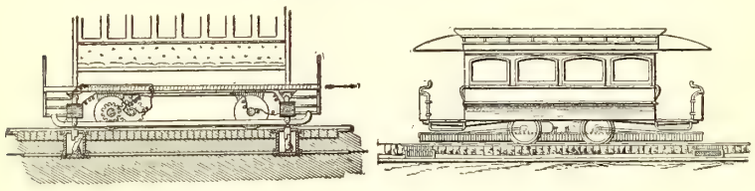


LIEUT. PATTEN'S IMPROVED SIEMENS SURFACE CONTACT SYSTEM.

to say that such systems— that is, those other than the open slot conduit —cannot be made operative.

But let us return to the open slot conduit systems that have been tried and installed. What do we find? We find, in the first place, a very small conduit poorly constructed. The wires are located in very poor positions and badly protected. The drainage is exceedingly poor, and the voltage is exceedingly high. The last state existed when attempts were made that failed, although in others that have succeeded the voltage is low, being about 300 volts. The aim has always been to produce a cheap system, a system which will compete with the trolley. This is a very desirable aim, but not one that is absolutely necessary, and from the fact that cable traction companies will put in cable systems where the track construction alone costs very nearly $100,000 per

mile, single track, as in this city, I think we can afford to spend quite a little on a conduit system which will operate as well as the cable system and certainly has advantages which the cable has not. The problem is, primarily, one of mechanical construction of the conduit. We must get a large conduit, a dry conduit; we must place the wires in such positions as to make them high and dry, and various other conditions must be studied, and it seems to me that it is rather a rebuke to electrical engineers that they have not been able to devise, or have not devised, or that some philanthropic man or corporation has not advanced the interest of the conduit system; but they have not. Let us take the cable conduit, for instance—and those that have recently been built are certainly excellent conduits—and what do we want to do? If we look at the problem thoroughly, we want, in the first place, as previously mentioned, to put the wire high and dry and protect it; the insulators must be far apart and located in manholes or pits; they must be far apart; the contact should be an underbearing one, the voltage should be as low as the first cost of the plant will permit, in fact, below 300 volts if possible, for reasons which I will bring out hereafter; and if possible we should use, at a low voltage, the structure as a return. I believe that those points can be met, and that a system containing them can very readily be devised; in fact, C. H. Warner, an electrical engineer of this city, and myself, some time ago, attempted to attack that problem. We were striving for the $50,000 prize, and we have not as yet gotten it. We devised a form of conduit, taking the ordinary Broadway conduit, in this city, with which you are all familiar, and we got up an insulator which consisted of a central core of insulating materials, in which was imbedded a stud or bolt. On the core of



McELROY, NICHOLSON & McTIGHE SYSTEM.

insulating material were placed a number of petticoats of enameled metal, and separated from one another.

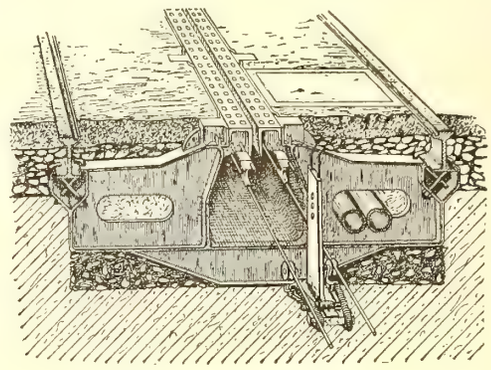
A number of these were placed on the core and clamped by the oil cup at the bottom, through which the bolt passed, and the whole was fastened together by a nut on the bolt coming against the bottom of the cup, the clip being attached to the end of the bolt. The insulator was supported by arms attached to the top petticoat, which came against an enlarged portion of the insulating core. You see by this arrangement a very long surface was presented for surface leakage, namely, the inside and outside of each of the petticoats and the oil in the cups. The insulators were supposed to be in the regular manholes and were located at thirty feet apart, and the wire was supposed to be sustained; the contact was supposed to be an underbearing one.

Now the main electrical point in the system is the voltage. If we can get the voltage low enough, why, we may put the conductor on the surface of the street, as Mr. Edison proposed some time ago. There are various methods of producing low voltage, and one of them is the method which has been adopted by the General Electric Company recently, to supply the ordinary overhead trolley system. It consists in applying the three-wire system to the electric railroad, and it can be very readily applied to conduit construction in this way. We can take an ordinary conduit, such as the Broadway conduit is, or any other, and let the structure itself be the neutral wire. Suppose we use about 300 volts now, we put, as you know, in many conduit systems two wires, an outgoing wire and return wire; now all we employ here are two wires; one forms a negative, one a positive, and the structure the neutral, and by alternately connecting between the neutral on one side and the neutral on the other side, we can balance up our three-wire system fairly well without very many additional devices, because, don't you see, although one car may be stopping and the other could be going at full speed and another up grade, still for all that we can get a fairly even distribution and fairly even balance. We can also have a double track system with one set of three wires; for instance, the plus wire in one conduit of one track and the minus wire in the other, the structure being the neutral. In that way we could really have the voltage about 250 for actual work, while we would have a 500 volt distribution. If the Edison Illuminating Company can afford to spend millions in installing underground three-wire feeders at 220 volts, for furnishing hundreds of horse power in lights, it certainly seems possible that the electric railway companies, whose dividends are just as high, if not higher, could afford to put in a system at the same voltage or perhaps somewhat higher voltage, and perhaps in that way something successful may be done.

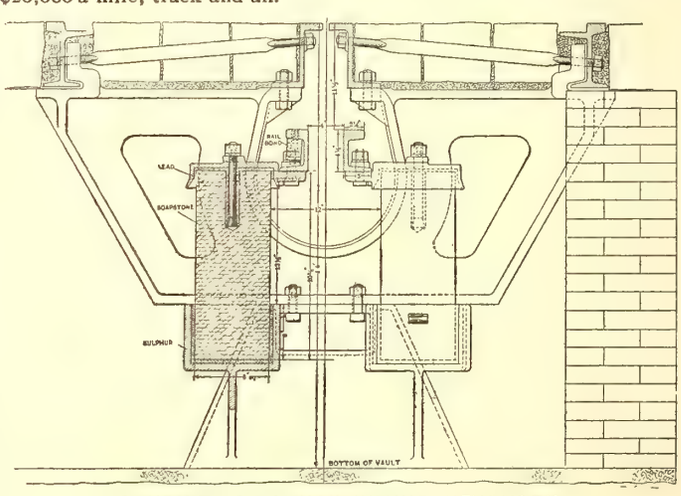
But we have a most promising thing in the alternating system. As you all well know, the voltage possible is unlimited. We can reduce from 10 volts to 1-10th, or from 10,000 volts to 100 volts, but the question again has been the motor, and I want to explain to you this evening various methods, and make suggestions in which the alternating system can be operated, even with the present system of motors through an ordinary open slot conduit, by converters located along the line and taking the current from secondary wires, which would be of perhaps 100 volts or slightly above, anyway not much more than 100. One of the methods is this: We can use a single phase or multiphase system, and we can put upon the car a synchronous motor. This synchronous motor is operated continuously, and when the car is doing no work is practically taking very little current. To connect and disconnect the motor from the axle we can get up some mechanical gear to reduce or connect this kind of motor to the axle. We may also, perhaps, devise a hydraulic gearing. There is a third system which seems to be very promising. It consists in putting in a pneumatic gear between motor and axle. Now, I think we can use one of these gears, either the pneumatic, the hydraulic, or the purely mechanical; but if neither of these should be successful, we may be successful in another way; we can use the tri-phase system and put in induction motors on the car and have two wires as before, the third one being the structure, the induction motor taking the current from the two wires and from the structure, and being connected to the axle of the car through gears, and being regulated and operated by the usual forms of regulating device for such motors.

Now we come to another system devised by H. Ward Leonard, of this city. He proposes to take a synchronous motor with a single or multiphase system, operating the synchronous motor continuously, having the synchronous act as a motor generator, and transforming the alternating current into a constant current, which is used on the motors of the car.

The only point is simply this: I do not think it is so much a question of building a system, but it is one which sounds very like this: What will it cost? The cost, it appears to me, is such that it will only insure adoption in our largest cities; but if we can build a system I feel quite confident that it is wanted. I am borne out in that direction by eminent electrical engineers; in fact, a number of companies who are putting down their good dollars to put in such a system certainly believe that way. The cost, in my mind, will not be less than $30,000 to $40,000 per mile—single track—that is, including perhaps some cheap paving. This estimate, however, is low, and not for the best construction, and assumes that there will be but very little obstruction in the way of pipes, sewers, etc. But we must not compare this with the trolley; the trolley will reign supreme in its own field, and it has certainly been of enormous value in the ten short years of its life; and to say that at the coming of the conduit system the trolley goes out is making a false prophecy, because the trolley has its own field, and will stay. We will never get a conduit system which will be put in for $20,000 a mile, track and all.



THE LOVE CONDUIT.



CONDUIT FOR LENOX AVENUE, NEW YORK.

In conclusion, I would say that I believe we can solve this problem. I have shown you some of the ways in which it has been attempted to solve it, and some of the ways in which it may be solved. Some of you undoubtedly have other ways. We have got to have an underground or conduit system for our large cities, where they will not let us use a trolley, and from the fact that at least three companies, three large corporations, that I know of are trying the ordinary open slot conduit, I think we will shortly see something in actual operation.

But before closing I want to speak about a system, a stretch of which will be installed upon the Lenox Avenue cable road of the Metropolitan Traction Company. It has been devised by the engineers of the General Electric Company, has been approved by their most eminent men and contains various features, some of which I have already described. The ordinary conduit yoke is taken, and at the manholes, thirty feet apart, placed upon suitable supports, insulators which

are of rectangular form are located. They are supported in cups and embedded in sulphur; these insulators are of soapstone, and fastened to the top is an arm of iron. There being two conductors used there is no structural return. To this arm is fastened the contact conductor, which is of channel iron. The contact shoe comes down through the slot and has two arms which press outwardly from the center, supporting the bar against the contact rails, making a continuous rubbing contact. As I said, the insulators are located in the manholes and are easily accessible; they are some distance apart, and the voltage, last of all, is low, it being intended to use about 250 to 300 volts. I want to point out the fact, without criticism, that the conductors are very nearly directly below the slot, which was apparently the objection in some of the first systems, but the peculiar construction and location of the insulators on this system may prevent trouble from this source.

DISCUSSION.

In the discussion which followed the reading of the paper, C. B. Fairchild referred to the underground system now being placed on the Metropolitan Railway, of Washington, D. C., and described elsewhere in this issue. The cost is estimated to be more than the cost of cable construction. Mr. Fairchild stated that the Siemens-Halske Company, which proposed at one time to put in an underground system, admitted to him that the cost would be more than the ordinary estimates for cable construction. In New York City the cable roads were built for not less than $150,000 per mile, single track, but in Washington the cost is about $30,000 per mile, of single track; ordinarily, however, the cost would be from $60,000 to $75,000 per mile with single track.

Referring to the question of contraction and expansion in conduit conductors, Mr. Fairchild stated that in Washington, where the temperature in the conduit varied from below freezing to 140 degs., a great deal of difficulty has been experienced in this connection. He referred to the extreme dampness and great amount of mud and street sweepings in cable conduits, all of which would necessitate great care in insulation. A heavier construction will also be required to support electric cars than required for cable cars, on account of the motors, and the cost will be correspondingly great.

Electric traction is very much harder on the rails than cable traction where the headway is under three minutes. Even where the rail is from seventy-five to eighty pounds, the cost of maintaining the track where electric cars are used is surprisingly great.

Robert Lundell spoke of the Johnson-Lundell surface contact system now being tried at 59th Street. He stated that his company is now ready to put down the system at $30,000 per car mile double track for the electrical equipment without rails or ties, and the track would cost about $20,000 a mile additional. This system has been described at length in these columns. The voltage is 300.

C. J. Field made the statement that in some cases, the cost of the trolley system was as high as $75,000 per mile for a single track, which included $20,000 per mile for paving the streets from curb to curb. He thought that the Buda-Pesth system, as modified, would fill all the requirements of American conditions.

E. A. Merrill spoke of the use of the three-wire system at Bangor, Me. The trouble seemed to be in balancing, and at Bangor, when going up steep hills, very frequently they would have to take the trolley off one side and put it on the other wire. The same difficulty in balancing was found in Milwaukee. He stated that he knew of one road where the cause of the difficulty was not discovered, but the road was abandoned.

Annual Report of the West End Street Railway Company, of Boston.

The following is an abstract of the seventh annual report for the year ending September 30, 1894, and is one which will, on the whole, please the shareholders. The usual 8 per cent. dividends on the preferred stock were paid, together with a regular 6 per cent. and an extra 1½ per cent. dividend on the common stock:

REPORT OF EARNINGS.

Year ending Sept. 30,	1893.	1894.	Inc. in 1894.
Earnings	$6,692,578	$6,823,879	$131,301
Expenses	4,550,734	4,807,083	256,348
Net	$2,141,843	$2,016,795	*$125,047
Interest, taxes and rent.	689,778	725.064	35,286
Balance	$1,452,064	$1,291,731	*$160,333
Dividends	1,329,650	1,193,375	*136,275
Surplus	$122,414	$98,356	*$24 058

*Decrease.

Of the total revenue, $6,734,311 was from passengers. Advertising yielded $34,158, an increase of $2,832 from the previous year.

CLASSIFIED OPERATING EXPENSES.

		Increase.
General expenses	$418,874	$17,681
Maintenance of track	**536,177	255,161
Maintenance buildings	41,796	*24,644
Maintenance cars and vehicles	48,701	110,632
Maintenance horse equipment	130,225	79,124
Maintenance electric equipment	356,833	13,760
Road and snow expense	164,458	*33,788
Transportation expenses	2,510,016	*181,257
Injuries and damages	240,000	19,677

*Decrease.

**Includes the charge to track improvement account last year of $192,190.22, and similar work performed during this year, amounting to $80,617.64, or a total of $272,807.86.

GENERAL BALANCE SHEET.

Assets.

September 30,	1894.	1893.
Construction	$6,135,484	$6,076,760
Real estate	4,667,552	7,315,153
Power stations	3,203,271	1,845,853
Electric car houses and shops	1,563,087	166,811
Electric line equipment	1,480,717	1,276,417
Cars, 2,115 in '94 and 2,172 in '93	5,119,973	5,009,436
Horses, 1,223 in '94 and 2,123 in '93	163,882	284,484
General equipment	548,464	512,614
Malden & Melrose Railroad	214,520	214,520
Somerville Horse Railroad	294,482	82,353
Furniture and fixtures	15,178	19,978
Stock and bonds	75,100	75,100
Track improvement	82,320	192,190
Cash	1,313,100	738,654
Cash for October dividends	136,275	.....
Materials and supplie	365,008	472,639
Accounts receivable	185,915	255,822
Insurance	15.523	31,114
Total	$25,579,850	$24,569,898

Liabilities.

Common stock	$9,085,000	$9,085,000
Preferred stock	6,400,000	6,400,000
Funded debt	9,175,000	6,690,000
Notes payable	.....	1,219,700
Current liabilities	492,783	770,443
Sundry items	397,712	224,866
Profit and loss, surplus	29,356	179,861
Total	$25,579,850	$24,563,871

The surplus account gives a debit of $68,861 written off for old track removed and not replaced, and $180,000 discount on bonds, presumably the $2,000,000 4½s which must have been sold at 91. An interesting feature of the report is an analysis of the stock holdings, preferred and common, on September 30, 1894:

	Pref.	Com.
No. shares	128,000	181,700
No. shareholders	3,611	3,399
Average holding	35	53
Trust shareholders	471	81
Trust stock	23,256	5,797
Women stockholders	1,677	1,164
Stock held by women	38,364	24,727

The company added 10.477 miles of track, and took up 3.482 miles, making a net addition of 6.995 miles. The mileage owned September 30, 1894, was 261.334; the mileage operated, 272.894. The completed overhead mileage is 212.466. The revenue passengers carried numbered 137,028,449. Of the mileage run, 87.29 per cent. was electric and 12.71 per cent. horse cars. Of the passenger receipts, 90.17 per cent. was from electric, and 9.83 per cent. from horse cars. The reconstruction account for the year was $210,352, of which $47,415 was charged to construction, $80,617 to operating expenses, and $82,320 to track improvement account, to be written off against earnings. Other and new construction cost $172,586, which was offset by a credit of $113,861, book value of track taken up, etc., leaving the net addition $58,724. There was a reduction of 900 horses during the year. The company had 606 horse and 1,507 electric cars on September 30, also 1,223 horses and 1,842 electric motors.

President Samuel Little, reporting for the directors, says:

"Owing to the general business depression, only a comparatively small increase in the gross earnings is shown, while the operating expenses show an increase of $256,348.42. This is more than accounted for by having included the track improvement account of last year, amounting to $192,190.22, and similar work performed during this year, amounting to $80,617.64, or a total increase on this account alone of $272,807.86. It has been thought best by the directors to change the dates of paying the common stock dividends from January 1 and July 1 to April 1 and October 1, in order that the dividend year may agree with the fiscal year of the company; and three months' dividend was declared payable October 1, as shown on the previous page.

"At the close of the year, 93 per cent. of the mileage, namely, 1,770,000 miles per month, was run by the electric system, and the equipment of the larger part of the balance is rapidly progressing. * * * * The company sold during the year $2,000,000 4½ per cent., twenty year bonds, with the proceeds of which the entire floating debt has been retired, and at present there is cash enough on hand to cover the expense of finishing the electric equipment now under way and contemplated."

THE STREET RAILWAY JOURNAL

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

Street Railway Publishing Co.,
Havemeyer Building, 26 Cortlandt St., New York.

There Are No Signs of Disintegration in the American Street Railway Association. On the contrary, there has never been a more enthusiastic and thoroughly harmonious meeting than that at Atlanta this year. It is a work of exceptional difficulty to guide a great organization of this character so wisely and carefully that conflicting interests shall have no power to interfere with fundamental aims, and that personal disappointments and hard feeling shall not lead to schisms, parties and cliques, eventually destroying the prestige of the Association. That this has been so far accomplished in the American Street Railway Association is absolutely true. Its presidents have been, without exception, "men of affairs"—broad in their views, strong in character and full of resource in the many difficult situations arising in their several administrations. From the very first a single secretary has been in the service of the Association, and his genial personality and untiring efforts in behalf of its members have contributed not a little to the unusual success of the great organization which looks to him for the detaiis of its life. The various executive committees, who have held office from year to year, have cheerfully given their time and brain power to the best interests of their fellow members. Altogether, the industry has great reason to be, and is, indeed, proud of its fine representative Association and grateful to those who have given it a standing second to no similar organization in the world.

* * * * *

The Association has gained great strength in the South during the past year, and a far larger number of Southern delegates were present at Atlanta than have ever before been seen at a convention. This is, no doubt, largely due to the selection of a Southern city for the Convention of this year, but we can hardly help believing that a portion of the credit, at least, must be given to the Street Railway Journal for the efforts which it has made during the past year to bring the Southern street railway properties prominently into view, and to impress upon their managers in private interviews the fact that the Association is conferring upon its members benefits enormously in excess of the insignificant membership fees and expenses of attending the conventions—however far away. We are confirmed in our belief by the many kind and cordial greetings and congratulations received from our Southern friends attending the Convention, and by their free expression of satisfaction and pleasure at finding themselves in line with the great street railway interests in other sections of the country. We hope and believe that the time will come when the American Street Railway Association will welcome delegates to its conventions from North, East, South and West, from Canada, Alaska, Mexico and South America—all joining in one united and not unkind effort to absolutely overrun whatever city may be fortunate enough to be selected for the meetings.

* * * * *

The letter from Mr. Bowen, read at the Convention and referred to a new Committee, expresses a real need in street railway practice, and one which it should not be difficult to meet. The question of patent valuations is so complex, and is involved in so much uncertainty, that we do not wonder that large companies prefer to avoid constant litigation by buying off those who claim to own "rock bottom patents" on various desirable appliances. Nevertheless, these claimants, while generally entirely honest in believing themselves to be the first in the field, are oftentimes, in reality, thrashing over old straw on principles laid down many years ago, and there is every probability that those who have real rights in the premises will appear in due time, and require a second compensation. The work of sifting out conflicting claims is one which could easily be undertaken by a board of skilled patent lawyers, designated by the Association as its official legal advisers in patent cases. Members of the Association should be privileged to write to the secretary, or directly to the official head of such a board, for an opinion on any particular device, and this should be given for a moderate fee—perhaps $10 for each case passed upon—if the work of the board can be properly classified and continually kept up to date. It is even possible that the Association can derive an actual revenue from such a system, if it chooses to definitely engage one or more patent lawyers for this class of work. We strongly recommend that the committee appointed by the chair to consider the subject matter of Mr. Bowen's letter do not allow the subject to drop until some definite and valuable action be taken by the Association.

Our Financial Supplement has opened the eyes of Eastern capitalists to the wonderful growth and solid business prosperity of the street railway interests of this country. The financial dailies, weeklies and annuals of the East have for so many years almost ignored the growing importance of street railways that the publication of so large a mass of statistical matter has come upon them in the nature of a shock, from which they have hardly yet recovered. We have remarked with some amusement that a hoary headed "Manual," which has for several years published its street railway statistics in a small volume devoted chiefly to a buyers' directory of steam railroad officials, decided this year—immediately after the pub-

lication of our Supplement—to incorporate the statistics of some fifty of the larger systems of the country in its principal publication. Another financial contemporary proposes this month "to take up the matter of street railways somewhat gradually," and in the current issue of its investors' supplement devotes 11 pages out of 165 to this important department. This is, however, an excellent beginning and we heartily welcome the co-operation of our financial friends, in our efforts to popularize street railway investments. We trust that street railway companies will cordially help us in making the 1895 edition of our Supplement—the blanks for which will go out this month—a more complete presentation of the street railway interests than was the case even with our first issue.

A Characteristic Interurban Electric Railway connecting a city of about 45,000 inhabitants with smaller cities and towns and operating about sixty miles of track, is described elsewhere in this issue. While the conditions for economical operation, owing to the location of the railway in the anthracite region of Pennsylvania, are particularly favorable, the extent of the traffic carried shows that the road would be profitable even if fuel were considerably more expensive. Interurban traffic is something which can be developed by care and good service, and there seems to be no reason why this branch of the electric railway business should not undergo as rapid a development and extension during the next few years as strictly urban electric railways have experienced during those which have recently passed. Just where the point lies where the present electric railway becomes less economical in operation than the steam railway has not yet been determined. In fact, its position varies with the different conditions presented, and the field for electric power is constantly widening with the improvements made in electrical apparatus. But the decreased receipts from local traffic on many steam lines, and the complaints of electric railway competition from the managers of such lines show that interurban business is being profitably carried on by electric cars. It takes considerable courage to extend an electric railway through several miles of uninhabited or sparsely settled territory with the hope of serving a town beyond or building up an undeveloped business. But while such a line may not pay for some years, it is usually possible to secure, at small expense, the right of way for a long term, so that until roads of this character become more common and competition for franchises becomes greater, really valuable property of this character can often be secured for a small outlay.

Street Railway Consolidations are more often advantageous to the public than otherwise, and we are glad to see that the daily press is beginning to appreciate this fact. In steam railway circles, consolidations usually mean higher freight rates, and, occasionally at least, poorer passenger accommodations. With street railways, however, rates are never raised above the five cent fare, now of such universal application, while consolidations usually bring about improved transfer arrangements which are an immediate and direct benefit to the public. Moreover, it is the almost universal experience that the larger companies take a broader view of the necessities of the public, and more clearly recognize the fact that the public cannot be induced to ride in poorly kept cars, than do the smaller companies. In another column we point out a notable illustration of the benefit which New York is receiving from the consolidation of seven formerly independent companies into one, by virtue of which the issue of transfer tickets has in three years' time grown from nothing to 1,000,000 per month.

The Internal Transportation Facilities of the Greater New York will probably be, as a whole, superior to those of any other of the first class cities of the world. Manhattan Island—the heart of the immense new city of 3,000,000 inhabitants, which will soon be created as one of the results of the last election—will be tunneled from its lower to its upper end, and through the annexed district on the mainland to the northern limits of the present New York. A four track railway system will probably be decided upon for this tunnel, and express trains will cover the sixteen miles to be traversed in one-third the time now required. The four elevated lines which now furnish the most rapid transit on the island, extensions of which reach up into the annexed district, already carry 600,000 passengers a day, and their capacity will be somewhat increased by the recent building of a third track on one of the lines and by probable improvements in terminal facilities. The surface railway lines running north and south are being rapidly cabled and will carry an enormous local traffic. The steam railroads terminating at 42d Street handle a heavy suburban traffic, and their capacity will be increased by the new high bridge across the Harlem River, which will prevent a great many of the delays now experienced in getting past this highly congested point. A great bridge is to span the North River and another the East River at Blackwell's Island, intended primarily to connect the great railway systems centering at Jersey City with those of Long Island, but also providing for greatly increased passenger traffic between the different parts of the greater New York, as well as the populous towns of the New Jersey mainland. The tunnel under the North River will soon be completed, and numerous ferry lines ply to and fro between all population centers tributary to Manhattan Island. In Brooklyn and Long Island City the entire surface lines are now operated by electricity, and the service rendered is so far superior to the old that it has already induced a great amount of new traffic, as well as that "stolen" from the elevated system. The latter is extensive and is still well patronized. On Staten Island important plans for the improvement of transportation facilities are in contemplation, and in eastern New Jersey, which is really a residence district of New York City, though it cannot be incorporated in the Greater New York, a complete network of electric lines is building to carry a part of the enormous traffic now given exclusively to the steam railroads. It is believed by some who do not fully realize the forces which are at work in our great cities in the line of development and increase in population, that some of these transportation systems will gain materially at the expense of others. Manhattan Elevated Railway stockholders particularly seem to have become timid over the competition of the Metropolitan Traction Company's cable lines and over the expected competition with the new underground line to be built by the city. Experience tells us, however, and there is no reason to doubt that it will be in this case a true criterion, that although a temporary decrease of earnings may be expected with added competi-

tion, this decrease will be very quickly made up by the growth in population, due to the new facilities offered for country residence and city business, and the stockholders of none of the great urban transportation systems need fear that their properties will not be permanently profitable.

The Wear of Wheels in Electric Railway Service is discussed in several articles this month, and is a subject which is worth the serious attention of street railway managers. The conditions to which street car wheels are subjected have undergone a complete change since the general introduction of electric power, and the experience acquired in horse railway service is of little value in determining the results to be expected under electric cars. The size of the cars has been increased to such an extent that the weight on each wheel of a fully loaded twenty foot car now equals, and frequently exceeds that to which freight and passenger car wheels are subjected in ordinary steam railway traffic. These weights are occasionally as great also as the limiting weight allowed upon the steam roads. At the same time the unfavorable conditions of sand and dirt, which formerly prevailed in horse service, still exist with an increased injurious effect, because the stops made are quite as frequent as formerly. Under these circumstances the wear and breakage of wheels has increased, and that more costly accidents have not occurred from breaking of wheels, speaks well for the care exercised by managers. Motor equipments have, by very force of circumstances, been arranged so as to facilitate the removal of wheels and axles, but with the force and apparatus required, frequent removals are of necessity inconvenient and expensive, and the cost greatly exceeds that of the wheels themselves. It is perhaps no wonder, therefore, that complaints have been frequent that wheels are not wearing as they should, or as they formerly did. Manufacturers are handicapped by the fact that the pressure of other problems requiring immediate solution in electric railway operation, has prevented many managers from giving the attention to the wheel question which they otherwise would. In consequence, one wheel has often been considered as good as another, and but little attention has been paid to any requisite but price. As shown in the paper on "Brakes and Brake Shoes," at the Atlanta Convention, comparatively few roads keep records of their wheel wear, and on a still less number have these records been accurately maintained for any considerable length of time.

It is our intention to devote considerable space in the next few issues of the Street Railway Journal to this department of operation, and we earnestly solicit managers who have kept records of their wheel wear to give others, through our columns, the benefit of their experience. It will be our effort to educe from these records the necessary qualities of a perfect electric car wheel, and to treat the question not only from the standpoint of the life of the wheel itself, but also to describe the proper section of wheel, methods of casting and the effect of different sections on the rails and other portions of the equipment. The relations between the wheel and the track, especially at curves, switches and crossings, are exceedingly intimate, and the life of the wheel and permanent way at these points in largely dependent upon the proper shaping of these parts to the other. A badly designed wheel, or one which has lost its proper shape through excessive wear, will often produce an extensive depreciation at such points, where repairs are most difficult and expensive.

As the teachings of horse traction throw but little light on the behavior of wheels in electric service, neither should we expect to apply without qualification the knowledge gained of wheels in steam railway service, since the average electric car wheel is performing a more severe service than any steam railway wheels in use. While its total load is not as great as that on the driving wheels of heavy locomotives, from imperfect figures now at hand, in regard to the wear of the trolley car wheels, it appears that, though of far harder material than locomotive wheel tires, electric wheels wear out much more rapidly. Judging from figures published in the December number of the Street Railway Journal, a locomotive driver tire may run 12,000 miles for the removal by wear of one-sixteenth of an inch in depth. A motor wheel of half the diameter would probably wear nearly three times as deep for the same mileage, though the locomotive wheel would probably have 100 per cent. more weight upon it than the latter. Upon the Central Iowa Railway an engine with 10,750 lbs. on each driving wheel ran 11,918 miles for each one-sixteenth of an inch worn from its tires. Its service was one where there were many curves and grades, and much sand was needed. It was what would be called hard service on a steam road. With such conditions facing the managers of electric roads in the matter of the wear of wheels, it should be evident that the sooner a systematic record of the performances of wheels is begun, the better it will be for the economy of operation. Much might be said in this connection in regard to the effect which a careless motorman may have upon the life of the wheels. He is certainly as much a factor in their wear as is the careless engineer upon a locomotive. The superintendent usually finds his careless grinding out of wheels somewhat expensive at first. But as worn out flat wheels make themselves apparent to the most careless, retribution follows swiftly, though at some cost to the company. Fortunately, this element in the destruction of the wheel is more under the control of railway managers, than is the quality of the iron in the manufacture of the wheels.

The Street Railway Postal Service.

In the report of the Second Assistant Postmaster General, it is stated that electric cars are becoming more and more important factors in mail transportation from year to year. Forty-seven special lines of this kind have been arranged for by the post office department, at the rates fixed by law for the carrying of mail on steam roads. The routes thus far established are comparatively short, the longest being but eighteen miles, and they are principally laid out through suburban towns, naturally giving a more expeditious and satisfactory service than could be obtained by the use of the star or mail messenger service. The report continues: "Consideration is now being given to the feasibility of utilizing electric and other rapid motor street car lines, to facilitate the transportation of mails in the important cities between the main post offices and branch offices, and to and from the railway stations. A plan of this kind would probably include the running of a special car over the several street lines for the exclusive use of the mail service, not only for carrying locked pouches, but in which a certain amount of distribution would be possible. This office hopes to accomplish some substantial results in the direction indicated within the next year."

STREET RAILWAY WHEELS.

Sharp Flanges.

A sharp flange may be technically defined as one in which the part of the flange next the rail has become vertical. The extent of this vertical surface or its depth may be said to determine the degree of sharpness, which does not, as might be supposed, necessitate a razor edge upon the flange. Another definition of a sharp flange would be a wheel in which the flange is so worn as to be without flare.

Wheels having the so-called sharp flanges are rightly considered by railway men as most dangerous. No other defect is more likely to produce accidents. A sharp flange mounts the rail with extreme ease, regardless of the actual depth of the flange itself, and hence is always likely to produce a derailment from the most trifling cause.

The reason for this is not at once evident. With a vertical side the five-eighths flange of an ordinary thirty inch wheel will touch the rail for four and a half inches in advance of the point of contact between wheel tread and the rail. The whole of this surface is in actual grinding contact with a rail of ordinary section. The result is a powerful lifting action, greatly aggravated by any side motion, by dirt or other obstruction. In this way, the forward revolution of the wheel is constantly tending to throw the car from the track. A very similar case, which all who are familiar with steam engines will call to mind, illustrates the point; it is the ease with which a governor belt jumps off from the double flanged pulleys on which it runs. These pulleys have vertical flanges, often of considerable depth.

THE CAUSES OF SHARP FLANGES.

In the early days of railroading in the United States, every superintendent and car builder had his own ideas on the subject of sharp flanges and their causes. As the sharp flange was early recognized as a most dangerous defect, a variety of opinions resulted. The steam railroad men had no data on this subject, and consequently no one could prove that any other theory was wrong or his own was right. Every man, therefore, went on his own belief, and argument had very little force.

It is only within a comparatively few years that wheels on steam roads have been made truly round and of equal size. The former practice was to put them on to their axles as they came from the foundry, regardless of size or truth. At that time, the idea of a difference in the hardness between the two wheels as a cause for sharp flanges was very prevalent. In proof that this was the reason, it was very common to test the two wheels with a file, and as it was usually found that the sharp flanged wheel was much softer than its mate, it was assumed that the proof was sufficient. This was not altogether conclusive, however, because the hardness of the tread on a considerably worn wheel was tested against one on which the wear had been light.

Some master car builders experimented on the effect which a difference of diameters in wheels on the same axle had upon the wear of the flanges. It was quite commonly believed that in consequence of the unequal sizes of wheels on the same axles, there is a tendency for one wheel to run forward, and consequently force the opposite wheel against the rail. Long continuance of this action would, of course, result in sharp flanges. While this was perhaps a very common cause of flange wear at that time, it seems now to be of little importance. It is now a usual, if not a universal practice with manufacturers, to size their wheels with extreme accuracy by means of gauges. The diameters of two wheels on the same axle are practically obtained to within the thirtieth of an inch. A variation to this extent is altogether too small to determine which wheel of a pair shall have a sharp flange. There are many other circumstances of far greater importance which influence the wear in this direction.

"Trucks out of square," or a want of parallelism between the two axles of a truck, is now considered one of the most frequent causes for sharp flanges. At least, recent experiments point to this as the case. If squaring gauges are not carefully used, this is often an unsuspected cause. Even by the employment of gauges it is not always easy to determine the absolute parallelism of the axles, nor can it always be established that they are also at right angles to the rails. It may also happen that, while the axles are at right angles to the track, and parallel to each other, the wheels do not "track" properly. In other words, while the axles form with the side bars of the truck the four sides of a parallelogram, it is not rectangular. In such a case the diagonal distances from tread to tread will not be equal. In trucks without attached bodies, gauges from center to center of brasses can be used for the purpose of testing this point.

Trucks that start square in the world not infrequently become distorted by severe usage, in accidents, etc. On steam roads such distortion was not uncommon. But as the gauging was by no means as difficult as on the street railways, there was little excuse for such a condition. On street cars, the difficulty of tracing this want of parallelism in the axles becomes very great, and much of the trouble of sharp flanges undoubtedly might be avoided could this one cause be more carefully controlled.

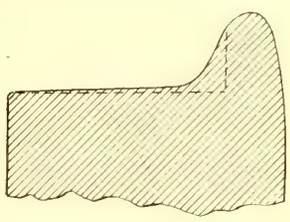


FIG. 1.—OUTLINE OF FULL AND OF SHARP FLANGES

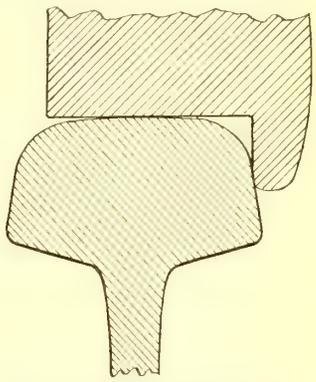


FIG. 2.—SHARP FLANGE ON IMPROVED RAIL SECTION.

We have heretofore referred, in the pages of the STREET RAILWAY JOURNAL, to a case of sharp flanges, which does not appear to be accounted for by any of the theories which have been hitherto presented. The case is that of the cable line of the Third Avenue Railroad, on 125th Street and Amsterdam Avenue, in New York City. On this line, both the wheels on one side of each car wear their flanges sharp. Turning an axle end for end stops the cutting where it had begun, but it begins on the wheel before untouched. In other words, the flange wear is constant upon one side of the car. It is thus independent of the hardness or softness of the wheel, the squareness of the truck or the diameters of the two wheels on the same axle. It is also independent of the curves and the elevation of one rail, etc., because the cars are turned end for end every morning, and make their runs during the day without turning. So far, no rational theory has been offered for this action, and it is probably due to some undiscovered element connected with the car, the wheels, truck or hauling mechanism.

However, it is hardly necessary to consider the question of the primary reasons causing one wheel to hug the rail so as to be worn into the form shown in Fig. 1. The space has in some way been excavated or worn away from what was the original outline of the wheel, as shown by the solid line. In other words, some kind of a tool has been at work to cut out this metal. It will be evident, therefore, to anyone, that if we could in any way prevent

the cutting or grinding from taking place at this point and in this form, it would not matter much whether the truck was square, one wheel softer than the other or whether there was a tendency to hug the rail, brought about by any unknown cause. If we can manage to prevent the grinding from producing this objectionable form, we shall be independent of the causes.

THE REMEDY FOR SHARP FLANGES.

Some years ago, several steam roads in this country, in investigating this subject, came to the conclusion that if the corner of the rail was not sharp enough to cut such a groove in the wheel, sharp flanges would not result. In other words, they believed that the wheel wearing against the rail finally took the form of the rail head. Acting upon this, a rail head was designed, which should more nearly fit the ordinary form of wheel when new. An outline of this head is shown in Fig. 2. The dotted outline shows how the sharp flanged wheel, in Fig. 1, would ride upon such a rail, and it also clearly proves that such a rail is incapable of wearing a wheel into any such form as that shown in our first figure. In a word, the theory was that though there might be numberless reasons to determine the cutting, yet if the cutting member is so shaped or formed as to make an effectual barrier against the production of the undesirable form of wheel, the trouble will be avoided, and sharp flanges become a thing of the past. Several roads adopted the form of rails shown, and with the most satisfactory results.

About ten years ago several engineers undertook to demonstrate by figures whether this change in rail heads produced anything like the results expected theoretically. They found the figures quite as satisfactory as could be desired. The number of wheels from the steam roads of the Eastern states which were condemned for sharp flanges amounted to from 25 to 40 per cent. of the wheels worn out. The general average of the scrap heaps was found to be 25 per cent. Some of the roads reported as high as 40 per cent. Acting upon these figures, which showed the immense importance of the matter, several roads adopted a modified rail head for the purpose of doing away with this excessive wear. This head, which is shown in Fig. 2, had a curve between the side and the tread with a half inch radius. The angles of the sides of the head with the vertical were 18 degs. This form made the head of the rail practically identical with that of the standard flange. Perhaps it would be more correct to say that they were parallel. After several years of use a census of the scrap heaps of the roads which had adopted this form of head showed that the proportion of wheels condemned with sharp flanges had been reduced to 5 per cent. Two roads which adopted this form of rail head were the Lehigh Valley and the Delaware & Hudson Canal Company. On both these roads the figures given were verified very carefully. Ten years having passed, a request for information in regard to wheel wear brought the information that no change had taken place in the extremely low figures that had been previously found. R. G. Blackwell, the superintendent of machinery on the Delaware & Hudson Canal Company's roads, says, under date of October, 1894, that "the showing still holds good."

Through the kindness of John S. Lentz, superintendent of the car department of the Lehigh Valley Railroad, who also investigated the subject of sharp flanges, the following information was obtained from Robert H. Sayre, second vice-president of the road. Mr. Sayre says, under date of October, 23, 1894:

"No changes have been made in the radius of the corners of the head of rails. It was, and is, half an inch. The angle of the side of the head has been changed, however, reducing the angle from 10 to 5 degs. This was done in a way of compromise to the Committee of Mechanical Engineers, who had in hand the uniformity of shape of head of rails. The matter came to naught, however. No records have been kept since the lease of the Lehigh Valley Railroad to the Reading, but my opinion is that we have fewer wheels from sharp flanges than any other road in the country."

A more conclusive proof could hardly be desired in regard to the effect of a rational form of head in preserving the shape of the wheel tread and flange. In a word, we find that when the shape of the tool which cuts out the wheel is changed, the destruction and dangerous cutting ceases, and the wheels retain their natural form until worn out.

THE SAFETY OF FLARING FLANGES.

A question often arises in this connection as to the safety of a wheel and rail with an exceeding flare in the tread. Contrary to the general belief in regard to such matters, the very flaring section is safer and is not as easily derailed as any other. One of the leading founders in the United States had an order at one time to provide wheels for an elevated structure on which derailment had to be most carefully guarded against, since guard rails were not provided. The form of rail used was one having a deep flange at an angle of 45 degs. This extreme flare of the flange was found efficient, and such wheels could be made to leave the rails only with the greatest difficulty. How this can be, can perhaps be best understood by considering the fact that a sharp flange, which is technically one having a perfectly vertical side, is derailed with very little difficulty. A sharp flange on a rail head with a nearly rectangular section, and only a small fillet at the corners, can be made to mount the rail by very slight sidewise pressure. It follows that the use of rails of the flaring section reduces the number of broken flanges, because the relative thicknesses of the different parts of the flange are not disturbed and though wear may go on, still there is no diminution of strength at the root. When extreme wear takes place, the flange has less depth, but the strength is not diminished.

The Wear on Wheels and Brake Shoes.

The question of whether the wheel would wear if relieved from the brake shoe is one which has been very considerably discussed. It is sometimes stated by railway men that 40 or 50 per cent. of the wear is due to the action of the brake on the wheel. This is perhaps true, but it is also true that a loaded wheel running on a rail wears rapidly, even though it has nothing to do with the brake and brake power. A plain cast iron bearing wheel under a transfer table in a New England car shop is a case in point. It had a four and a half inch face, and ran on an ordinary straight track. In eighteen months of service it had a groove worn in it two and a half inches wide and one and three-sixteenths inches deep. There was no wear whatever on it beyond that given by the weight during its revolution. There was no brake shoe or slip, and apparently no reason for wear. The wheel undoubtedly had a considerable load, though how much could not be ascertained, but it was so situated as to carry most of the weight of the small engine and boiler by which the table was driven. In this case, the wear was determined by the mere running of the wheel on a clean rail without side motion, carrying a load and on an axle by itself. We may conclude from this extreme case that there will be wear of wheels whenever they are called upon to carry a load. Dust, dirt and sand or gravel will increase the wear. The application of the brake will also add to the wear due to the rail. It may be assumed as certain, therefore, that the life of the wheel will be prolonged by doing the work of braking elsewhere than on the tread of the wheel.

There are no figures available on this point at the present time, but there are some interesting facts from which it seems safe to draw conclusions. For some time past the Third Avenue Railroad, in the city of New York, has employed a brake drum on the cars of its 125th Street line. The stops made on the cars thus fitted are, upon occasions, remarkably short. The line being driven by cable and having a high speed, the brake power required is very great. The brake drum, however, shows little or no wear, after having worn out one or two pairs of wheels. Indeed, in many instances, the marks of the turning tools are not removed. The brake blocks are of rock maple.

It is fair to conclude from this experience that the wear due to the friction of the brake is largely reduced by removing from the brake shoes the mud, dust and grit

found upon the rail and wheel. The brake under such conditions appears to be more effective than when applied to the wheel. This is probably partly due to the more effective form of the Robertson brake mechanism which is used on these cars, and partly to the fact that the rubbing surfaces are in more intimate contact than is possible between the brake shoe and the wheel. The coefficient of friction is higher between surfaces moving at slow speeds than at high speeds, as shown in the table published on pages 690 and 691 of our November issue. This accounts for the greater efficiency in spite of the shorter leverage employed.

The introduction of new power brakes and the radical changes which the road is making in its equipment prevent any very accurate and fair estimate of the mileage of wheels being made. Upon the face of the returns, however, the wheels appear to be making 38,000 miles under these heavy cars in this hard service. The soil along the line of the road is sandy and gritty, and for a mile or more the road has a macadam surface. There has been also a stretch from 160th Street to about 190th Street, or a mile and a half unpaved. In this portion of the street the natural soil covers the whole roadway. Here sharp sand, coarse gravel and broken country rock compose the street materials. A worse soil could not easily be found, and as the rails are not raised above the level of the dirt the wheels are well supplied with cutting and grinding material.

Experiments are now in progress which will give some figures upon which the questions of drum braking on this particular road may be settled and its economy determined.

Trolley Car Wheel Service.

The electric motor car wheels are performing a much heavier service, and are subjected to more severe strains than is usually thought possible. Motor cars weigh, as a rule, from 16,000 to 18,000 lbs. The latter figures are by no means unusual, and the former quite common. Passenger coaches on steam roads are usually considered light at 50,000 lbs., and their weight increases with the class, until the heaviest sleepers go up to 70,000 or even 80,000 lbs. Of course, comparing the total weight, the motor cars are very light, and would not test a bridge or permanent way like a passenger coach.

But when we come to the actual load upon each individual wheel the question becomes entirely different. The motor car which, with all on, weighs 18,000 lbs., will frequently carry, at the busy hours of the day, 100 passengers. A fair average weight for these will be 130 lbs. In many instances it will be more, for a large proportion will be men. We should, under these conditions, have 13,000 lbs. of load, making a total weight resting upon the wheels of 31,000, or 7,750 lbs. per wheel. A passenger coach of the ordinary type, weighing 64,000 lbs., would carry, on eight wheels, 8,000 lbs. per wheel. Usually, the very heavy cars are carried on twelve instead of eight wheels. The 72,000 lb. cars, therefore, would have, when loaded, only a fraction over 6,000 lbs. per wheel. In fact, an ordinary twelve wheel passenger car, weighing 96,000 lbs., would bring little more weight upon its individual wheels than a loaded motor car under the conditions stated. It must be remembered that the wheels under the motor car weigh from 300 to 350 lbs., according to the size, a few going higher. When cast iron wheels are used for the passenger service on steam roads, the weights will be from 550 to 600 lbs. The steel wheels may go as high as 700 or 800 lbs.

The light motor wheel is lightly proportioned in all respects except the tread itself, which though only two inches wide is very much thicker and should be more heavily chilled than that of a steam road wheel.

The service of the two classes of wheels is as different as possible. The steam road wheel has runs of considerable length at rather high rates of speed. Its work is done on a clean rail. The use of the brake is infrequent. On the other hand the motor wheel does not run at a speed above twenty-five miles per hour. Its rails are always dirty or so rarely clean that such a condition may be neglected in the consideration. The application of brakes will average from five to ten times per mile. One railway manager estimates that there is an application of brakes for each passenger. For roads in cities this is probably a fair estimate. When the line is hilly, as it is apt to be in the Eastern states, the use of the brakes will extend over a large portion of the running time.

From an examination of these facts when compared with the steam road served, it will be seen that the motor wheel has a much more severe work to do than even the heaviest wheel on steam roads.

The rapid wear of motor wheels is thus rationally accounted for by the fact that they are actually doing more work and work of a more severe character than that of the steam road wheels. Only the heaviest of the modern freight cars when loaded to their fullest capacity impose so heavy a load upon their wheels as do the motor cars loaded. There is an additional duty upon a motor wheel from which the steam road car wheel is free, and which has not been mentioned because of the difficulty of estimating its influence. This is the fact that motor wheels are used for driving. That this entails much slipping and wear is well known. Up to the present time no accurate data have been obtained bearing on this subject. Many engineers of experience hold that it is needlessly large. Under some conditions on curves our own experiments seem to show that it may not be far from 25 per cent. with the inside wheel. The outer wheel slipped less in the experiments, but still there was much grinding that was not necessary.

That slipping will be reduced and that the life of motor wheels greatly increased, are results which are to be hoped for. In nearly every instance where a study of the subjects has been taken up, conditions unfavorable to the wheels have been found, which might be changed. The outlook for increased mileage is therefore good.

The following tables showing the weights of modern freight cars of various types illustrate the points made above. The cars are from some of the leading steam roads of the country and may be taken as representative of three different classes. The tables show total weight when loaded and the weight per wheel under this condition, as well as the weight of the car and the capacity.

KIND OF CAR.	NAME OF ROAD.	Weight.	Capacity.	No. of Wheels.	Total weight of car loaded.	Weight per wheel.
Box (local)....	B. & A.	25,600	50,000	8	75,600	9,450
"	C. H. & D.	19,400	32,000	8	51,400	6,425
Grain car.....	N. Y. C. & H. R. R.	{26,800 / 30 650}	60,000	8	{86,800 / 90 650}	10 550 / 11,331
Refrigerator..	Merchants' Dispatch.	36 550	40,000	8	76,550	9,568
Carriage car..	N. Y. Central.	{28,900 / 27,600}	30,000	8	{58,900 / 57,600}	7,362 / 7,200
Flat "	" "	20,200	50 000	8	70,200	8,775
Box "	Mich. Central.	21,200	40,000	8	61,200	7 650
" "	Erie.	26,200	50,000	8	76,200	9,525
" "	Pennsylvania.	29,350	60,000	8	89,350	11,170
Flat "	N. Y. & New England.	19,000	40,000	8	59,000	7,375
Box "	Lehigh Valley.	28,400	60,000	8	88 400	11,050
" "	C., C., C. & St. L.	26,200	50,000	8	76,200	9,550
" "	West Shore.	24,100	40,000	8	64,100	8.012
Refrigerator..	Merchants' Dispatch.	{35,250 / 35,200 / 35,450}	40,000	8	{75,250 / 75,200 / 75,450}	9,406 / 9 400 / 9.431
Box car.....	L. S. & M. S.	23,650	45,000	8	68,650	8,581
Furniture.....	" " "	32,050	60,000	8	92,050	11.506
Large coal car	Pennsylvania.	20,000	60,000	8	80,000	10.000
" " "	"	19,100	50,000	8	69,100	8,637

The following figures in regard to a few passenger coaches on steam roads show the weight per wheel, etc.

NAME OF ROAD.	KIND OF CAR.	No. Wheels.	No. Passengers.	Weight of car.	Weight Loaded.	Weight per wheel.
Ft. Wayne, Pitts. & Chicago.	Passenger.	12	50	47,250	53,850	4 490
N. Y., New H. & Hartford...	Drawing-Room.	12	..	68,850	.....	5,740
Boston & Albany.....	61-ft. Day Coach.	12	..	66,930	. . .	5,580
" "	55 " " "	8	..	45,310	. . .	5,663

Weights of street cars, weight per wheel, and dead weight per passenger—from various sources :

Kind of Car.	Road.	Weight of Car, lbs.	No. Passengers.	Dead Weight per Passenger, lbs.	Weight Loaded.	Weight per Wheel.
Horse Car.....	3d Ave., N. Y.	5,600	50	112	12,100	3,025
Trail "	" " "	5,600				
Open Grip.....	" " "	.....	...	180	.....	.....
Cable Car.....	" " "	12,000	32	375	16,160	4,040
Electric Motor....	Butte Traction Co.	17,249	...	.....	.....	4,312
Cable Grip	" " "	4,800	...	.....	.....	1,200
Trailers, 16 ft.....	" " "	4,500	...	.....	.....	1,125
8-wheel Cable	125th St., N. Y. City.	26,000	80	180	.....	3,250
Train, Trailer,5,600 lbs. and Open Car.	" " "	36,640	160	250	.....	.....
Open Car, as above	" " "	8,000	...	.....	.....	2,000
Electric Motor.....	.....	18,000	100	13 000	31,000	7,752
" "	.....	18,000	50	6,500	26,000	6,125

The Wear of Wheels in Electric, Cable and Horse Car Service.

A representative of the Street Railway Journal recently interviewed a number of gentlemen on the subject of the relative wear of wheels in electric, cable and horse car service. Below will be found some of the opinions expressed:

Edward C. White, proprietor of the Globe Iron Works, of New York, said:

I have been in the car wheel business for many years. During that time I have seen several important and radical changes made. It is unfortunate that every change has been in the direction of reducing the selling price. Almost every step in this direction has been taken at the expense of quality. The system of purchasing is to some extent blamable for this unfortunate condition. A wheel is a wheel, regardless of quality, in the eyes of most men who make purchases for street railways. The question in buying is, usually, the absolute price regardless of quality. As a result, wheels are sold about as cheaply as sash weights, and in a great many cases appear to be of but little better metal or of more value.

No class of men are more alive to this condition of affairs than the wheel makers themselves. They appear to be helpless. No appeals which can be made in regard to the advantages of a better wheel for more money receives any attention from the roads. Makers are therefore compelled to make guarantees and trust to luck and their own skill in wheel making to make the average life come up to the agreement. If they fail, not only they suffer but the roads also.

In the matter of mileage, the wheel maker is in a peculiarly unfortunate position. I do not think that the roads generally are keeping a sufficiently accurate record of mileage to be of any use in determining how far a wheel has run or how long it has been in service. It is upon these imperfect records that the wheel maker has to rely to establish his guarantee. When the subject of mileage of wheels was taken up on steam roads about the year 1873 the same trouble was encountered. At that time the records of the mileage made by cars and wheels was most imperfectly kept. As the steam roads were seeking better wheels, and as the quality was determined by the miles run, they were forced to keep more perfect records in regard to the life of wheels. As soon as wheel makers found that a better article was appreciated a change was made. The roads put themselves in position to know when they received a good article. As a result, the average guarantee rose from about 25,000 to 30,000 miles, which was the actual life in 1872 or 1873, to 40,000, and in some cases to 60,000 miles. The actual life of many wheels under the improved conditions ran far beyond the guarantee, often passing 100,000 miles. This was an enormous gain for the roads.

At the present time the average guarantee of street car wheels is, say, 35,000 miles. This is about as much as can be got out of a wheel at the present price, which is not far from 1.5 cents per pound. I would not hesitate to guarantee 45,000 miles, if the price were made right. The economy to the company could be easily demonstrated.

The introduction of trolley and cable cars has changed the conditions entirely. The wheels, which answered very well for street cars drawn by horses, are not suitable for the work of heavy trolley and grip cars. They are not sufficiently strong. They wear too rapidly. The cost of replacing wheels has materially increased with the complicated machinery on motor and grip cars. The cost of taking out and replacing a pair of wheels is variously estimated by different roads at from $3, on those having the best facilities, to $6, and even more, on roads not so well equipped in the repair departments. Adding the cost of replacing to the original price of the wheel, it will be found that a $5 wheel guaranteed for 60,000 miles, if it runs only 15,000, might cost from $14 to $22, according to the cost of replacing.

The point which I wish to urge is the necessity for facts. Until the street railways keep accurate and complete accounts of the mileage made by both wheels and axles of all cars, the wheel maker will have little opportunity to improve the quality of his product. The time when each pair of wheels goes under a car should be put on record, as well as the number of miles it runs to the time it is taken out. The cause for removal should be also stated in the record. When such records become general, it will be possible to give more serviceable wheels which will be safer, and in the end cheaper. Until such facts are collected, each superintendent will say, "the wheels on our road are giving good satisfaction," and "as we get them for the lowest market price, there is no reason in purchasing a more expensive wheel."

Wm. Robertson, general manager Robinson Electric Truck & Supply Co., said:

There does not appear to be a general comprehension, or actual recognition, among street railway men, of the radical mechanical differences between the horse and the electric cars as a means for transportation. To this cause may be traced many of the costly mistakes which have been made, and which are now going on.

The driving wheels on electric cars are, as a rule, subjected to an excessive wear never encountered on horse cars. These wheels are constantly slipping and sliding, even on straight track. Take an ordinary car, with two motors It will have a wheel base of six feet or six feet six inches long, with a twenty foot body. When in operation, and especially if loaded at the two ends, the overhanging weight causes "teetering" or galloping, as the expressions go. This motion alternately imposes extra weight on one wheel, while the load upon the other is diminished. As the load is lightened, the traction of the wheel diminishes, and, since the motive power remains constant, there is a certain amount of slipping, while the other wheel does more than its share in driving the car. The next instant the motion reverses the conditions, and the other wheel slips. This slipping, due to teetering, seems to be almost constant on some roads. In addition to this, the conditions of the track may be such that the wheels frequently slip, without moving the car. This may result from a variety of causes, such as bad track, insufficient weight, mud or dirt on the rails. This slipping is sufficient, I think, to account for a large proportion of the unusual wear of the driving wheels under trolley cars. Slipping between the wheel and the rail is necessarily much more destructive than it is between the brake shoe and the wheel. This is evident, because the pressure of the wheel upon the rail is usually greater than that of the shoe on the wheel, and because of the constant presence of sand and dirt on the rail in quantities much larger than ever reach the shoe. The wonder is not at the amount and rapidity of the wear; on the contrary, it would be more natural to expect wear to go forward with far greater rapidity than is actually the case. While such conditions are constantly met, it is by no means necessary to accept them as unavoidable. They ought, however, to have attention. It will not be long before the rapid wear of wheels, and the constant expense of replacing them, will compel a change in method.

Engineer Barr, of the General Electric Company, said:

The results of several careful sets of tests made in the West may be summed up as follows: The friction of chilled cast iron upon a steel rail is considerably less than that of steel upon steel. The friction of steel upon steel under the conditions of dirt, dust and sand found in street railway service is substantially greater than when clean. But the friction of the cast iron wheel is also increased in such a ratio under the same conditions that practically there is little difference to be found between them; certainly not enough to make it worth the extra cost of using steel. The two kinds of wheels are, therefore, practically equal on this count. The hardness of the two metals was the next point. Here the advantage is all in favor of the cast iron, the hardest steel not at all approaching that of the chilled cast iron. In this respect the cast iron wheel has a great advantage, one of the disadvantages of the steel wheel being that it easily becomes flat. A flat wheel on a street railway car is much more of a nuisance than on steam roads. It will produce a greater amount of noise, and, owing to the fact that the street cars are not as well provided with springs as those on steam roads, the discomfort to passengers is proportionally greater. This noise is a great cause of complaint from residents along the line of the streets, especially where they are narrow, making the flat wheel practically unendurable on this account alone. So far as can be ascertained, the wear of the steel wheel is much greater than that of the cast iron wheel. Rapid wear calls for frequent removal and turning off. Counting the cost of the removal and replacing and the machine work, and adding the high first cost of a steel wheel (solid), it is easily seen that there is a great money difference between the cost of running a given number of miles with steel and cast iron. This difference is considerably increased by the good price realized for the cast iron scrap.

When we come to the question of a steel tired wheel as compared with the cast iron, the danger from breakage becomes an important feature, as it is greater with steel than with iron. The reason for this does not at first seem apparent. But the steel wheel, as commonly used, consists of a cast center and a steel tire held on by bolts or rings, etc. These are all liable to give out and allow the wheel to separate. The worn tire is also liable to be broken, and thus cause a destructive accident. This result is all the more probable because in order to attain any measure of success on street roads it becomes necessary to make the metal exceedingly hard, and consequently it is more brittle. In this consideration of the subject I have not noticed the solid steel wheel because on account of its softer body it appears to be entirely inapplicable to use upon street roads. While these wheels may be had of sufficient strength to be removed from all danger of breakage from strain, they cannot compare in life and relative economy with cast iron.

The cast iron wheel when well made is strong, wears well, is not easily flattened, and is cheap. Comparing the cost of running 300,000 miles on steel and on cast iron the figures are greatly in favor of the cast iron.

One of the largest makers of car wheels in the United States, in answer to a question, said that he thought a great increase in the wearing powers of wheels for street cars was possible, and he believed it could come from manufacturers. Better wheels could be made, and

the increased cost would be more than made up by a longer life of the wheel. The general direction of the work would be in the use of better metal with greater care in moulding and foundry work generally. "At present," he said, "we are making just as good a wheel as we know how to, and are taking as much care with the details as we possibly can at the figures which we get for our product. We fit and grind very accurately, in fact to a needlessly close limit, but, of course, if the price were better, improvements would be possible, which are out of the question now. There is no question in my mind that such a wheel as we might make would pay the railroads."

ONE of the officials of the Broadway road (New York City) said that the work on his road was too recent for him to be able to draw intelligent conclusions in regard to the wear and mileage of wheels under grip cars and heavy trailer cars. Comparison with the life and wear of wheels on the old horse car system could only be made when sufficient time had elapsed to find the average under the new systems. New rails, heavier cars, new wheels and a very large increase in speed were all factors in the question. Time only can give the true answer, and at least a year will be needed before figures will be available from which valuable results can be obtained. In the meantime we must collect facts, make observations and note results.

SPECIAL CORRESPONDENCE.

Influence of Soil on Wheels.

EDITORS STREET RAILWAY JOURNAL:

The question of how and why a wheel wears is one which is discussed, generally, with very little reference to the important condition of what kind of soil forms the foundation of the street. If you could get at the figures relating to the life of wheels down along the Jersey coast and in some parts of Florida, and then compare them with those which had run through a clay region, I think you would find some things which would be most surprising. On the New York & New England Railway, steel driver tires wear at the rate of one-sixteenth of an inch for every 12,000 miles. Down in Florida, they wear one-sixteenth of an inch in going about 3,000 miles, and the railroad companies think they have done wonders if they get 5,000 miles with that amount of wear. It seems to me that such figures as these ought to be somewhat encouraging, and look toward the use of steel tired wheels on street roads.

The heaviest of our street cars carried on four wheels is probably not much over 20,000 lbs., or, say, 5,000 lbs. per wheel, while the lightest locomotives will carry at least double that weight per wheel, and so on upward until the maximum reaches 16,000 and perhaps 18,000 lbs. These wheels, too, it must be remembered, are frequently fitted with brakes of the most powerful kind, and since, on many roads, the use of sand is constant, their conditions cannot differ, so much as has been heretofore supposed, from those occurring in street traffic. Under heavy passenger cars where, of course, the sand is not used, thirty-three inch wheels, with steel tires, have records of as high as 300,000 miles, and some of the wheel makers talk of wheels that have done a good deal better than that.

W. O. T.

Electric Arcing and Wheel Wear.

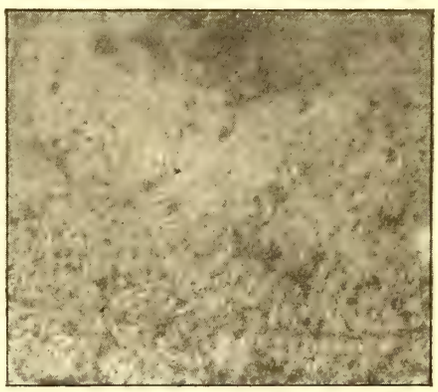
NEW YORK, November 10, 1894.

EDITORS STREET RAILWAY JOURNAL:

The statement that the arcing between the wheels and the rails of an electric car materially shortens the life of the former is often made, but so far as the evidence goes there is nothing to show that this is the case. The facts are about as follows: Under an electric car running at a high rate of speed, say fifteen and, perhaps, twenty miles per hour, the wheels give out quicker than on the old horse road which the trolley line has replaced. Investigation shows that the mileage is less. Upon looking at the wheel a good many spots or pits are seen. Combining these facts with another that now and then a flash has been seen under the wheels, some conclude that the pits are produced by the arc.

Looking at the enlarged photograph of a portion of the tread of a trolley wheel, which I send you herewith, you will see that there are certainly several thousand pits for each square inch of the tread. Now, unless a car is running in an exceedingly sandy country, and with an excessively dirty rail, the flash due to arcing will not be seen once in a minute. It does not occur, ordinarily, once in 1,000 ft. on roads of the best construction. We can, however, get some idea of the probability of the matter by considering the wear of the wheel and the number of pits.

I think no one will examine the tread of a trolley wheel without admitting that an arcing effect sufficient to produce such an excavation of the metal would be plainly seen at night by one watching the wheels of the car. In round numbers, the tread of a thirty inch car wheel has 180 sq. ins. One of these wheels will run about 3,000 miles for each sixteenth of an inch worn off from the tread. As none of these pits is a sixteenth of an inch in depth, we may safely assume that all of them that can be seen have been made within 3,000 miles of wear. If there are 1,000 of these pits per square inch of tread, which I think a fair estimate, we shall have 18,000 on the whole tread, which must have been made in running a distance of 3,000 miles. Dividing, we find there must be made about sixty arcs per mile, or one on every eighty-eight feet during the whole life of the wheel. There may be some roads doing as well as this, but I have not seen more than one that would come anywhere near this figure.



PITS ON WHEEL TREAD.

Now, what about another side of the question? The treads of these trolley wheels look just like the worn treads of horse car wheels or those of any other street car wheels. I question whether there are any men who will assert that arcing produces pits in the treads of horse car wheels. In looking over a pile of old wheels, it will be a very sharp man who can tell, from the tread alone, one street car wheel from another. They are all rough as compared with the treads of worn steam road wheels.

As for the reason for this rough appearance, I have little to offer. The heat generated by the application of the brake shoe and the sudden cooling of the metal by the rail, may have something to do with it. The numerous repetitions, amounting on an average to ten or fifteen per mile may make up by number what they lack in intensity. The brake power on a street railway car is child's play beside that of the air brake. Some railway men say they think the rough condition of the tread of the wheels is due to the grinding of the dirt and sand into the metal. This appears to be more reasonable. The concentrated pressure brought on the metal by a grain of sand upon the rail is far greater than the crushing strength of steel or iron. A grain of sand one-tenth of an inch square would have to bear so large a portion of the weight of an ordinary grip car, as to produce a pressure on the tread of the wheel at the rate of about 600,000 lbs. per square inch. Naturally, we find the tread of the wheel pitted and a dent or dimple in the solid steel rail. This load is nearly double the crushing load of the hardest tempered steel, while car wheel iron is supposed to be crushed by about 180,000 lbs. per square inch, and steel like the ordinary steel rail crushes with a little more than 100,000 lbs.

As there seems to be ample reason for the pitted and worn treads of street car wheels in the ordinary conditions of service, it does not appear necessary to suppose that arcing or any other electrical cause is at work.

JOHN JONES.

Steel Tired Wheels, Wrought Iron Centers.

New York, November 24, 1894.

Editors Street Railway Journal:

Since the adoption of electricity as a motive power great improvements have been made in every department of the street railway business, with one exception, and this is rather surprising, when we consider the important function it performs on every car. I refer to the wheels. Manufacturers of wheels have done considerable experimenting, but very little definite data can be obtained, as the subject is one which has had but little encouragement or consideration from street railway men.

As a matter of fact, standard cast iron wheels in this country to-day will probably not average more than 35,000 miles. There have been few improvements made in the cast wheel, and to-day, by the most approved methods, it is impossible to get any number of cast wheels which are absolutely true and free from various defects. Combination wheels of various kinds have been put on the market, but as yet with no great success. Steel tired wheels have been tried, but we have no reliable data as regards their mileage records made here. In Europe (admitting, it is true, the conditions are very different) the steel tired wheel has been in use for years, and we have records of where the same wheels have been used in constant service for five and six years. Some years ago considerable doubt existed among steam railway men as to the question which was the better wheel to adopt, the cast iron wheel or a combination center with steel tire. After several years of experimenting, the steam roads almost universally adopted the steel tired wheel. In locomotive service they have been adopted exclusively, and records of 500,000 and 600,000 miles have been obtained. True, the service required on steam roads is diametrically opposite to what is required on surface roads in our cities; however, as electricity will probably be the standard motive power for the next hundred years for street railway service, and since its adoption, we have followed very closely the best engineering work done by steam railroad engineers, it seems reasonable to assume that if a steel tired wheel has made in active service 500,000 miles in steam railway service, a wheel built on similar lines should make a record of 150,000 miles in street railway service. If a steel tired wheel will make 150,000 miles it should certainly command attention and consideration from street railway owners. Steel tire manufacturers in this country are unwilling to make any absolute guarantee as to the life of their tires, as they have no mileage record or data whereby they can form any approximate estimate as to the mileage they should make when employed on electric or cable roads. Wheel centers, equally important with the tires, can be obtained guaranteed to give five years' service in commercial operation, or, if found defective, replaced free of cost. If any wheel made will make 150,000 miles, it will obviously be cheaper for the street railway owner to buy it, even at three times the price which is paid to-day for cast iron wheels.

The writer is just placing on the Electric Traction Company's road, of Philadelphia, two sets of wheels for test purposes. The centers of these wheels are manufactured by the Arbel establishments in France, four of them being equipped with steel tires made in France and four of them being equipped with steel tires made by the Midvale Steel Company, of Philadelphia. These two cars will be operated over the same route, and kept in constant service; just what results can be obtained as to mileage of these steel tires, is at this time unknown.

The wheels above referred to are thirty inches outside diameter, the center weighing 105 lbs., steel tire 150 lbs., making a total of 255 lbs. This is a much lighter wheel than the standard thirty inch cast iron wheel. The centers of the wheels are made in separate parts, and are then forged, this process making a much stronger wheel than can be obtained by casting. The centers are turned true on the lathe, the tires are adjusted, turned true, and the result is all wheels under the car are exactly the same diameter.

The cost of such a combination wheel is necessarily much greater than that of the cast iron wheel, but should its adoption be favorably considered, it is reasonable to suppose that its manufacture in large quantities would decrease the price, although it would never reach the present low price of cast iron wheels.

I have been told that a mileage of 120,000 miles has been made with steel tired wheels in an American city, but I have no positive or absolute data to substantiate the statement. Increased speed acquired and now permitted in our various cities on electric railways, makes it the more necessary that the element of safety receive consideration.

Considering the fact that when operating roads by horses, the average speed was but five miles an hour, and to-day, with electricity, an average of from eight or ten miles to twenty-five miles an hour is made, it is strange that the question of stronger and better wheels has not received more consideration. If one is desirous of driving a shaft in a mill at double its former rate of speed, would he not increase the size of his hangers and bearings, or would he simply increase the speed and take chances? It is not my purpose to predict or assume that the standard cast iron wheel will ever be universally discarded, but with increased speeds, heavier cars, the additional weight of the motors, etc., a better wheel is wanted, one which is stronger, the spokes and hubs of which will not crack or split, one which is lighter in weight, thereby decreasing the hammer blow on the rail joints, one which will give increased traction, and above all, one which will give increased mileage. Radical improvements must be made. In the meantime, is not the wheel question worthy of more than the "let well enough alone" attention?

Yours truly,

Wm. Hazelton, 3rd.

Repair Shops of the Metropolitan Street Railway Company..

The consolidation of seven New York City roads into the Metropolitan Street Railway Company has brought about a concentration of the repair work formerly carried on by the independent companies. The smaller repair shops have been closed and the company's work is now done at two points, the cable power station on 50th Street, and in a new building on 53d Street between Tenth and Eleventh Avenues, directly in the rear of the Belt Line division's car house.

The 50th Street cable station contains a very complete machine shop devoted to the repair and manufacture of the cable apparatus. The shop is operated by a Wetherill-Corliss 32 × 42 in. engine, which also runs the dynamos, the mills for grinding feed, the fans serving the adjacent buildings andan Otis elevator. Friction clutches are provided, so that the main shaft of any department can be cut out without interfering with the operation of any other portion of the works. The machine shop contains the following tools:

One cable shear cutter, manufactared by the Cockburn Barrow & Machine Company, Jersey City, N. J., a machine capable of cutting a bar of iron 4 × 1 in.

One planer 10 ft. × 42 ins. × 63 ins., made by the Pond Machine Company, of Plainfield, N. J.

One radial drill, 10 × 5 ft., also by the Pond Machine Company.

Two Pond lathes, one 36 ins. × 14 ft., the other 24 ins. × 14 ft.

One 20 in. × 10 ft. F. E. Reed lathe.

One 16 in. × 8 ft. Reed lathe.

One 2 in. Acme bolt cutter.

One 3 in. cutting-off machine manufactured by the Herbert Rogers Machine Company, of South Sudbury, Mass.

One 3 ft. Springfield tool grinder.

One special "F" Springfield grinder.

One Brown & Sharp No. 1 Universal milling machine.

One Sellers twist drill grinder.

One Gould & Eberhardt 26 in. shaper.

One Gould & Eberhardt 25 in. upright drill.

One 32 in. upright drill, manufactured by Prentiss Bros., of Worcester, Mass.

One Cincinnati Universal reamer and cutter grinder.

One Dwight Slate sensitive drill.

The smithy is equipped with a 600 ton Bement & Miles steam hammer.

Directly above the machine shop is a pattern shop in which are the following tools;

One 25 in. × 10 ft. pattern maker's lathe, manufactured by the New Haven Machine Company.

One 8 × 8 in. draw stroke trimmer, manufactured by Perkins & Company, of Grand Rapids, Mich.

One Baker Bros. Toledo combination rip and cross cut circular saw.

One 3 in. band saw.

Necessary auxiliary tools.

One portion of the pattern shop is partitioned off for a stock and tool room.

Sixteen men are employed in the machine shop, four blacksmiths in the smithy, and several carpenters and pattern makers in the pattern shops. The company makes its own grips, and uses cold rolled steel for pins and bolts.

The 53d Street repair shops take care of all the repairs of the horse and cable car bodies of the company's system, About fifty-five men are employed here, half of whom are in the paint and varnishing department, which occupies nearly all of the second floor and all of the third. A freight elevator handles the cars from floor to floor, and the rooms are brilliantly lighted by incandescent lamps, so that night work is possible. The power for operating and lighting the shops, and for the auxiliary work of the station and the adjoining car house of the Belt Line Division is supplied by a Watts-Compbell and an Ideal engine, located on the ground floor. The shops contain the following machinery: One band saw and one upright drill and mortiser, manufactured by C. D. Rogers & Company, of Norwich, Conn., one circular saw, one planer, one buffing wheel. There are two blacksmith shops in the building, one on the ground floor and one on the second floor near the paint and varnishing department.

Motor Repairs.

Turning Commutators—Testing.

By James F. Hobart.

Frequent re-surfacing of the commutator is necessary, both for economy and for good service. No motor can be operated at the least possible cost, which carries a commutator badly out of round to waste current by sparking. Schemes have been proposed for dressing commutators without removing the armature from the motor, but this has not yet been made to pay, and putting the armature in the lathe is practically the only good way of doing at present.

In turning commutators, it is of vital importance that the tool cuts cleanly, and does not leave fragments of metal clinging to the side of each segment on which the turning tool issues from the cut. For this reason, the ordinary tool used for turning brass, will not answer. To begin with, commutators are not made of brass, but of copper, therefore the tool shown at *a*, Fig. 1, although

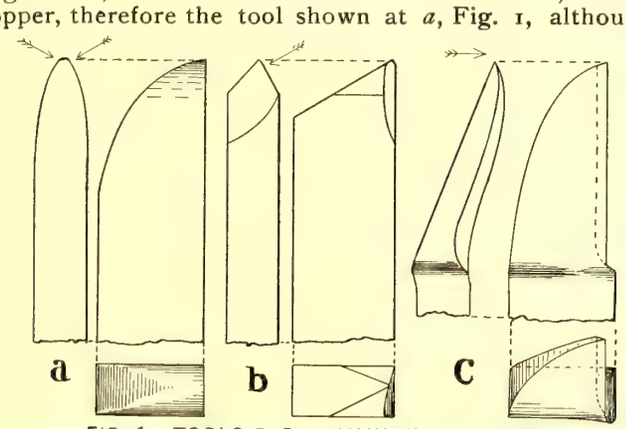


FIG. 1.—TOOLS FOR COMMUTATOR WORK.

much used for cutting brass, is useless on commutator work.

Fig. 1, *b*, shows a good tool for commutator work. This tool will also work wrought iron well, provided the rake and clearance are not too great. The ordinary diamond point tool works very well if it be ground on top so as to cut only in one direction, right or left, but not both. Tool, *b*, is also ground in this way. It will be noted that the point of *b* is ground off slightly. This is necessary in order to make the tool stand up to its work. If the tool be left pointed, the sharp end will soon wear off, then the tool cannot be kept up to its work without a great deal of pressure being put upon it. It will also jam the metal, instead of cutting it, and the metal will be forced into the mica insulation, instead of being cut cleanly off. The consequence will be the short circuiting of several of the segments.

No matter what tool is used for dressing the commutator, a finishing cut should be run over it with a tool something like that shown at *c*. This is commonly known as a "side tool," and if set so the ground-off point is exactly parallel with the axis of the commutator, this tool will cut cleanly and well. The arrows show the direction of cut for each tool; that is, the work must be fed up in the direction indicated by the arrow, or, the tool must be fed up in an opposite direction. In the case of *a*, where two arrows are shown, the tool may be used to cut in either direction.

After turning up a commutator, it should be gone carefully over, and each insulation strip of mica carefully examined. Every bit of imbedded copper must be picked out with a sharp awl. Furthermore, the commutator

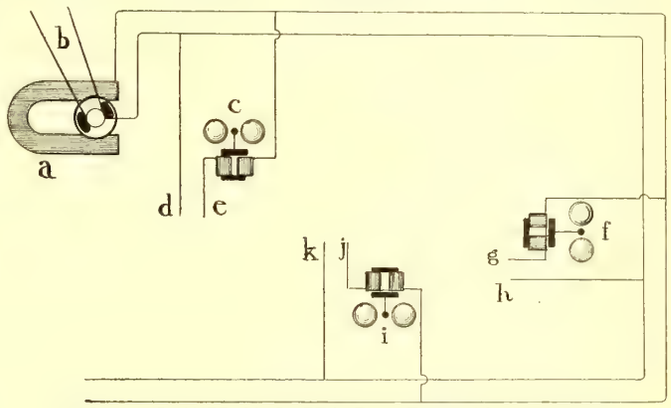


FIG. 2.—POWER MAGNETO FOR TESTING CIRCUITS.

must be carefully tested to see that no undiscovered fragment of copper has formed a hidden short circuit. The testing should be done with a Wheatstone bridge, but in general shop practice, nothing but a magneto is available. However, a good magneto, so wound that it will ring a bell through 30,000 ohms resistance, makes a fairly good testing instrument, and one which is far ahead of no instrument at all.

Magneto testing, in the average car shop, is a costly operation, as managed at present, and is susceptible of great improvement. As now employed, the magneto must have two men to use it, one to turn the crank, the other to apply the terminal wires to the parts to be tested. Sometimes the man (or boy usually) will turn with all his might, sending out a very high voltage which will work through a very high resistance. At other times, he goes so slow on the crank, that the low voltage generated can scarcely ring the bell through considerable of a short circuit.

The remedy for such trouble is to drive the magneto by power, and dispense altogether with the man or boy who does the turning. Frequently there is but one magneto in the shop, and it is sure to be wanted in half a dozen different places during the day. It would be a saving to set up the magneto permanently, drive it by belt or by a small electric motor (from the street current) and then establish half a dozen testing stations where the work may all be done from the single magneto. Fig. 2, shows such an arrangement. The magneto, *a*, is driven by belt, *b*, and forces its high tension, alternating current through the line wires shown in the engraving.

As many magneto bells, *c*, *f*, *i*, etc., must be provided as there are stations to be served. These bells are connected in as shown, bringing one terminal, *e*, *h*, of each bell, down within reach of the workman who is to do the testing. Another terminal, *d*, *h* or *k*, etc., is connected to the other magneto lead and the testing apparatus is all ready for use. Should a workman at the first station re-

quire to use the testing apparatus, he simply connects terminals, *d* and *e*, with the commutator, or other part to be tested, using flexible cord for that purpose. Just before using, the wires should be touched together, and if the bell responds, the apparatus is all right. If the bell does not ring, somebody is probably using one of the other testing stations, in which case, a few moments' wait will set the apparatus at liberty.

This method of magneto testing is much better than the old way of carrying the magneto around the shop, and taking along a man to "do the circular work," *i. e.*, turn the crank. By this method, the magneto is always in order. It is also always in place, as nobody borrows and forgets to return it. For work around the barns, a portable bell may be rigged up, with terminals at binding posts upon its box. Then, connect the box with the magneto leads by means of a double wire (telephone or incandescent lamp cord, and then test from the box, using short wires attached thereto, precisely as were used the wires, *d e*, *g h*, *j k*, etc.

Sometimes it is not possible to get hold of a magneto bell, *i. e.*, one with a polarized armature, and magneto impulses must be made to ring an ordinary bell. This is



FIG. 3.—CONTACT PIECE FOR TESTING.

easily done by screwing down the spring, practically making a single stroke bell of it. When the spring remains in contact with the adjusting screw, while the hammer is in contact with the gong, there is nothing to interrupt or cut off current from the bell, when the spring is thus screwed down, and the bell will answer nicely to the alternating current, provided its frequency is not so great that the coils cannot have time to act between impulses.

Another method of testing, which is much used in some repair shops, for testing T. H. starting rheostats, is to arrange five car lamps in series and connect them through the parts to be tested. If the lamps don't glow, it is taken as evidence that the insulation is O. K. This seems like a rough and very crude method of testing for insulation, but it works well for some purpose—controllers and rhostlats particularly. The street current (500 volts) is used in making this test, and it is usually applied by making contact with the turned-up ends of wire, one of which is shown at *a*, Fig. 3.

To keep the terminals of the testing wires out of mischief, they should be placed carefully in holes drilled for

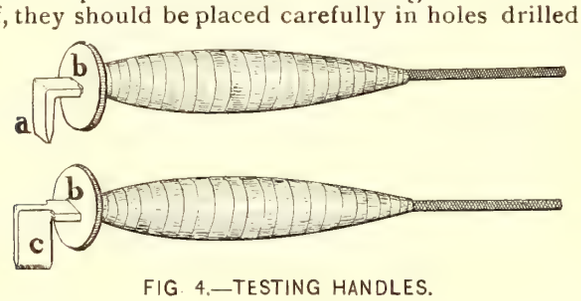


FIG. 4.—TESTING HANDLES.

them in a piece of slate which in turn is fastened to the wall in a place not likely to be interfered with accidentally. The danger of shock to the person, and of fire to the building is thereby reduced to a minimum. Do not, as once I saw, place the testing terminals of a 500 volt circuit in holes three-eighths of an inch apart, *in a piece of pine wood*. A nice little tinder box, and nice dry pine for tinder!

The handle of test wire shown by Fig. 3, is made by winding on insulating tape until the size and desired shape has been made up. A much better set of "testing handles" is shown in Fig. 4. These are made of steel, with hard rubber guards, *b*, *b*, fitted on to prevent the hand from slipping against the live metal. Back of these rings, tape is applied to make up the size wanted. It will be seen that the end of the wire at *a*, takes the form of a scraper, and with it a road to bright metal can easily be made through grease or dirt. The other terminal, *c*, is forged to a different shape. It is more like a section of knife blade, and when rubbed back and forth on a piece of metal, it will dig for itself a little channel leading down to solid metal. To assist it, the edge of the tool is cut with file teeth, so that metal covered with rust, or hard oxide can be made bright.

Notes on Power Station Economy.

By Geo. H. Davis.

Economies of engineering have become so universally studied and applied that the idea has almost become synonymous with engineering itself. The first questions to arise are: Will it pay? How much will it pay? What will pay better? We are not looking for the artistic as a primary consideration, neither do we put serious thought on some complicated machine merely for the amusement of the masses. Economy, durability and simplicity are the principal elements of good design, and after these a reasonable amount of ornamentation is desirable. Simplicity, however, when not gained at the expense of the highest efficiency and utility of the machine is the cornerstone of success both in men and mechanisms.

It is probably true that, in the 6,000,000 H. P. being constantly consumed in the United States in the railway, lighting, factory and mill interests, the coal consumption per horse power per hour might be reduced one-third in amount by careful, close calculation and originality in design. The interest on the extra cost of the best will never exceed or even approach the operating expenses resulting from cheap equipments, and it is obviously bad economy that continues to operate an old and wasteful plant when the extra operating expenses over those of the new and modern design will pay more than the interest and depreciation on the cost of the new.

Studying carefully the tests which have been made of power during the past four years, it is found first in the smaller electric light plants that 45 per cent. of the number which have been tested run at such a fearful waste of fuel, labor and repairs, that extra operating expenses would much more than pay the interest and depreciation on the cost of a new equipment. The causes for this are many and distributed over almost every part of the plant. The older equipments are almost universally non-condensing, having exceedingly small units, high speed, countershafts, inefficient boilers, engines and generators. The piping system consists merely of a main extending from boiler to engine poorly placed and poorly covered; the drips, if taken account of, are discharged into the atmosphere. The arrangements for coal handling and discharge of ashes are, in many, of the most primitive sort.

However, these plants were built when the business was new and many of the installments were made as an experiment by manufacturers, capitalists and engineers. Small generators were the only ones that could be purchased. They were wound for exceedingly high speeds and low voltages, the magnetic leakage in some types being as high as 50 per cent. Armature reactions, eddy currents, narrow limits for neutral points, excessive sparking, hot armatures and hot bearings are some of the disagreeable things that engineers in such stations have to contend with. Next to the generator is the narrow, thin belt running at high speeds between short centers, with a slip of from 2 to 5 per cent. from actual tests. The countershafting alone is a considerable source of loss even if the best designed bearings on the best of foundations are used. In a recent test of one of the most carefully managed lighting plants of the old type, using a countershaft and small units, it was found that the total efficiency from engine cylinders to generator brushes was 62.2 per cent., and that the loss due to countershafting and belts was 14.8 per cent.

Some lighting franchises would not pay however economical the power plant might be, and, therefore, the owners seek to close up the business with the least possible loss, which they consider would be best effected by

wearing out such machinery as they may have on hand. The majority of railway and lighting plants are profitable, and with better economy the dividends might be correspondingly increased, and it is with these that we have to deal.

The following simple arithmetical calculation will show the gain in operating expenses, by reducing the coal consumption one-quarter pound per horse power per hour: In a plant using 2,500 H. P., driving twenty-one hours of the day, on a coal consumption of two pounds per horse power per hour, we have a total of 105,000 lbs. per day. With a coal consumption of 1.75 lbs. per horse power hour, we have a total of 91,875 lbs., or a difference of 6.5 tons. At $2.50 per ton, an annual saving of nearly $6,000 would be effected, which would pay the interest at 6 per cent. on an investment of nearly $100,000. At a coal consumption of 2.75 lbs. per horse power per hour, which is often the actual figure, we have an annual expenditure of nearly $24,000 more than is necessary, or the interest at 6 per cent. on a plant costing nearly $400,000.

No account is here taken of the extra water consumption which is often taken from city mains at considerable cost. Then, too, a plant arranged in large units in minimum space requires from 25 to 40 per cent. less in the cost of labor in attendance.

Generally, in operating mills and power plants, we know the cost of production of power by daily records kept, but this is only a test of the plant as a whole. If it be uneconomical in the consumption of fuel and water, there may be a hundred small and more or less obscure parts that might unitedly or individually cause the waste. Of course, the boilers and engines are the principal considerations, but assuming that these are in perfect condition, so far as their peculiar design will permit, then there are details in steam fitting and auxiliary parts, which if not in place or in bad order, may entirely destroy the economy which might otherwise be attained.

There are certain parts in steam fitting which cannot with economy be left out. In an experiment extending over a considerable period of time, while a large plant was being completed, it was observed that the addition of live steam coils in the receivers, complete pipe covering, an auxiliary heater, and return of all drips to the boilers, reduced the coal consumption from seven to five pounds per car mile.

Again the change of valve setting in engines, after a careful study of cards taken, resulted in a saving of 10 per cent. of the usual coal consumption. The most economical points of cut-off and compression can never be determined by mere inspection. Calculations based on a thorough knowledge of the particular design of engine in question are always most satisfactory.

The many things that can be determined from indicator cards alone give one the best clue to the internal workings and faults of an engine. It is no great trouble to take a set of cards, and a few hours' study of the same will often result in a saving equal to the engineer's wages. The outside mechanical operations are usually well cared for because defects there are apparent to any unskilled assistant. Pipe covering is frequently defective when put in place, and an afternoon's work with two calorimeters will serve to show just what the loss is, and it may be found that the extra condensation, if saved, would more than pay the interest on a perfect piece of work. It is well known, with a given pressure of steam, what the condensation should be in the bare pipe and also that perfectly covered.

No station equipment is complete without a full set of testing instruments. Their cost is but a trifle as compared with the resulting saving due to their intelligent use. Among the instruments that are most valuable are a full set of the best indicators; cheap ones, like cheap watches, are worse than useless; a set of well calibrated thermometers reading from 0 to 600 degs., also a pyrometer, two calorimeters, preferably one separating and one throttling watermeter, a tank with condensing coil for measuring hot water, a standard pressure and vacuum gauge.

A frequent analysis of the flue gases is a source of economy. Different grades of fuel require different quantities of air for complete combustion, and no one can tell by the mere inspection of a furnace whether combustible gases are disappearing through the chimney or whether an unnecessary amount of air is being drawn into the furnace to help in condensation. The apparatus necessary for a complete test of flue gases need not cost $5, and if used will save hundreds of dollars.

Boiler incrustation often causes great heat loss, and in using bad water it is a great worry with the managing engineer to know what to do. Compounds, as a rule, are valueless, and often produce chemical reactions with every kind of metal in the piping system. Generally speaking, frequent mechanical cleaning of boilers outside and inside is the only reliable process. Refined kerosene will assist in the work by preventing scale from clinging to the water contact surfaces, and much of the sediment is thus taken to the mud drums automatically.

Every station should also have a simple oil testing outfit, because consignments of oil vary greatly among themselves and are very different from samples submitted, and it is a very bad practice to "try" oil on a costly engine. One may by this means detect poor lubricants, but the machine is often badly injured in the process.

A chief engineer of a power plant should be a busy man. It is a small part of his duty to see that assistants are attending to their ordinary work, that the floor is clean, the polished work bright, all steam leaks repaired and that the engines don't pound; anyone can do this. There is a standard of economy which is remarkably high in the best designed modern plants, and no one can reach it either in the design or operation unless he really knows his business and is a constant student of the situation.

No operating engineer can make a poorly designed plant economical, but if a plant has in its design and construction the best that is known and used at present, there should be an electrical horse power delivered at the switchboard on the consumption of two pounds of combustible per hour.

Engineering problems of to-day are solved neither by the learned scientists who have devoted their entire lives to laboratory and mathematical research, nor by practical men without scientific knowledge, but by men who have served as apprentices in engineering work, later becoming educated in their chosen branches, either in the technical schools or through private study, and finally entering the profession with the best that scientific research can give and much that experience can teach. It is, therefore, no easy thing to make startling improvements on the best that is known and used. However, in the multitude of details which enter into all engineering questions and usually governed by local conditions, there is always great opportunity for betterment, and through the improvement of these we bring a plant to a standard of economy otherwise impossible.

Transfers in New York City.

The consolidation of seven of the largest street railway corporations in New York City into the Metropolitan Street Railway Company, and the close affiliation of this company with others through the agency of the Metropolitan Traction Company, have brought about substantial benefits to the citizens of New York. The company has introduced such a complete system of transfers that a person boarding its cars at any point can be transferred, with one or two exceptions, to any point on its lines, and can ride for a distance of ten miles—all for the sum of five cents. In other words, the consolidation has accomplished the following striking results:

First. Three main through routes from the lower end of the city to Harlem have been established, one of these three routes being already equipped for cable operation.

Second. It is proposed to extend certain of these lines to the extreme northern limits of the city and to thus make it possible for a passenger to ride from the Battery to Kingsbridge, a distance of sixteen miles for the one five cent fare.

Third. Another through cable line is building on Lexington Avenue on the East Side, to connect with the

Broadway system at 23d Street, and with the Union Railway Company's electric lines in the annexed district.

Fourth. The "Belt Line" and numerous crosstown lines running from the Brooklyn Bridge and various ferries on the East and West Sides below 59th Street are operated as feeders to the north and south lines, and transfers are granted at the one fare.

In the words of the New York *Sun*: "It is impossible to overestimate the importance to the traveling public, particularly in a city of the shape of New York, of such an economic factor as exists in a five cent fare as opposed to a ten cent fare. There are 300 days of travel in every year for a vast majority of our people, and 300 days means $30 of economy."

The Metropolitan Street Railway Company operates seventeen distinct lines, and transfers passengers at thirty-one points on its system. It prints thirty-seven Stedman transfer tickets, all of which are given out by conductors, while on the Broadway line transfer agents are stationed at several points, provided with small cards instead of the Stedman ticket. The transfer tickets are not registered, but are turned in on each trip, and a complicated but highly efficient system of checking up the transfers at the office prevents their misuse.

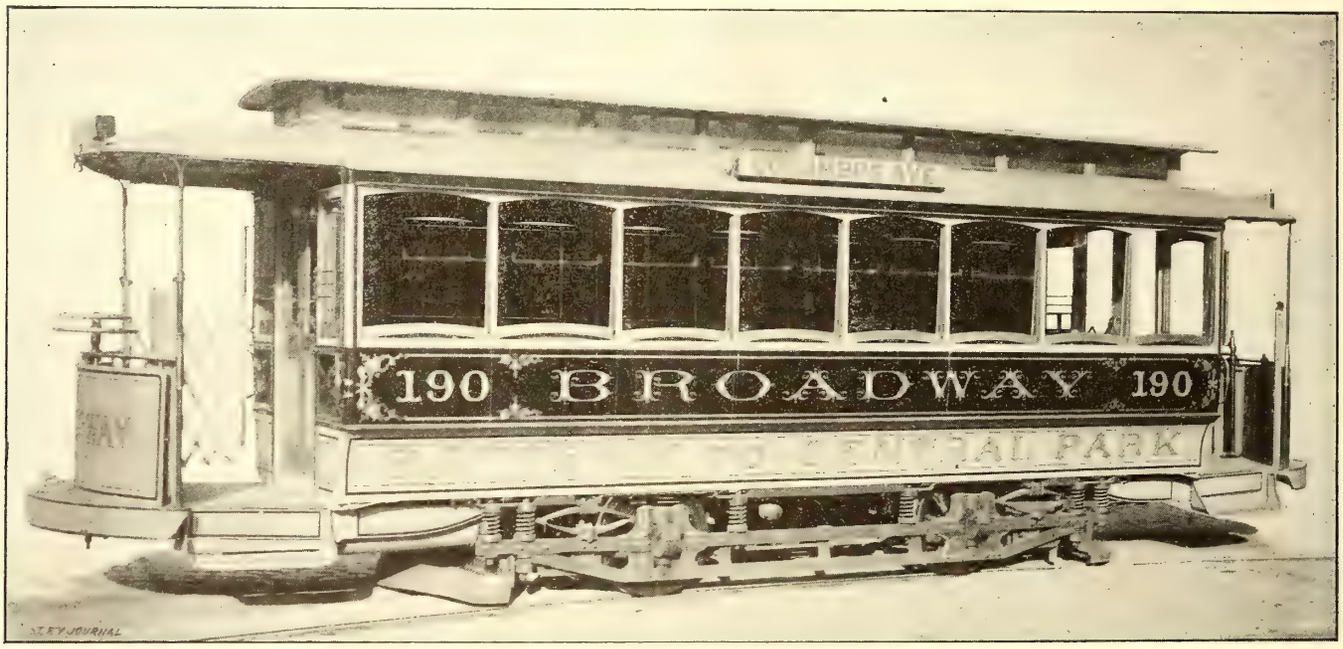
The company began to perfect its system and to issue transfers in 1887. In the first year, the number of transfers issued daily was about 3,000. In 1888, the transfer business was, in round figures, 1,000,000 passengers; in 1889, 2,000,000; in 1890, 2,225,000; in 1891, 2,500,000; in 1892, 2,800,000; in 1893, 3,150,000, and in 1894, when the many transfer stations were established, the figures have already reached the enormous total of 7,000,000. In 1895, it is estimated that from 12,000,000 to 15,000,000 transfers will be issued.

A New Street Railway Association in Georgia.

The meeting of the American Street Railway Association in Atlanta is already bringing about excellent results in the cultivation of a more fraternal feeling among the South. A few prominent Southern presidents met quietly at the Kimball House, in Atlanta, immediately after the Convention, and appointed a committee to take steps to organize a state association in Georgia, the committee being composed of Joel Hurt, president of the Atlanta Consolidated Street Railway Company and of the American Street Railway Association, Col. D. B. Dyer, of Augusta, and Jack King, of Rome. It is needless to say that this association will be cordially welcomed by all similar organizations which are becoming so numerous.

The Columbus Avenue Cable Railway.

The Columbus Avenue cable railway will be put in operation, it is hoped, the first week in December. The track construction is practically completed and all that remains to be done is to finish the work of reconstruction at the power station and lay the cable in place. The cable will be driven from the power station of the company, corner of 50th Street, 51st Street and Sixth Avenue, the one formerly used for operating the uptown section of the Broadway cable line. Its use for this purpose has been given up for several months, the Broadway system being operated entirely from the Houston Street station. The station and the type of yokes used have been illustrated and described in former issues of the Street Railway Journal. We present on this page an engraving of the type of car adopted as standard by the Metropolitan Street Railway Company for its Broadway, Columbus Avenue and Lexington Avenue lines. All the new cars on these lines will be similar to that shown, the route of the car being indicated by a triangular sign on the roof adjustable from the interior of the car.



STANDARD GRIP CAR—METROPOLITAN STREET RAILWAY CO., OF NEW YORK.

The car bodies are being furnished by the John Stephenson Company, Ltd., and are of the "Broadway" type, which has been described in these columns, two of the characteristics of which are wide aisles and platforms. The cars will be lighted by Pintsch gas. Folding gates are used to enclose the inside of the platforms.

The cars are mounted on Peckham improved extra long 6 E trucks, which have been adopted by the Metropolitan Street Railway Company as its standard.

The street railway mail service has been introduced into Pittsburgh, the first branch put in operation being on the main line of the Duquesne Traction Company, on November 11. The east end office receives fourteen dispatches from the main office and two direct from Pennsylvania Railroad trains, and sends out eleven dispatches to the main office and two direct to the trains. The assistant superintendent of the mail service says that the department intends to place regular mail cars on the Duquesne line, on which route agents will distribute mails in transit to the suburban post offices. It has also been decided to put boxes on the cars of the principal lines.

At the request of the post office department, the Pittsburgh, Allegheny & Manchester Traction Company has submitted a map showing its facilities for carrying the mails to Sharpsburg, Etna and Millvale. Maps of the West End and Second Avenue lines with their connections have also been prepared.

Kinks in Station and Railway Practice.

From F. M. Leland, superintendent of the Oakland, San Leandro & Haywards Electric Railway, of Oakland, Cal., we have received several practical ideas. The company has recently built in its machine shop a small air pump, to be used in blowing out armatures when they are brought in to be overhauled. A forty pound blast has been found to do the work much better than the old fashioned bellows. Armature thrust plates have been found to be too weak, and specially heavy plates, with ribs, have been manufactured in the shops to replace the original plates. The company uses and likes the Crossley rope brakes. The standard axle is 3⅝ ins. in diameter. No passes are issued, the employes and officials only riding free.

The company's run cards are arranged with great care, are neatly printed, and contain a number of interesting features. The motorman's inspection sheet is worthy of reproduction.

MOTORMAN'S INSPECTION SHEET.

OAKLAND, SAN LEANDRO & HAYWARDS ELECTRIC RAILWAY CONSOLIDATED.

Run No...... *No Car*.....
Date.....*Name*.....
Condition of Cap.....
" " *Coat*.....
" " *Vest*.....
" " *Pants*.....
General Appearance of Man.....
" " *Car*.....
Position of Badge.....
Condition of Brakes.....
" *Trolley*.....
" *Rheostat*.....
" *Motor*.....
What Kind of Watch?.....
Is his Time Correct?.....
Has Motorman got Dope?.....
" " *Oil in Torch?*.....
Has Car a Proper Link?.....
Has Employee Proper Time Card for this Run?.....
Remarks.....
.....
Inspected by.....

REGISTERING FARES AND TRANSFERS.

The Buffalo Railway Company uses two registers in its cars, one for cash fares and tickets, and the other for three cent fares and transfers. F. O. Rusling, superintendent, reports that this method of keeping account of the number of passengers in the cars is very satisfactory. No employe or policeman rides upon his badge. The conductor gets something from every person in the cars, and registers every fare, ticket or transfer as received.

IMPROVEMENTS IN CLEVELAND.

J. B. Hanna, secretary and treasurer of the Cleveland City Railway Company, writes us as follows:

"Our latest idea is to fit up a special car, to be used as a car for our directors and officers, and also to rent to parties for an afternoon or evening. We believe it will be a paying venture. Our lines are now long, compared with what they used to be, reaching out into the country in pleasant districts, and the rides are attractive, aside from the novelty.

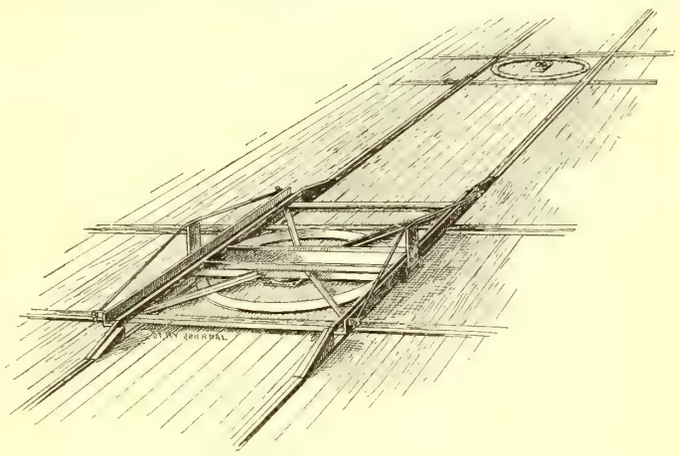
"Both the nine inch, ninety pound and the six inch, seventy-eight pound girder rails, spiked directly to the ties, laid two and three years ago, still stand up.

"The everyday operation of our power plant convinces us that the marine boilers and triple expansion engines are economical to a degree beyond our expectations or figures claimed for them. We are just as well pleased with the direct connected generator in this plant. The dangerous results predicted by those opposed to this type have never been experienced. In a run of two years we have never burned out or short circuited a machine. The strains predicted on the engines, on account of the variation of loads, have not bothered us at all. The more we see of this the more thoroughly we are convinced that our pioneer work in this field has been demonstrated a success." (The plant referred to by Mr. Hanna was illustrated in the March, 1893, issue of the STREET RAILWAY JOURNAL.—Ed.)

A CONVENIENT TURNTABLE FOR A CAR HOUSE.

A convenient turntable, which can be placed in car houses without cutting the floor, is in use in some of the car houses of the Metropolitan Street Railway Company, of New York. It was designed by Thomas Millen, master mechanic of the company, and is easily constructed. A sketch of one of these tables is shown in the accompanying engraving.

The table consists of a frame of channel iron. The side members are three inch angle bars with supporting trusses using a three-quarters inch rod. On the horizontal flange of these angle bars is riveted a strip of iron upon which the car wheels run. The center girder is made of a six inch I beam with two three inch angle irons riveted to it, as shown in the engraving. The upper flanges of the



SURFACE TURNTABLE.

I beam are planed off at the ends, so that the side frames rest on the center web. At their ends the side bars are connected by means of one and a half inch angle bars, and to the center girder by two inch angle bars.

The under side of the central truss is provided with a boss which fits into a socket bolted into the floor. A circular track about four feet in greatest diameter is provided for the turntable to slide upon. Inclined blocks which rest on the rail permit the car wheels to mount the turntable.

The chief advantage of this table is that it can be moved from any part of the car house to another, as occasion requires, it being easily lifted by two men. It is also very cheap to construct.

CAST IRON TROLLEY WHEELS.

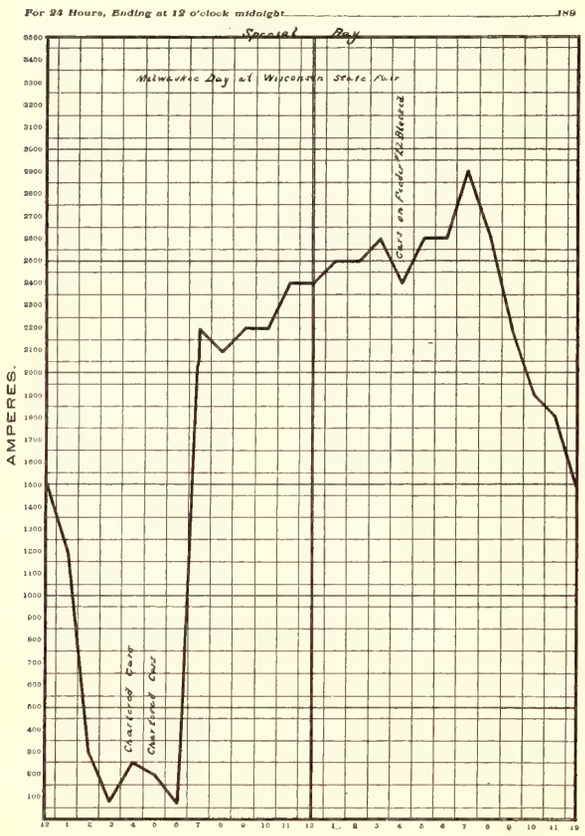
Cast iron trolley wheels have been in use for some time on the line of the Dallas (Tex.) Rapid Transit Railway of which George D. Hartson is superintendent. Mr. Hartson writes that while the wheels do not show any great difference in the first cost compared with brass wheels, they have much longer wearing qualities, and they do not wear the trolley wire any more than brass, nor do they heat any more than when made of the latter metal.

Mr. Hartson has also been employing a wooden line insulator or hanger between the trolley wire and span wire. The wood employed is bois d'arc which is plentiful in that part of Texas. It is a hard, close grained wood. The insulator is turned in a lathe to the shape of of the regular bell hanger and after being well filled with P. & B. paint is slipped down on the bolt of the trolley wire clip and is wired to the span wire with a tie wire in the same way as a feed wire is fastened to a glass insulator. The cost of the wooden insulator is about twelve cents.

POWER HOUSE CURVES.

O. M. Rau, electrician of the Milwaukee (Wis.) Street Railway Company, sends us power station blanks used by his company, and intended to furnish to the executive officers a current history of the day's operation. Reports of this kind are highly interesting, showing the effect that special days have on the operation of a road, and being—with the summary of results which usually accompanies these blanks—an excellent check on the operating force at the station. Mr. Rau believes, and with reason, that the graphical system is the best for a quick understanding of results. It requires but little practice to be able to trace, in the curves, the effect of special incidents of the day, such as the delay of cars by accidents, excursions, baseball games, etc.; and by comparing "cards" from month to month the general condition of the feed wire and return circuits can often be learned and steps taken to prevent the gradual increase in resistance due to deteriorating contacts. The crying need of the hour, however, is a thoroughly practical self registering current and wattmeter adapted for a continuous "indication" of the station output, so that "plotting" with all its crudities and inaccuracies may be made unnecessary.

Load Diagram of River St. Power House.

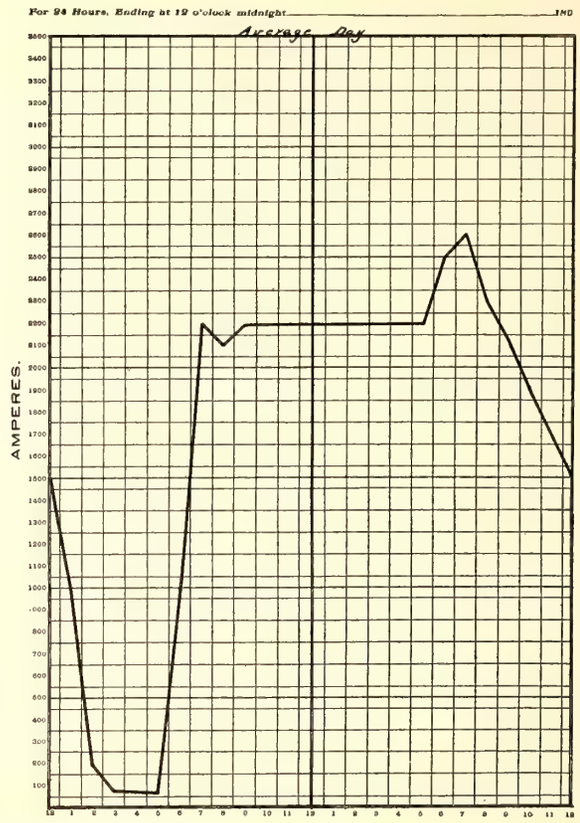


ARMATURES, LIGHTNING ARRESTERS, ETC.

S. Roy Wright, superintendent of the West End Street Railway Company, of Denver, Colo., says:

"On our Sprague No. 6 motors we have made the field terminals with a double turn or bend, both turns being well tied down to the field, so that if the terminals should break off, as frequently happens, the inside turn would still remain, and another terminal can be soldered on, without having to take off and unwind the field to get at the end of the wire. We use strong sheet brass instead of thin ribbon copper for connections, and instead of one strand of fine flexible cord we use No. 7 B. & S. copper cable for connections between the fields. On the armatures we use sheets of thin mica to insulate between the layers of wire, heavily shellacing the ends of the armature only. We then bake until quite dry. For bands we use a heavier wire, and have fewer armatures burn out now than has been the case before. We connect the armature wires direct to the commutator bars, having discarded flexible connections, as we find that by giving the wire a loop back we get better results than when we used straight, flexible or other methods of connection. Our armatures are baked by electricity in a simply constructed heater of our own design, and we find this method more satisfactory than the use of steam coils. We make all our own commutators, using soft copper for the bars, and micanite for insulating. We then heat and screw up the bars alternately two or three times to get them well in place and tight. The brush holders, rocker arms, contact buttons, etc., we have cast and dress them ourselves. We make our brush holder insulators out of a composition of sawdust and glue pressed very hard, and find them more satisfactory and much cheaper than vulcanite.

Load Diagram of River St. Power House.



"The lightning arresters on our switchboard we have altered and increased in number, one arrester having two wires from the bus bar to a water resistance, a zinc plate in this being connected by wire to the pump of the artesian well. The circuits are broken by four sets of sharp pointed carbons held as close together as we can place them without touching one another. As lightning passes from one carbon to the other a plug is drawn to break the following arc. We think that by having pointed carbons close together lightning of a lesser voltage will cross than would be the case with flat or smooth surfaces a little further apart. We have also put one new lightning arrester on the switchboard so that we might have three in line on the bus bar in addition to those previously up, that is, one on each of the feed wires. These were through fuse wires with the circuit broken by circular carbons, and worked well enough until a severe stroke of lightning blew out the fuse wires. Then we had to wait until they were replaced, and replacing them was not always a pleasant thing to do during a heavy storm.

"We have put up electric signal lights operated by the cars on the curves with single track, where the motorman cannot see the approaching car, aud we find that they work most satisfactorily."

USES FOR OLD STREET CARS.

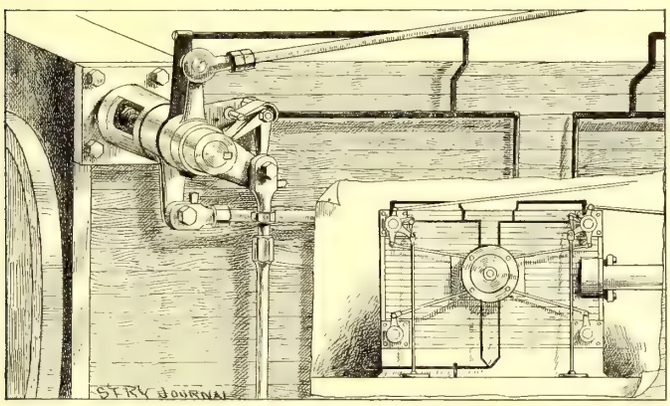
Under the above title the *Boston Transcript* gives an interesting account of Yankee enterprise in Cambridge, Mass. While the West End road was considering where to dump, burn or otherwise dispose of its old horse cars at minimum expense, a Mr. Sturtevant quietly stepped in

and bid for thirty-six of them. The price is not named, but he got all he wanted. Then he adroitly put one in a friend's back yard in Brighton, and told the children they might use it for a play house. Never were children more permanently pleased at a new toy. They sat up nights to use the car. Other little folks came for miles, peered through the fence, went home and teased for a street car to such an extent that a demand was immediately created. In a few days Mr. Sturtevant began to make sales. The amount of amusement obtained for five or ten dollars per car was more than had ever been within the power of parents to provide before. Other uses for the cars began to be suggested. One purchaser concluded to turn his into a hen house; a contractor pays his men every Saturday night from an old car; one man has turned his into a carpenter shop for his boy; another car furnishes a club house for young men, the lamps being useful (as well as the curtains) when card playing is on the tapis. Altogether, it would seem from the *Transcript* article that suburban Boston has gone car hunting with a vengeance, and that one of the minor problems of electric railway operation bids fair to be solved.

AN EMERGENCY CUT-OUT FOR CORLISS ENGINES.

Our illustration shows an extremely simple and effective device designed by W. H. Goodwin, chief engineer of the power station of the Atlantic Avenue Railway of Brooklyn, for quickly shutting off steam from Corliss engines in cases of emergency. With this device the dash pots can instantly be released, thus shutting off all steam, without unhooking or closing the throttle of the engine.

It is entirely independent of the governor, and con-



EMERGENCY CUT-OUT FOR CORLISS ENGINE.

sists of a horizontal bracket attached to the inside of the bonnet of the admission valve by two small studs. Pivoted to the end of this bracket is a bell crank lever, one arm of which is attached to a horizontal rod, which operates a cam attached to the wrist pin. The lower side of the cam is provided with a boss, which is designed to engage and release the latch of the dash pots. A vertical rod is attached to the other arm of the bell crank lever, and extends down to the floor where it is connected to a Y. A horizontal rod extends from this Y to the rear end of the cylinder.

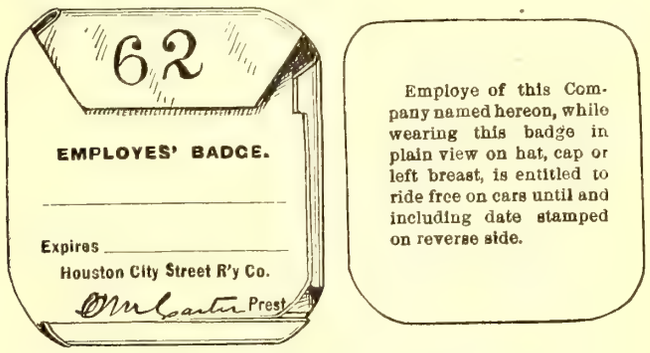
To operate the device, all that is required is a slight pressure of the foot on the floor lever which, through its connections, operates the bell crank lever and throws the cam in contact with the latch and instantly releases the dash pots.

It is constructed of quarter-inch brass pipe, and weighs, complete, less than five pounds.

In large power stations where a number of engines are employed, the device may easily be arranged to be operated by electricity. The floor levers may be operated by electro-magnets, and connection made to a keyboard at the chief engineer's desk, so that in case of emergency, the engineer may instantly shut off steam from any engine.

EMPLOYE'S BADGE.

The Houston City Street Railway Company uses the badge illustrated herewith. It consists of a brass holder with card on which is written the name of employe and date of expiration. This card can be changed as often as may be desired.



Street Car Ticket for Letter Carriers.

The Rochester Railway Company—always well in advance in new devices for fare collecting—has put in use a special ticket for letter carriers, arranged for the purpose by J. H. Stedman. The purpose of the ticket is to enable the postal authorities to get the full benefit of the tickets paid for by the Government for carriers. The tickets are divided into two classes, one for the morning routes and the other for the afternoon and evening routes. Each package bears the carrier's number, and when given to the conductor the date and hour are punched. The tickets can only be used when the carrier is on duty and carrying the regulation satchel. The conductor punches out the month, day and hour, and misuse of the ticket can thus be easily detected in the office.

Street Railway Casualties.

ON November 16, a boiler exploded in the street railway power house, at Elwood, Ind., killing one man, and doing damage to the extent of about $60,000.

THE new building of the Montreal Street Railway Company, in course of erection on Craig Street, collapsed on November 9, burying several workmen in the ruins.

THE South Nashville car sheds of the Nashville (Tenn.) Electric Railway Company, containing nine electric cars, and a large number of tools, were burned on November 4, the loss being about $19,000, fully insured.

A LARGE number of books and a quantity of important papers belonging to the Third Avenue Cable Company, of New York, were destroyed by fire on November 10, and the general offices of the company in the upper portion of the building were badly gutted.

The car house and equipment of the North East Electric Railway, of Kansas City, were totally destroyed by fire on November 7. Thirteen electric cars were destroyed. Two new car bodies were saved. The loss was $20,000, fully covered by insurance. The house will be rebuilt at once and new cars added to replace the old.

A Large Electric Railway Combination.

Plans have been published of the consolidation of the Second Avenue Traction Company, of Pittsburgh, Pa., with the Braddock & Turtle Creek, Pittsburgh & Homestead, Glenwood & Dravosburg and McKeesport & Reynoldstown Passenger Railway Companies. The combination will include over fifty miles of electric railway, and will connect McKeesport and other cities mentioned with Pittsburgh. The company intends to establish a pleasure resort on the line of the route, which will comprise some thirty-five acres. The line will cross the Monongahela River at two points.

An Important Legal Decision Sustaining the Trolley System.

Judge Barker, of the Supreme Court of Massachusetts, has recently rendered an important decision in a suit to test the legality of the overhead single trolley electric system brought by private parties' residing on Garden Street, in Cambridge, Mass., against the West End Street Railway Company. The plaintiffs asked that the company be enjoined from operating its road by electricity, claiming that they were owners of the fee of the street, and that the operation of cars by the single trolley system was a new servitude entitling the abutters to compensation, and the act authorizing the use of the system was unconstitutional, in that damages were not provided for. The principal facts on which they relied to prove the new servitude were (*a*) the increased weight of the track, (*b*) the increased size and weight of the cars, (*c*) the fact that the cars might be run in trains and only stop at fixed points, (*d*) the obstruction to street travel from such cars and trains, (*e*) the additional liability to accidents, (*f*) the unsightliness of poles and wires, and the danger that they might fall, (*g*) the danger to life and property of the electric current on the wires, and (*h*) electrolytic action of water and steam pipes. The plaintiffs were represented by able counsel, and presented a great mass of evidence to sustain their contentions. The decision was in favor of the defendants at every point. The prayer for an injunction was denied, and the plaintiffs' bills were dismissed. The importance of Judge Barker's decision is such that we reproduce the more important paragraphs.

It is possible to propel such cars at a much higher rate of speed than street cars can be drawn by horses, and also to propel them more slowly than street cars can be drawn by horses. In sparsely settled districts their usual rate of speed is greater, and in crowded streets is less than that of the horse car. Electric cars are more completely within the control of those who operate them than horse cars. They can be stopped and started more readily, and their course and progress and movements are more easily controlled. As usually operated they stop to receive and deliver passengers only at designated points. * * * As compared with horse cars, the noise of the electric car properly made and in good order is no greater and no more disagreeable than that of the horse car. Electric cars in use are a source of danger to other vehicles and to persons using the streets in their vicinity, but are not unreasonably dangerous beyond other modes of carrying passengers in the streets. There is nothing about the electric car properly constructed and operated, or about the appliances used in their operation, either in respect of noise, or of concussion communicated to adjacent land or buildings, or unsightliness, or of danger either from the cars or the appliances used in connection, which is unreasonable considering their use, or which, considering their use, is calculated to annoy, disturb, or seriously inconvenience ordinary persons who dwell upon lands abutting on the streets through which the cars pass, or who have occasion to be on such streets or in their neighborhood. * * * * * *

In the operation of street cars by this system, when a dynamo in the power house is in use, electric currents of equal value are at the same time leaving and entering the dynamo. * * * * If the track is properly bonded or welded and the proper return wires are laid and connected with the rails and the dynamo, nearly all of the current which passes to the rails from the motors will return to the dynamo through the rails and the return wires. But the ground itself is a conductor and some part of whatever current is at any point discharged from the car wheels to the rails will enter the soil and tend to find its way to the dynamo through the ground itself. In so doing, if it meets with metal pipes leading in the direction of the dynamo, it will enter them and follow them, so far as they afford the easiest means of progress upon its route. An electric current thus entering a metal pipe from the soil, tends to preserve it from oxydation or rust and from disintegration; but such a current thus leaving a metal pipe situated in damp or wet earth or in water, produces electrolysis of the pipe and tends to disintegrate and destroy it.

Whatever appliances may be used for facilitating the return to the dynamo of the electric current discharged upon the rail in the operation of street cars by the overhead single trolley system, there will necessarily be some portion of the current so discharged which will not remain upon the rails and the other appliances constructed to facilitate its return to the dynamo, but will leave them and enter the ground, and will pass through the earth in the direction of the dynamo. The operation of all such currents upon metal pipes in their way is that stated, namely, to tend to preserve them where the currents enter, and to destroy them by electrolysis where the currents leave the pipes in damp or wet ground or in water. When such currents are large in intensity and in volume the destructive process is rapid, and there are instances in which large pipes have been so destroyed in six weeks. But when the system is properly constructed and installed, and kept in order, the amount of electrical current which leaves the appliances constructed to facilitate its return to the dynamo, while appreciable by the application of scientific tests, is yet so small as to produce no damage by electrolysis or otherwise. When the usual method of operation is followed, electrolysis is greatest in the vicinity of the power house, where the return currents concentrate. When that method is reversed, and the current is sent to the motors through the rails, electrolytic action is greatest in the vicinity of the car, and at a distance from the power house.

The fixed tracks and the poles and overhead structures of an electric street railway constructed and operated upon this system do not unreasonably obstruct other travel in the street, and do not hinder or prevent the use of the street by other methods of transportation, except as the street is actually occupied by the cars when in use, and do not unreasonably obstruct the use of the street for water pipes, gas pipes, sewers, telegraph lines, telephone lines, electric light lines, or any other purpose than travel for which the streets may be lawfully used.

As compared with the fixed appliances of the horse car lines formerly in vogue, the tracks of the electric street railway are no greater obstruction to other travel.

All the fixed appliances of an electrical street railway upon or under or over the surface of the street are used solely to transport travelers over the street, and a street equipped with such a line of railway can be used by more travelers than by any known method of surface transportation, and with less danger and inconvenience to the persons transported, to other persons using the street, and to those occupying abutting lands. than when the street is used for the same amount of transportation by other methods.

The usual and ordinary effect of the location and operation of an electric street railway in a street, upon the market value of abutting and neighboring estates, is to increase rather than diminish that value. There are many persons who dislike to have such a railway in the street upon which their residences abut, and who are annoyed by the structures necessary to their operation, and by the running of the cars; but neither the structures nor the operation of the lines have the effect of annoying ordinary people.

There has been, in fact, no such delay or laches, and no such acquiescence on the part of either of the plaintiffs as ought to prevent them from having relief in equity, if the defendant has not a legal right now to construct and operate this line of railway by the proposed system; nor has the defendant done anything which ought to render it liable to be enjoined from completing the equipment of the line as an electric street railway, or from operating cars upon it by the proposed system, if the statutes are valid under which permission has now been granted it so to do by the local authorities and the Board of Railroad Commissioners.

Franchise Decision in Indianapolis.

A highly interesting decision was rendered in the courts of Indiana, on November 10, this decision affecting the respective rights of the Citizens' Street Railroad Company which has operated the entire street railway system of Indianapolis for many years, and the City Railway Company to which the City Council recently gave franchises, together with a supposed right to dispossess the Citizens' Company in the use of the streets on which the latter's tracks are at present laid. The features of this case are of such general interest as to be well worthy of a brief digest of the situation.

The Citizens' Street Railroad Company was chartered by the Legislature on January 18, 1864. No limit was placed upon its corporate life. The franchise obtained from the city of Indianapolis was granted for thirty years only, and would by its terms expire on January 18, 1894. In April 1880, the original city ordinance was amended so as to read "thirty-seven" instead of thirty years, this amendment being made upon the company's representations that it desired to issue bonds running for twenty years from that date. The city claims that the company never formally accepted this ordinance.

Within the last two years the City Council has intimated that it considered that the company's rights would end in 1894 and that it would not extend the franchise of the Citizens' Company, except under far more burdensome conditions. As the company did not see fit to accept these conditions, the Council on April 20, 1893, granted a franchise to a new organization, the City Railway Company, by virtue of which the latter was empowered to build and operate street car lines through the streets now used by the old company. This, of course, at once brought the trouble to a head, and litigation was commenced.

The Citizens' Company contended that its franchise did not expire in 1894; that the earliest date of expiration which could possibly be construed by the city was January, 1901; and that it really was entitled to operate its road perpetually, unless the Legislature itself should see fit to act upon its reserved right to limit or repeal its charter. In other words, the company's attorneys

(among whom, it will be remembered, was Ex-President Benjamin Harrison) argued that the city had no right to impose a thirty year limitation upon a company chartered by the Legislature in perpetuity, for the specific purpose of operating the Indianapolis lines. It was not denied that the city might have orginally refused to grant the company permission to build its road.

The decision of the ranking judge (Judge Baker dissenting) upholds the right of the Citizens' Company to operate its lines, unless and until the Legislature shall repeal or limit its chartered life. Important paragraphs in the decision are as follows:

"Subject to the reserved power of the legislature to amend or repeal the act, perpetual corporate existence was given in explicit terms, and in the absence of express or implied limitation thereon, the necessary presumption is that the franchise granted was intended to be of like duration—subject only to legislative revocation. It is not to be supposed that the Legislature intended that there should be corporate existence without a franchise—the only reason for such existence. * * * * If agreements by common councils, like the one in question, are authorized and binding they must, when made, operate to suspend *pro tanto* the reserved power of the Legislature by repealing the act to terminate the life of companies organized under it. They are inconsistent with that power. On the contrary, if, when made, the agreements created no vested rights because made subject to the power of the Legislature to revoke or modify them, then in legal contemplation they are without force, and the power of city councils to make them is a mere pretense. It is a delegated power to make an agreement which cannot bind or ought not to bind one party, the corporation, because it does not bind the other party, the state. In respect to such powers the city is the agent of the state, and besides being anomalous, the proposition that the city and company will be bound by such contracts and the state not bound is manifestly unjust and unfavorable to the public interests.

Judge Baker dissents from Judge Woods' conclusion that the Legislature alone has power to compel the Citizens' Company to cease operations, and holds that its rights expire in 1901.

Franchise Decision in Detroit.

To determine the life of a franchise, the United States Court of Appeals reversed the lower court ruling in a suit instituted by the city of Detroit to oust the Citizens' Street Railway Company from the occupancy of the streets. It was contended that the term of occupancy by the company had expired in 1893 by limitation, and was now an unlawful trespasser. The defendant company is the successor of a company which obtained a thirty years' franchise in 1863. A controversy arose in 1879, and resulted in the council extending the franchise for thirty years from that date, in consideration of the company paying increased taxes and reducing fares. The state law under which the company was organized provides that the corporate life of all companies organized under it should be limited to thirty years. Query: Could the council extend the term of street rights of a company beyond the duration of its corporate life? The Circuit Court declared that the council had no such power, and the contract between the city and company was void. But the Court of Appeals, for the Dist. of Mich., October 2, 1894, reverses this view, on the ground that the legislative authority was ample to warrant the council in extending the company's grants, and that the acts of the legislature conferred power, without express terms of limitation. The power to make an irrevocable contract, giving an easement of some considerable duration, is an inseparable incident in any scheme for furnishing public facilities. Hence, the duration of such grants must be a question of discretion to be exercised by some public authority. That the exercise of that discretion should be left with the local government is in accord with the decentralizing policy so peculiar to the state of Michigan, is beyond dispute.

Parades vs. Street Railway Service.

Judge Bradley, of the Supreme Court of the District of Columbia, has recently rendered a decision bearing upon the respective rights of street cars and other vehicles in public thoroughfares, and the various semi-public parades of militia, circuses, masonic organizations, etc. Justice Bradley holds that the sidewalks are appropriated to the exclusive use of pedestrians, and that, while the latter have certain rights in the use of the roadway, these rights are limited by the rights of street car companies and vehicles, and that the pedestrian is under obligation to use proper care to avoid accidents. "No one has the right to stand in the street in the middle of a car track and obstruct the passage of the street cars, and * * * is subject to arrest for obstructing the passage of the cars, and he ought to be arrested. The use of the streets for parades and processions is legitimate whenever authorized by the proper officers * * * but such use of the street should be subordinated to the rights of the citizens and to the passage of their vehicles along the streets, and also to the rights of the street car companies, for their rights are not the exclusive rights of the car company itself, but are the rights of the general public. * * * A man who plants himself in the center of the car track either upon the occasion of a parade or upon any other occasion, and looks neither to the right nor to the left nor backward to see whether or not a car is coming upon him, is guilty of negligence, and if that were the sole cause of the injury, and if any injury is received, he will not be entitled to recover anything from the railroad company."

Legal Responsibility for Accidents.

A charge setting out the duties of a street railway company, but omitting to charge that a person on the street has duties also, is erroneous. And, in determining whether a child was guilty of negligence when playing on the track, the child's capacity and the use she made of it to avoid injury determines; and an instruction that a street railway owes a person on the track no other duty than shouting to her, is improper. Evidence that the car ran an unusual distance before being stopped tended to show defect in appliances. So held by the Wash. D. C., *Mitchell* v. *St. Ry. Co.*, 37 Pac. R. 341.

The Oregon Supreme Court affirms a verdict and judgment in favor of a plaintiff of moderate circumstances who sent a child three years old to play under the care of its nine year old brother. The child was run down at a crossing, the car running 128 ft. after the accident, before it stopped, the grade being only two and a half feet. The court held that the question of negligence upon the part of each was for the jury. *Hedden* v. *City etc., Ry. Co.*, 37 Pac. R. 540.

To some extent a motorman would have a right to assume that one in a position of danger would withdraw from it; that he would hear the gong sounded, and move to a safe place. Thus no recovery can be had, says the Massachusetts Supreme Court, in *Doyle* v. *St. Ry. Co.*, 37 N. E. R. 741.

The Oregon Supreme Court holds that though a child was negligent in going on the track, yet, if the company's servants saw its dangerous position, they must exercise all diligence to avoid injury. Further, whether the running of a car at the rate of ten miles per hour past a school was negligence, is for the jury. *Wallace* v. *Street Car Co.*, 37 Pac. R. 477.

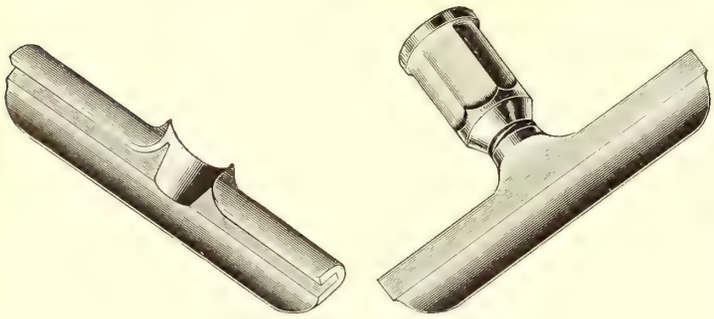
Legal Notes.

Where conductor makes a mistake in giving transfer, and the passenger in consequence thereof is ejected by the conductor of the connecting line, the company is liable. So ruled by the New York Supreme Court. *Muekle* v. *St. Ry. Co.*, 29 N. Y. Sup. 732.

In order to sustain an action against a street railway for maintaining an electric pole in a dangerous manner, it must be shown that it failed in a degree of care for public safety which it should have had, and that complainant was without fault. On the other hand it is no defense to action for injuries occasioned by a pole of an electric railway that it was placed in accordance with the provisions of the charter and city ordinance. So says the Maine Supreme Court, in case of *Cleveland* v. *St. Ry. Co.* 29 Alt. 1,005.

New Trolley Clamp.

The Central Electric Company, of Chicago, has designed, and is now offering a new trolley wire clamp of neat and compact appearance, and at the same time possessing the necessary strength. As will be seen from the illustration, it consists of two parts which lock together in such a manner as to make it impossible for it to become displaced after being placed in position. In fact, no strain that is brought upon the trolley



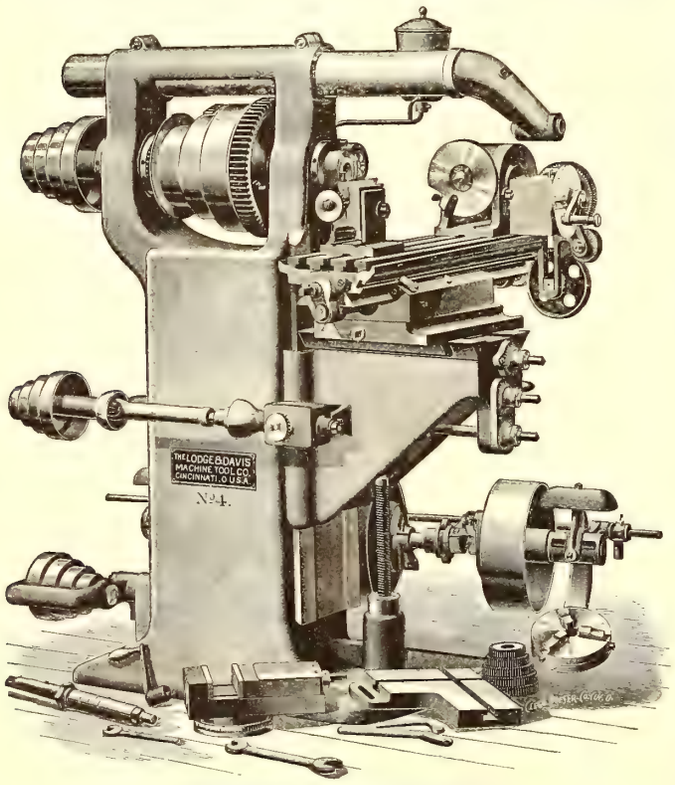
NEW TROLLEY CLAMP.

wire is sufficient to cause the clamp to release its hold. Of course no soldering is necessary.

These clamps are made to fit either a five-eighths or seven-sixteenths inch stud, and are finished in either bronze or malleable iron. No obstruction is offered to the passage of the trolley, it having a perfectly level track to run upon, and consequently there is no destructive and wasteful sparking.

Universal Milling Machine.

We illustrate on this page a universal milling machine, made by the Lodge & Davis Machine Tool Company, of Cincinnati, O. An adjustable overhanging arm is provided and fits in clamp bearings over each spindle bearing, the uprights being independently tied together, as shown. The spindle is of crucible steel, is hollow, and runs in phosphor bronze boxes adjustable for wear. The end of the spindle is



UNIVERSAL MILLING MACHINE.

threaded to take the same chuck that fits also the spiral head spindle. The table has three T slots running its entire length, and around it an oil channel is formed which catches all oil and conducts it to a drainage tube and suitable vessel which can be attached to it.

The footstock center is adjustable vertically for taper work, and the spiral head has the usual adjustments above and below the center line. It is made as compact as possible, and is provided with plates for indexing up to 360 teeth. Gears are provided for cutting spirals from 1.5 ins. to sixty-six inches pitch.

The table is fed automatically in either direction, at twelve different rates relative to spindle revolution, ranging from .007 in. to 1 in., and the feed is reversed by turning the knob seen at the left of the knee. It is automatically stopped by the stud which is adjustable in the T slot, and operates in either direction. The lower feed cone is upon a swiveling yoke which permits it to be adjusted to secure proper tension on both feed belts. The table can also be moved by hand, either from the left hand end or from the front of the knee, and it has a quick return motion. The handle by which the feed is thrown, and by which it may be thrown out if desired, is at the right of the knee.

All traversing screws are provided with micrometer graduations, and the dial plates are adjustable, and are held in place by knurled nuts which are readily loosened or tightened by the fingers. Taper ribs are provided for all sliding surfaces. The machine is provided with all the parts and attachments shown in the engraving.

The International Numeral Register.

Not satisfied with the magnificent record made with its present two styles of fare registers, the International Register Company, of Chicago, has recently perfected a third machine in the shape of a numeral disk, stationary register, a cut of which appears in this column. This new register was shown for the first time at the Atlanta Convention, and created a great deal of favorable comment. A large number of prominent delegates examined the sample which the company had on exhibition and all pronounced it a remarkably simple, substantial and and elegant machine. In the production of this device the manufacturers have not gone into any experiment, as the machine is practically a reproduction of its well known Pratt portable register, which has given such excellent service throughout the country for a number of years. The machine is a double register of a numeral disk design, having a



INTERNATIONAL NUMERAL REGISTER.

tally or permanent register with a capacity of 100,000 fares, and a trip or changeable register with a capacity of 299 fares, the latter capable of being returned to zero.

The permanent register is composed of a series of five wheels or dials arranged in a horizontal row across the face. The figures on these dials are large and plain and easily distinguished at a distance. The method of constructing this permanent register is entirely new with the International Company. The gears are all machine cut and there are no springs or pawls whatever to get out of order. Each wheel is rigid or permanent, and all are entirely dependent on the first or unit wheel for movement. This unit wheel is protected by safety dogs in such a manner as to be moveable only by pulling the cord and actuating the whole mechanism of the register. Thus, if the glass over the dial should be broken or access gained to the internal mechanism, it is impossible to change the reading of the tally, backward or forward, even though the whole mechanism be exposed. The great value of such an arrangement will be appreciated, as it overcomes all possibility of tampering with the total record, which is the most important part of a fare register.

The trip register is composed of three large revolving disks, the figures on which are seen through the aperture to the left of the center. In making this part of the register the manufacturers aimed to produce something plain, large and easily read. The figures on these trip dials are a full inch high and five-eighths of an inch wide, as shown by the engraving on the next page, which is exact size.

With large plain figures like these, the trip register can be read at

a glance, and the manufacturers claim that a person of ordinary eyesight can read them plainly for a distance of over 100 ft. At the end of the trip or run these trip dials are returned to zero (00) by pushing in the handle on the left and turning it to the left. With this operation a red curtain will be thrown into the trip window, remaining there until the register is entirely reset. This shows that the other mechanism of the register is locked and cannot be operated until the red curtain disappears.

The register has a stroke five inches long, which obviates the



EXACT SIZE OF TRIP FIGURES IN NUMERAL REGISTER.

practice of ringing up a number of fares in such quick succession as to make it almost impossible to tell how many fares were actually recorded by counting the vibrations of the bell. The manufacturers claim that a long, easy stroke is greatly preferable to a short jerk, as it will also prevent passengers from ringing up fares when meaning to signal the conductor, as the register will not operate with a short, quick pull.

As in the standard stationary machine, manufactured by this company, satin finished aluminum dials are used throughout the machine. The introduction of this metal for dials has proven very satisfactory, as it retains its beautiful white finish, giving the appearance of being always new. The size of this new register is 10¾ ins. in diameter and 4⅜ ins. thick, including the back part and actuating mechanism.



FIG. 2.—REGISTER DEPARTMENT—STERLING SUPPLY & MANUFACTURING CO.

It is made to be operated with the regulation cords and pulleys or with a rod and handles running lengthwise of the car.

The cases are finished in either nickel, antique bronze, lacquered brass or steel blue electroplating. The manufacturers recommend the latter as being the most durable, as well as making the greatest contrast with the white aluminum dials, and thus making the latter stand out plainly.

Reduction of Fares in Philadelphia.

The People's Traction Company has reduced the fares on its Germantown line from ten to five cents, and claims that it will give the longest continuous ride for five cents in the city, the distance from the present terminus of the company's Germantown line at Mount Airy to the southern terminus at Snyder Avenue being nearly ten miles. The present extensive system of one fare transfers will continue in operation, and transfer arrangements between the People's Traction Company and the Electric Traction Company is now under consideration. If accomplished, passengers from Germantown can reach any part of the city for a single fare.

It is expected that the greatly improved electric railway facilities through Germantown and Chestnut Hill will develop that section of Philadelphia to such an extent that the Pennsylvania Railroad Company's earnings, though temporarily reduced, will eventually be increased, while the electric lines themselves will secure an enormous traffic.

THE street railway company of Watertown, N. Y., proposes to extend the electric road from Brownville to the village of Dexter.

Works of the Sterling Supply & Manufacturing Company.

We present on this page some illustrations of the very busy shops of the Sterling Supply & Manufacturing Company, at 97 Bank Street,

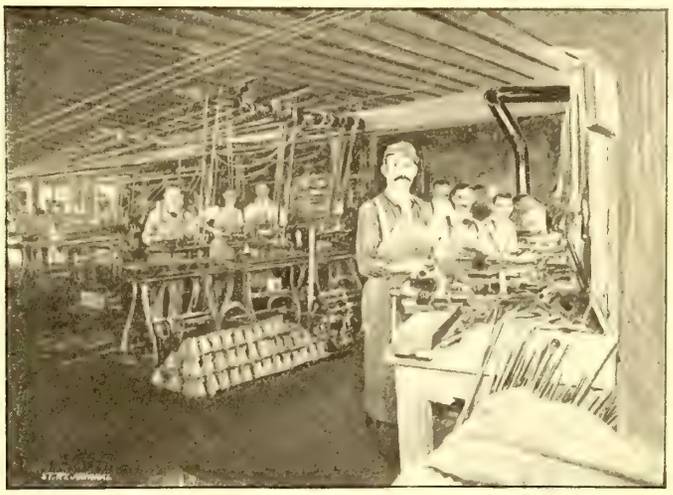


FIG. 1.—SAND BOX DEPARTMENT—STERLING SUPPLY & MANUFACTURING CO.

New York, the manufacturers of the Sterling registers, Sterling fenders, sand boxes, gates, etc. This company has been in existence considerably less than a year. It succeeded the old firm of Benton & Keyes, in the register business, in February last, but immediately added sand boxes, fenders and similar supplies to its line of manufactures. It has been singularly fortunate in having had its devices adopted on some of the largest and most important roads in the country. Among its customers it numbers such companies as the Metropolitan Traction Company, of New York; the Consolidated Traction Company, of New Jersey; the Nassau Electric Company, of Brooklyn; the Citizens' Street Railway Company, of Indianapolis; the New Orleans Traction Company and so on. The selection of the Sterling devices by such persons as are in the management of these and similar roads is equivalent to a certificate of merit, of far greater value than any medal or diploma that could have been procured.

The Sterling Supply & Manufacturing Company occupies two large shops, at 97 Bank Street, of about 10,000 sq. ft. aggregate floor space. It began with half this space, but the growth of its business soon required more room, and it looks now as though still larger quarters would be needed. One of our engravings shows the register department of the company, one the sand box department and one the fender department.

The company has in its employ John B. Benton, who may well be called the "Father of the Fare Register," and who without doubt is in the front rank of inventors in his line. Mr. Benton devised the register that has been in daily use on the Third Avenue road of New York for nineteen years, and the newest type of machine, the numeral disk machine is also his invention. The superintendent is the well known John J. Kennelly, familiarly and universally known as "Jack," whose connection with the street railway business covers many years of service, and whose experience embraces all its phases.

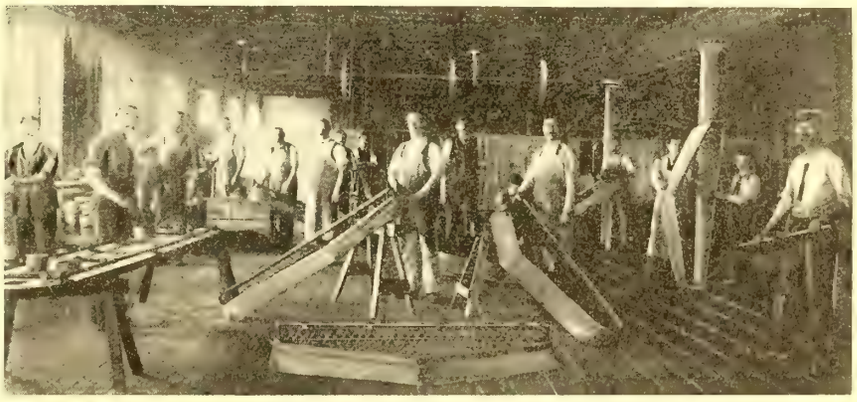


FIG. 3.—FENDER DEPARTMENT—STERLING SUPPLY & MANUFACTURING CO.

The energetic president is John H. Carson, with whom many of the readers of this paper are acquainted. He is urbane, indefatigable and always ready to explain the advantages of the Sterling goods. We wish to the Sterling Supply & Manufacturing Company a continuance of its present prosperity.

New Type of Street Car Heater.

The Safety Car Heating & Lighting Co., whose Pintsch gas lighting system for railway cars has achieved such a high reputation abroad and in this country, has recently put on the market a new type of heater for street cars. The system has been in use on one car of the Third Avenue Railway of New York for some time, and is giving excellent satisfaction both in quantity and quality of heat, and as regards economy of operation.

Coal is used as fuel, and the heat generated is distributed by water circulation similar to the well known and widely approved Baker

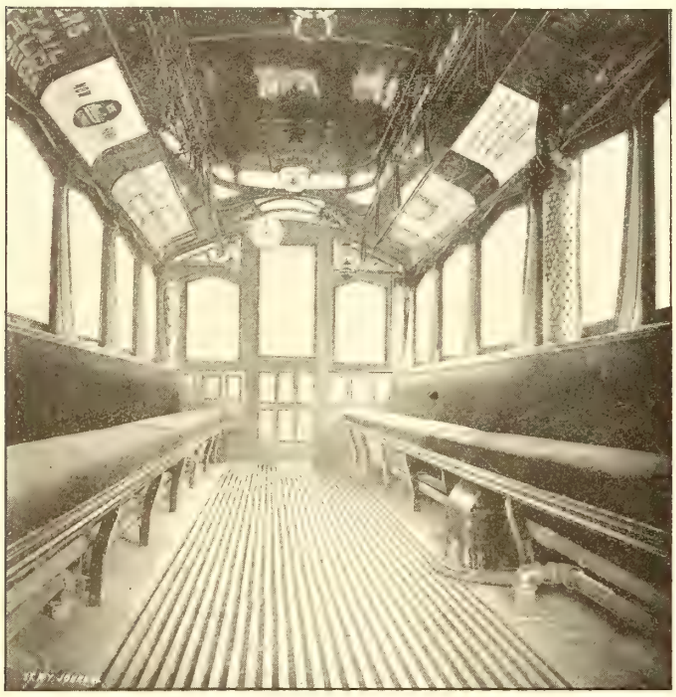


FIG. 2.—INTERIOR OF THIRD AVENUE CAR, NEW YORK.

heater system for steam railroad cars. The radiating pipes extend the full length of both sides of the car underneath the seats. The stove is a suspended heater, the fire being entirely outside of the car, and all ashes and dirt are removed from without. The smoke pipe or flue is arranged behind the seat backs. In this way no seating space in the car is lost, and the cost of the apparatus is soon made up by the additional seating capacity gained.

Fig. 1 shows the general arrangement of the apparatus, and Fig. 2 the interior of a car of the Third Avenue Railway, New York, equipped with the device. In the latter view the circulating pipes are distinctly shown. The upper end of the stove is behind the screen near the center of the car, and the smoke pipe with a protecting shell is shown behind the seat back. A small coal fire, four to six inches deep is used, and from twenty-four to thirty pounds of coal are used each twenty-four hours.

Behind the radiating pipes a galvanized iron deflector is placed, which throws the heat out into the car, and avoids the unpleasant heating of the seat.

This system provides for maintaining a continuous fire, and avoids the expense, dirt and annoyance of having to rekindle fires frequently. It also gives an opportunity for governing the temperature of the car by having the water in the radiating pipes vary in temperature from that of the atmosphere to at least 212 degrees, thus allowing any amount of radiation that may be desired.

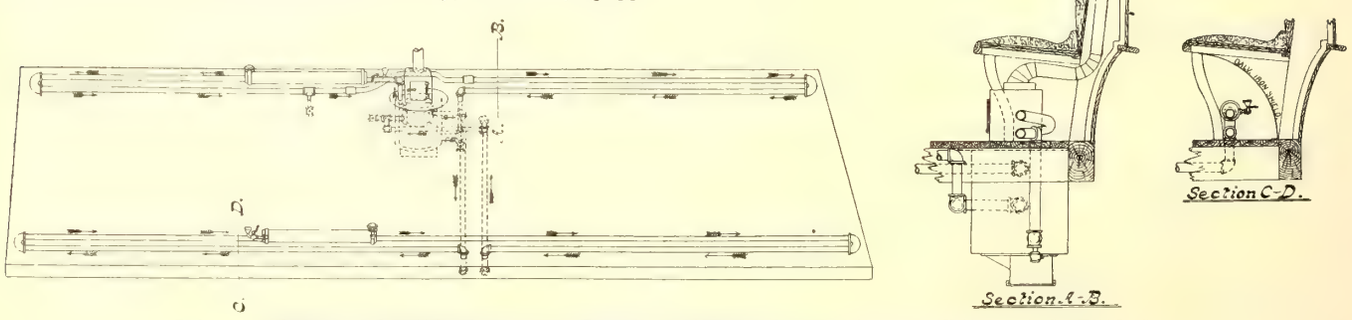
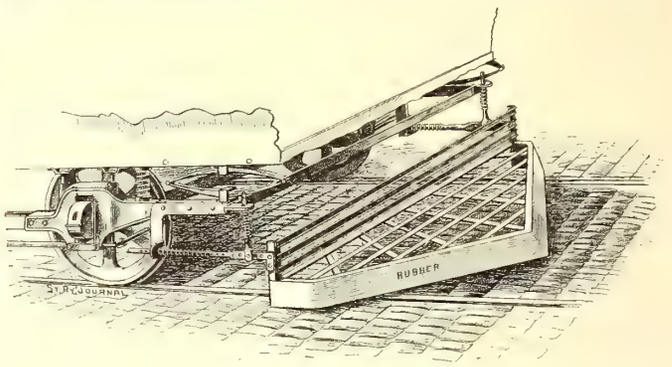


FIG. 1.—GENERAL ARRANGEMENT OF HEATING SYSTEM—SAFETY CAR HEATING & LIGHTING CO.

The heat afforded is also much pleasanter than that from ordinary stoves. That produced by the latter is local, and is not distributed evenly throughout the cars. As a result, the persons sitting near the stove are overheated, while those at some distance are practically no better off than if there were no stove in the car. Again, with this heater there is no opportunity for the escape of gas into the car, and the atmosphere which the passengers breathe is not vitiated in the least, as all the air supply for combustion is taken from the outside of the car, and the products of combustion are delivered outdoors. By its use, also, there is no chance for drying the air in the cars and creating the close and unpleasant odors often caused by the overheated surfaces of a stove. The location of the heating pipes, under the seats, is a desirable one, and the fact that they are so placed will tend to keep the floor always dry.

The Crawford New Automatic Fender.

We illustrate on this page a fender recently brought out by the R. C. Crawford Manufacturing Company, of Pittsburgh, Pa. Mr. Crawford has made a long and careful study of the fender problem, and his other fenders are well known to street railway managers. The fender illustrated was designed for special service, and is similar to the



NEW TYPE OF AUTOMATIC FENDER.

Broadway fender, except that it is supported in the Crawford patent method.

The frame is made of angle iron, and the ends are bent up, forming the rear of the fender. To these ends is riveted a light steel channel bar forming the back screen. The platform screen is composed of $1 \times \frac{3}{16}$ in. steel strips riveted together, a few of which overhang and are bent at the proper pitch. The rubber toe is riveted to the ends of these overhanging strips. The depth of the rubber is about four inches.

The frame is hung to the truck in the well known Crawford method, using vertical and horizontal spring actuated rods, except that the horizontal rod is riveted to the platform frame instead of pivoted. The fender platform measures from eighteen to twenty inches wide at the center of the V, and tapers to four inches wide at the two sides. It can be carried to run within one inch of the roadbed or any height from the track.

Owing to its construction, if struck by a movable object it will be pressed close to the track, preventing the object from getting under the wheels. If struck by an immovable obstruction or unevenness in the roadbed, it will relieve itself by the spring actuated vertical rod, which permits the fender to move upward. The power or tension of these springs can be increased or diminished as desired by moving a pin.

The fender can be carried as close to the wheel as desired by means of the adjustment holes in the horizontal rod. When necessary to put new wheels under the car, this fender can be removed by pulling two pins, and in case the wheels are of different diameters the fender can be adjusted to suit any diameter of wheel. The fender can also be folded up off the track, if desired.

Removable Vestibules.

Reference was made under "Convention Notes" in our last issue to the Brill removable vestibule shown at Atlanta. We present herewith an engraving of the double truck car exhibited, equipped with the vestibule. The desirable features of a removable vestibule are low cost, facility of attachment to any motor car dasher without extending beyond the line of bumper, and effectiveness. These latter features have heretofore been the main difficulty encountered, owing to the location of the brake shaft.



FIG. 1.—COMBINATION CAR—J. G. BRILL CO.

The brake handles used generally on electric cars, having a sweep of twelve inches, make it necessary to extend the vestibule out beyond the line of the buffer, or altering the location of brake shaft on platform, so that the handle will clear the vestibule, occupying much unnecessary room. A vestibule extending beyond the line of the dasher has the disadvantage of liability to breakage by the cars being run together in car houses and on street collisions.

The vestibule shown avoids the disadvantages referred to. It can be applied to any motor car having a dasher, and does not extend outside the line of the dasher. The brake handle is removed from the brake shaft proper and is placed on a short auxiliary shaft, which is fastened to and forms a part of the vestibule, which auxiliary shaft is geared to main shaft, clearance being given for the largest sized handle.

There were altogether three cars shown by the Brill Company at Atlanta. These were respectively a single truck car, a double truck car and a combination car. The first was finished throughout in solid mahogany, having round corner panels and carved finish. The decoration while not elaborate was very tasteful, and the car attracted a great deal of attention. The length was eighteen feet, the width at seat was six feet two inches, and the width over the belt rail was seven feet six inches. The interior of the roof was ceiled with three-ply veneer. The mahogany sashes were glazed with polished plate Mahogany blinds and spring roller curtains were used. The seats and backs were of mahogany strips covered with handsome Wilton carpet. Brill's patented gates, radiating drawbars, steps, ratchet brake levers were used, and solid bronze metal trimmings were employed throughout. The car was mounted on Brill No. 21 B truck with half elliptic springs under the journal boxes and elliptical spring buffers, which in actual service overcame all oscillation. The second car on exhibition was a twenty foot car body mounted on Brill's Eureka maximum traction trucks and is shown in Fig. 3. The finish of this car was identically the same as the eighteen foot car body, except cherry was used in place of mahogany. The car was mounted on Brill's Eureka maximum traction trucks, and notwithstanding the fact that many of the curves in Atlanta were of sharp radius without guard rails and far from perfect, the trucks showed no disposition to get off the track.

The other style of car was a combination open and closed car (Fig. 1). measuring twenty-one feet six inches long and was one of a lot furnished the Coronado Beach Company, of Coronado, Cal. The closed compartment measured eleven feet nine inches and was elaborately finished in mahogany, with handsome curtains, hand upholstered. In the main the description of the inside finish of the eighteen foot car applies to the closed compartment of the Coronado car. The car was mounted on No. 21 B truck.

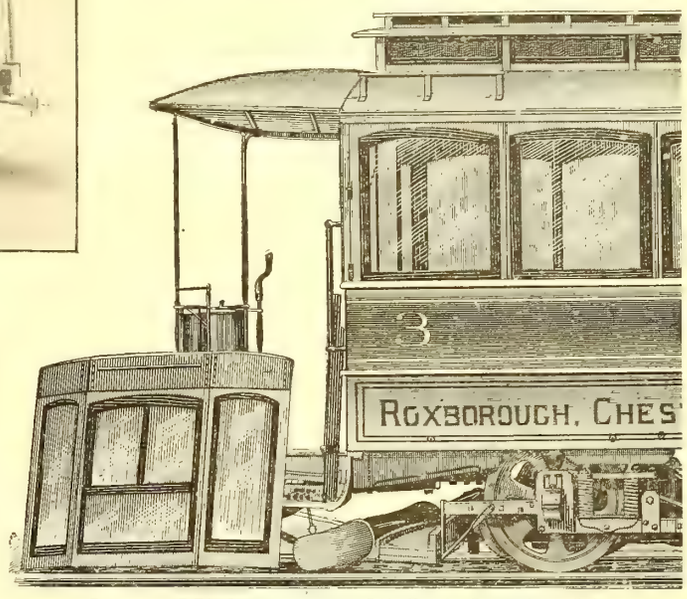


FIG. 2.—REMOVABLE VESTIBULE—J. G. BRILL CO,

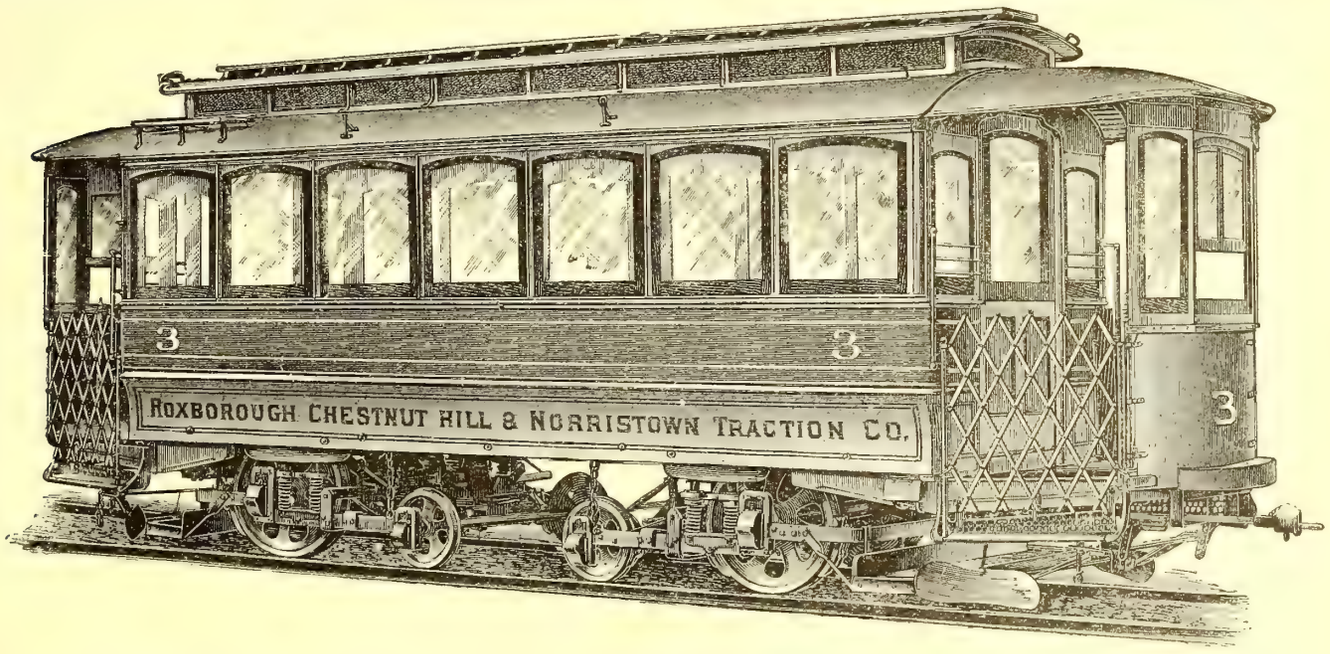
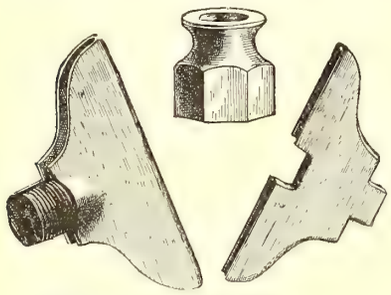


FIG. 3.—CAR EQUIPPED WITH REMOVABLE VESTIBULE—J. BRILL CO.

IT is stated that certain St. Louis capitalists are trying to obtain a franchise to build a street railway through East St. Louis, Venice and Madison, Ill.

The Van Buren Mechanical Clip.

The trolley wire support, shown in the accompanying illustration, is of the type known as "mechanical." It is designed to hold the line firmly and to make the splice without the use of solder. It is simple in construction, and easily and quickly adjusted. No special tool is required, as any ordinary wrench or pipe tongs will answer the purpose. The clip is composed of three parts, as shown. One is the shoe or U-shaped hanger with a screw lug at the top. In this the wire rests. Another is the tongue or clamping piece, which fits into the shoe, and rests on the top of the wire; while the third is a nut which screws on the lug shoe, pressing the tongue down and making a vise-like pressure on the wire. The nut is adjusted at the top to fit the various insulator studs. It makes, on the whole, a very strong and durable support, avoids the use of solder, and is claimed to save a great deal of time ordinarily consumed in putting trolley supports in position. The shoe, or running surface, is almost straight, so that the trolley wheel meets with practically no obstruction. Another feature is that any of the parts can be replaced with new ones, as they may be needed, at a cost much less than would be necessary if the entire hanger had to be removed. The clip is made and sold by H. Van Buren & Company, of Philadelphia, Pa.



VAN BUREN MECHANICAL CLIP.

The Brady Metal Company.

The Brady Metal Company, with an office in the Boreel Building, 115 Broadway, New York City, is now one of the leading manufacturers of an extensive line of metal goods, among which may be mentioned street car and electric car brass castings, bearings and trolley wheels, babbitt metal of nine different grades, phosphor bronze in ingots, bearings or castings, solder of high grade; standard crowfoot battery zincs, Magnus anti-friction lining metal, Magnus tin, Magnus metal for locomotive engine castings, and bearings for high speed shafting, self-fitting, lead-lined journal bearings for passenger and freight cars, locomotives and all classes of engines. The company has a brass foundry fitted with all modern tools and appliances, including a well appointed pattern shop with more than 6,000 patterns. This is located at 202–208 10th Street, Jersey City, N. J.

The two leading and best known officials of the company are Daniel M. Brady, president, and Adolph Onslow, general superintendent and metallurgist. Mr. Brady, who is also general sales agent of the company, served for more than eleven years as chief clerk to the late Leander Garey, when the latter was in charge of the car department of the New York Central & Hudson River Railroad and leased lines, and has been in active railway and manufacturing service for the past twenty-five years. He is, therefore, well equipped through long practical experience to deal in the most thorough manner with the technical requirements of engine and car equipment.

Mr. Onslow is a mechanical engineer of thirty-five years' experience, and was for seventeen years manager for the late D. A. Hopkins. He has the honor of having put up the first plant in America for the manufacture of self-fitting, lead lined journal bearings, of which in the past twenty-six years he has made more than 10,000,000. As is the case with Mr. Brady, his long practical experience places him in a position to deal intelligently with the demands of steam and street railways for the most serviceable and durable equipment.

An important feature of the method employed by the Brady Company, by which the self-fitting, lead lined bearings are moulded, is that every bearing is cast face down, regardless of the inconvenience in moulding or its extra cost. This method insures a solid bearing surface. The company invites close inspection and caliper tests at its works as well as chemical analysis at railroad or outside laboratories. Every pound of metal sold is fully guaranteed. These bearings are in use on six of the principal railroads in the East, running high speed limited trains, and up to date not one recorded complaint has been made against them.

The metals known as "Magnus," which are sold in either ingot or casting form, are now in use on many prominent roads, and the demand is constantly increasing. The latest extraordinary record made by Magnus metal bearings in a competitive test on a well known line, showed 3,194 miles of service to one ounce of wear.

The Brady Company is now supplying many of the largest surface lines with street car and electric car brasses, castings and trolley wheels, and is fully equipped for turning out material for very large orders of the same standard quality as the supplies which have been furnished for locomotive and steam car service. The company has a foundry capacity of 1,000 bearings and 10,000 lbs. of engine metal per day, and the output has increased 500 per cent. in the past six years.

The company undertakes to furnish metal at fixed prices per pound on monthly and yearly contracts, or, if desired, will furnish metal at current prices, these depending upon the current metal market for raw material.

Laconia Standard Truck.

We present on this page an engraving of the standard four wheel truck of the Laconia Car Company. Since the first of March the company has sold over 200 of these trucks in New England, and it has been adopted as standard by the West End Street Railway Company, of Boston. The chief claims made for this truck are: Absolute simplicity of construction, low cost of maintenance, economy in first cost, quick, powerful brake mechanism, every part exactly fitted and machined, the use throughout of all hot Norway iron rivets in its construction, and material and workmanship of the highest order. The car runs smoothly and steadily, and, it is claimed, avoids all pounding of the track.

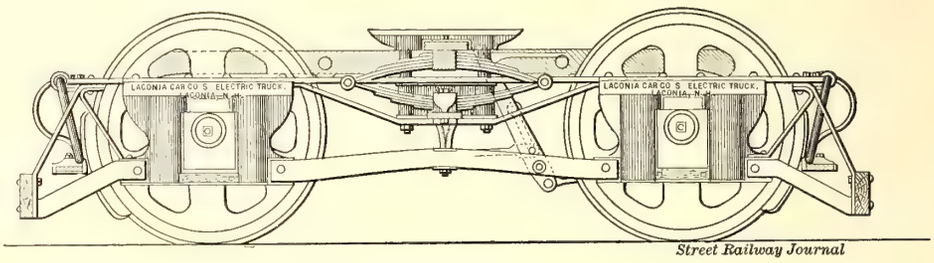


FIG. 1.—LACONIA SWIVEL CAR TRUCK.

Since the disastrous fire last June at its works, the Laconia Car Company has rebuilt, with much larger shops and greatly increased facilities. In the electrical department the company can turn out annually 700 car bodies and 1,000 standard trucks. In its steam department it can build 175 passenger coaches and 2,000 freight cars, and in its foundry can supply 15,000 car wheels for steam railways per annum, as well as gray iron castings for other purposes. As will be seen, the facilities in every department are of the best.

The Trimble Car Fender.

Jas. A. Trimble, the car builder, of New York City, is placing on the market a new fender which possesses some interesting features.

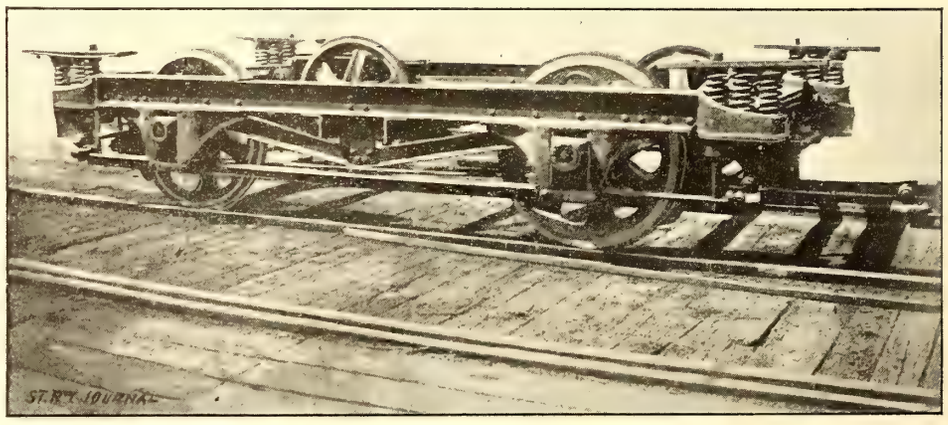


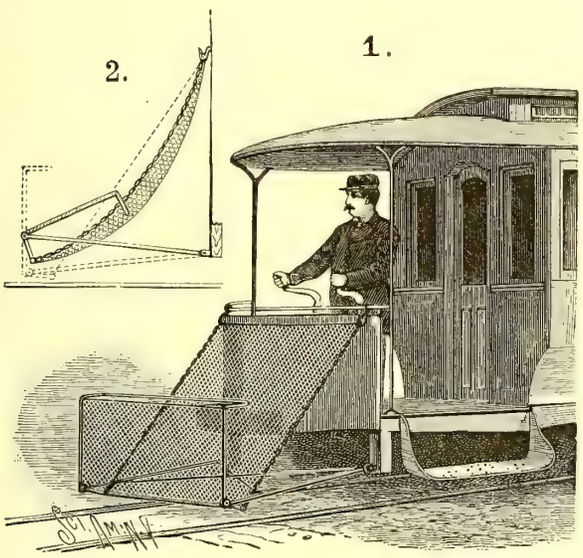
FIG. 2.—LACONIA TRUCK FOR SHORT CARS.

It consists of two folding arms which are attached to the under side of the car platform, and which are so arranged as to fold back of the line of the platform out of the way of the drawbar and bumper. The folding arms, when extended, form the sides and supports of a large basket-like network. The fender in its normal position is folded and at a height of about eight inches above the rails. In case of accident, the motorman by pushing with his foot a trip conveniently located on the platform, releases springs which instantly throw the fender out, spreading the net to within a very short distance of the pavement and covering the entire width of the track. There is no rigid bar or iron pipe across the front of the fender. In this extended position the fender is about two inches from the surface of the pavement, and is so arranged that in striking an immovable object, such as a high paving block, it will rise over the obstruction. The folding feature of the fender is important, because it permits the

use of trailers or the storing of cars close together in the car house without interference. The fender is at present in use on the North Hudson County Railway Company's lines.

An Improved Street Railway Car Fender.

The fender shown in the illustration is designed to be so flexible that it cannot possibly injure a person whom it strikes, but will catch up such person in such way that he or she will be carried safely along with the car until the latter may be stopped. The improvement has been patented by Henry W. Eaton, of No. 45 William Street, New York City. Fig. 1 shows the device in use, Fig. 2 being a side view, representing the position of the parts when a person has been caught on the fender. A forwardly extending lower framework is connected by a hinge joint to the car, and chains extend from the forward end of the frame to hooks at either side of the dashboard. The chains are connected by a netting, and are only indirectly connected with the lower frame, being attached at their outer ends to the arms of a swinging frame pivoted to the lower frame, and which extends normally upward, as shown in Fig. 1, this frame when turned over, as shown in Fig. 2, striking the chains and network to depress them near the center, and swing them and the frame up slightly at the front end of the fender. The lower arms of the swinging frame have at their free ends a cross bar extending beneath the sides of the lower frame, limiting the upward swing of the arms and the outward movement of the swinging frame. The first effect of striking a person is to cause the upright frame to yield gradually, so as to break the force of the blow, and the same moment the network, engaging the legs tightly between the knees and the ankles, relieves the body of much, if not all, of its weight and prevents the danger of breakage of the ankles by sudden shock. There is no chance for a person to be thrown violently against the dashboard. The vertical frame then swings inward under the weight of the falling body thus thrown upon the two nettings, the side chains buckling and raising the lower portion of the fender frame at its outer end. The whole device may be folded up in small space on the end of the car when not in use.



THE EATON STREET RAILWAY FENDER.

Coal Handling Machinery.

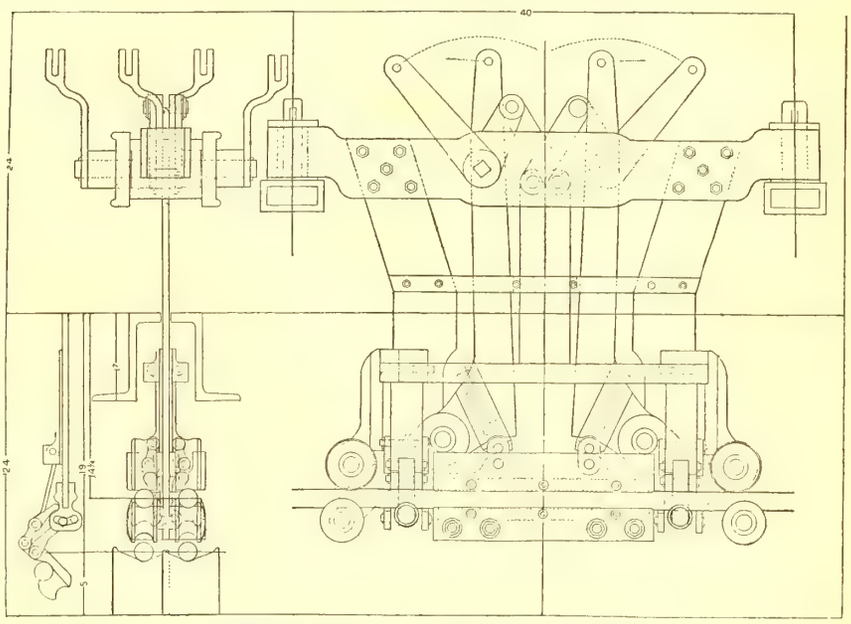
As before mentioned in these columns, the C. W. Hunt Company, of New York City, is furnishing some of the largest plants in the country with the most modern machinery for handling fuel and its refuse. One of the street railway plants in Brooklyn, equipped in this way, was recently described in our columns. Another plant of considerable importance, which this company has recently equipped, is that of the Ridgewood pumping station, of the Brooklyn (N. Y.) Water Works. This station has a daily capacity of 110,000,000 gals. The boiler plant consists of six boilers of the Bigelow make, and four internal fire, return flue boilers built by the Edge Moor Iron Company, of Delaware. About 120 tons of coal are burned daily. This is received in bottom dump cars, the track coming into the building at right angles to the line of the boilers and is loaded into the conveyor which passes below the cars underneath the hopper. It then passes vertically to the monitor of the storage building, where it is carried horizontally, and discharged at any part of the building. As the upper line of the conveyor is situated in the monitor at a considerable distance from the floor of the storage building, it is intended that as the coal is stored in the building, it shall be dumped on the side of the pile, which is nearly as high as the conveyor line, and gradually run down the slope to the floor, so that in falling the breakage of coal may be the least possible.

As the coal is received by railroad, it necessarily comes intermittently, and for this reason an especially large conveyor has been installed, which has a capacity large enough to unload a thirty ton car in thirty minutes. This conveyor consists of a series of gravity buckets pivoted on a double chain, the whole system being carried on self lubricating wheels. The buckets are so pivoted on this double chain that the force of gravity keeps them always in an upright position, whether full or empty, and no matter how tortuous may be the track over which they are drawn. The conveyor chain is driven by a special engine located in the top of the storage building, which engages with the chain by pawls, and the whole machine is so designed that dust cannot get into the working parts. It is noiseless in operation and moves slowly, the capacity being obtained by the size of the buckets and not by the speed of the chain. The coal is taken from the storage, weighed and delivered to the boiler room by a system of cars, tracks and scales. The cars are so designed that the fireman shovels direct from them into the furnaces.

The whole plant is of the most modern type. Although in this particular instance, the steam generated is used for pumping machinery, the methods of handling coal are applicable to similar boiler plants which are used in connection with street railway power houses. The adoption of modern methods in the handling of coal and ashes simply from the standpoint of economy cannot be too strongly urged.

A Combined Grip, Pick-up and Throw-off.

The accompanying engraving shows a grip with pick-up and throw-off, for cable railways, invented by George Muller, of Hoboken, N. J. The grip was designed for the Broadway cable conduit which has a depth of twenty-four inches. The mechanism of the grip consists of a fixed lower jaw and a movable upper jaw, the latter being actuated by two pivoted levers which carry gripping pulleys on their lower ends. Above these pulleys are arranged stationary pulleys which are mounted to turn on fixed spindles secured to the same frame which supports the lower jaw. The pulleys grip slightly in advance of the jaws, making the grip on the cable a gradual one, and causing the car to start without a jerk or jar. The pulleys are adjustable for wear, and their use reduces the friction on the cable when the car is running at slow speed. A very important feature of the grip is that a car can pass around curves at any speed, or, if necessary, can be brought to a stop on a curve. In this case, if the inner cable is in the grip, the flanges of the pulleys will prevent it from being drawn out of the grip, and if the outer cable is gripped the flanges of the pulleys will hold it free from the corners of the grip frame, and thus prevent the excessive friction and avoid the stranding of the cable.



COMBINED GRIP, PICK-UP AND THROW-OFF.

On a straight section of road, the grip, when released by the gripman, will open automatically, owing to the downward tension of the cable on the pulleys which are fixed on the ends of the levers. The cable is thereby freed as soon as the brake is applied to stop the car. The length of the two levers from the fulcrum to the upper ends produces such force that the grip is operated by the gripman with very little exertion.

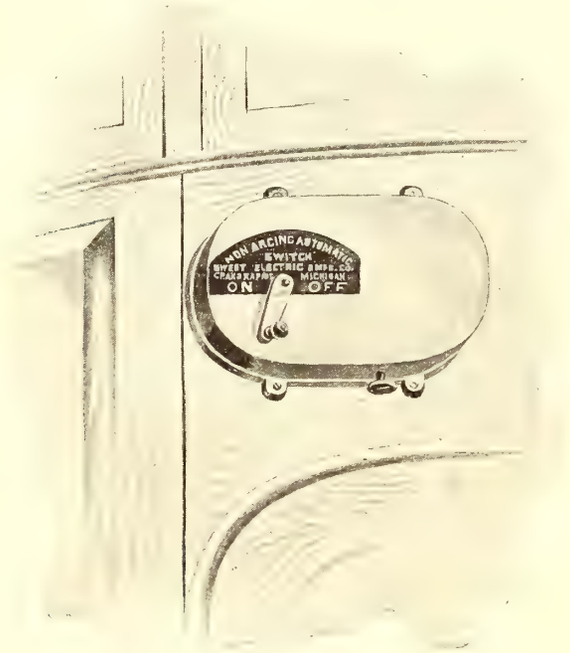
The combined pick-up and throw-off is shown in the cross section and detailed view of the pick-up at the lower left hand corner of the engraving. By this device either cable can be picked up at any straight section of the road, and should the pick-up arms come in contact with a carrying pulley they are so constructed as to roll over the latter without injury. The throw-off movement of the pick-up arms is a positive outward push that will force the cable out of the grip, even if there should be a loose strand in the cable; therefore, when the gripman first discovers that his cable is stranding, he can throw it off, stop his car and telephone to the power house.

As will be seen, the grip is devised for a duplex system, and by means of the pick-up can throw off the dead cable and pick up the live cable, in case of change of cables at any time. This will avoid the long stops of the cars in case of an accident during the busy hours of the

day, and should the road be blocked by a fire, the gripmen, after they have brought their cars over the crossovers, can pick up the cable and proceed. Should a car be stalled on a curve by a stranded cable which has been stopped and the cable be behind the grip, the outward push of the throw-off movement makes it possible to free the car from its anchored position, the leverage being sufficient to accomplish this result. An earlier form of the grip was illustrated in the STREET RAILWAY JOURNAL for December, 1892, in which four positions of the pick-up arms were shown.

Street Car Limit Switches.

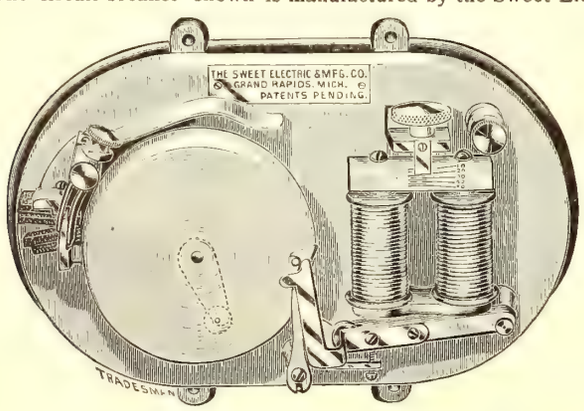
The definition of a limit switch is a cut-out or a magnet circuit breaker which opens the circuit instantly on a predetermined strength of current. The circuit breakers or magnetic cut-outs most familiar are those which are used on switchboards in power stations, and embody in all instances the long-throw switch to break the violent arcing, which always occurs on the breaking of the current.



NON-ARCING AUTOMATIC SWITCH, CLOSED.

Circuit breakers have been found more reliable than fuses, since the latter will pass momentarily great volumes far in excess of their nominal fusing capacity. In other words, if a coil in the armature in the field or any part of the motor should short circuit, or even a dead ground through cable connections becoming bare, momentarily the fuse will often carry 250, 300 or 500 amperes without fusing, and will open the circuit breakers at the station controlling the division on which the disabled car is. This affects every car on that division, whereas, if a simple and absolute circuit breaker is on each car the station is protected from all interruptions caused by short circuit.

The circuit breaker shown is manufactured by the Sweet Electric



NON-ARCING AUTOMATIC SWITCH, OPEN.

& Manufacturing Company, of Grand Rapids, takes up but little room, occupying a space of only $3 \times 8 \times 11$ ins. It has no lever for opening the circuit, but when the latter should be opened a small push button, conveniently located outside the circuit breaker may be pressed, accomplishing this result The switch is non-arcing and circular in form, and is easily charged from one car to another.

It has been urged that a magnetic or automatic circuit breaker is too sensitive, and that sluggishness is desirable for a street railway fuse. This may be true as far as the regular range of variation is concerned, but the same result can be accomplished by setting the breaker to the proper point. For instance, if the extreme maximum limit of current, even momentarily used is, say, seventy-five amperes, the circuit breaker can be set to open on the passage of, say, 100 amperes. The fuse does not protect, although rated at fifty, for it will momentarily carry 500 amperes.

No More Passes in New York State.

According to the new Constitution recommended for passage by the Constitutional Convention of New York, and passed upon favorably by the people at the last election, it is provided that

"No public officer or person elected or appointed to a public office under the laws of the state shall directly or indirectly ask, demand, accept, receive or consent to receive for his own use or benefit or for the use or benefit of another, any free pass, free transportation, franking privilege or discrimination in passenger, telegraph or telephone rates, from any person or corporation, or make use of the same himself or in conjunction with another. A person who violates any provision of this section shall be deemed guilty of a misdemeanor, and forfeit his office at the suit of the Attorney General. Any corporation, or officer or agent thereof, who shall offer or promise to a public officer or person elected or appointed to a public office any such free pass, etc., shall also be deemed guilty of a misdemeanor, and liable to punishment, except as herein provided. No person, officer, etc., of a corporation giving any such free pass, etc., herein prohibited, shall be privileged from testifying in relation thereto, and shall not be liable to civil or criminal prosecution therefor if he shall testify to the giving of the same."

According to a recent decision of Justice Ingraham, of the Supreme Court, a policeman is a "public officer," and cannot ride free on street cars, as is now the almost universal custom in New York City and State. This decision has created a sensation among the police force in New York, as it is believed that it will have the effect of taking at least $100 a year out of every policeman's pocket.

Portland Cement.

A recent number of *Engineering* contains a valuable article on methods of testing Portland cement, from which we quote as follows:

"It has been repeatedly shown that the tensile strength of coarsely ground cement, gauged neat, is much greater than that of the same cement finely ground, but that the tensile strength of a mixture of the former with sand is much less than that of a similar mixture made with the latter. For example, Messrs. Dyckerhoff found that cement which would leave a residue of 10 per cent. of coarse particles on a sieve of 400 meshes to the square centimetre (equal, say, 2,500 meshes per square inch) has a tensile strength when gauged neat nearly 42 per cent. greater than that of the same cement from which the coarse particles had been removed by a sieve of 5,000 meshes to the square centimetre, (equal, say, 32,200 meshes per square inch), but that a mixture of one part of the fine sifted cement to three of sand had 41 per cent. greater tensile strength than a similar mixture made with the unsifted cement, this percentage being increased to 64 in the case of a mixture of one of cement to five of sand. The samples in each case were twenty-five weeks old.

"Similar results have been obtained by many others who have investigated the subject. In one series of experiments made by the writer, it was found that adding 20 per cent. of the coarse particles to fine sifted cement decreased the tensile strength by 47 per cent., the age of the sample being seven days. Taking all the evidence into consideration, there can be no doubt that the tensile strength of neat cement is a comparatively useless test in assisting us to form a correct judgment of the true value of the material; nor does it seem reasonable to expect that the tensile strength of any material should be any indication of its cementing power. If, however, it should be desired to know the true tensile strength of cement, the active portion alone should be used, the inert portion being removed by a No. 180 sieve.

* * * * *

"A careful review of the present system of cement testing leads to the following conclusions:

"1. That the strength of a mixture of cement and sand is the most reliable of the present tests.

"2. That the tensile strength of neat cement may be omitted altogether as a test of good quality.

"3. That the weight per bushel is misleading, and should be omitted altogether.

"4. That color is not of sufficient importance to be considered as a test.

"5. That extreme fineness of grinding is so absolutely essential that a sieve of not less than from 175 to 180 meshes to the lineal inch should be used for testing purposes.

"The result of experience, therefore, compels us to arrive at the further conclusion that the present method of testing Portland cement requires very considerable alteration."

THE Allegheny Traction Company's property in Pittsburgh has been damaged by fire to the extent of $75,000.

St. Louis Street Railways—Statistics of Mileage.

The following figures, showing the exact mileage of the street railway companies in St. Louis, have been kindly furnished to us by Mr. Winthrop Bartlett, a civil and electrical engineer of that city. This table is correct to September, 1894.

	Miles of Single Track.	
	Owned.	Extensions.
Union Depot Railway Co.	76.74	0.55
Lindell Railway Co.	55.08	2.73
People's Railway Co.	13.60	.....
Missouri Railroad Co.	26.04	2.68
Southern Railroad Co.	15.66	11.02
St. Louis & Suburban Railway	28.64	.....
Cass Avenue & Fair Grounds Railway	32.18	18.03
Citizens' Railway Co.	16.60	1.49
Southwestern Railway Co.	5.04	5.04
St. Louis Railroad Co.	26.69	.....
Clayton & Forest Park Electric Railway	4.00	.....
Delmar & Clayton Electric Railway	0.97	3.09
Manchester Road Electric Railway Co.	2.60	2.60
Total	303.84	47.23

Electric Mileage	265.02
Cable "	33.83
Horse "	4.99
Total	303.84

Statement From St. Louis.

The street railway companies of St. Louis have made returns to the City Register, of business done during the third quarter, as follows:

	Trips.	Pass.
Baden & St. Louis	22,238	149 854
Cass Avenue & Fair Grounds	174,960	2,372,147
Citizens'	142,732	1,825,583
Jefferson Avenue	23,025	343,049
Lindell	339,740	4,572,958
Missouri	280,798	3,572,829
People's	49,904	1,011,792
St. Louis	171,522	2,695,703
St. Louis & Suburban	30,389	2,025,525
Southern Electric	78,384	1,136,465
Union Depot	173,749	5,039,491
Total	1,487,441	24,745,396

The totals for the third quarter of 1893 are: Trips, 1,518,566 passengers, 25,045,049.

Electric Locomotive for the Baltimore Belt Line Tunnel.

The General Electric Company has just completed at its Schenectady Works the trucks for the electric locomotive which it is constructing for the Belt Line tunnel of the Baltimore & Ohio Railroad at Baltimore. The locomotive when completed will weigh at least 100 tons and will be 1,200 H. P. traction. Its speed can be varied from zero up to thirty-five or forty miles an hour, and this can be increased if desired. For the work contemplated, thirty miles an hour will probably be the maximum. The locomotive will be mounted on trucks of this type, each with four drivers. Each axle carries a 300 H. P. gearless motor supported on springs resting on the frame of the locomotive truck. This leaves the wheels free to adjust themselves to the irregularities of the roadbed and to diminish the wear on both tracks and motors. The armatures are mounted on hollow shafts which surround the axles and are connected to them by universal couplings which allow a freedom of motion in all directions.

The locomotive is fitted with air brakes, the air being compressed by a small auxiliary motor in the cab. The electrical air compressor will also operate the whistle.

A Large Order for Electric Heaters.

An order which, it is said, is the largest which has ever been awarded for electric heaters was closed last month by the Central Electric Heating Company, of New York, with the West Side Construction Company, of Chicago. The heaters will be used for the equipment of all the cars of the Metropolitan Elevated Railway of that city, and the Central Electric Heating Company is to be congratulated for having secured this order.

This company is also equipping all the electric cars of the North Side Electric Railway, of Chicago, with heaters, and is doing an excellent business in other sections of the country.

Manufacturing Expositions in Mexico and South America.

The suggestion recently made by our enterprising contemporary, *Dixie*, that manufacturers in this country should unite in sending exhibits of their products to various places in Mexico and South America for exhibition purposes, is receiving the approval of some of the leading manufacturers in the country, including the J. A. Fay & Egan Company and the Lodge & Davis Machine Tool Company, of Cincinnati. These gentlemen claim that they have for a number of years been sending Spanish-speaking representatives into the countries named, and that they have always received good returns in the shape of substantial orders. A movement is on foot to hold a nationa convention of interested parties in Cincinnati early next year.

Electric Lighting of Cable Cars.

The Brooklyn Bridge cable cars are to be lighted by electricity and the contractors for this work, the Electrical & Mechanical Egineering & Trading Company, of New York, is completing the necessary apparatus. A trolley wire will be suspended over the track by span wires and the current will be there from by a pole somewhat similar to the ordinary trolley. The standard 500 volt system will be used.

Some New Corporations.

Bucyrus, O.—J. G. Meuser, of Galion, recently laid before the County Commissioners an application for a franchise to a new corporation, to build an electric railway on the public road between Bucyrus and Galion, the work to be completed within one year. This is a rival to the Bucyrus & Galion Suburban line, for which a franchise has already been granted.

Carthage, Mo.—The Jasper County Electric Railroad Company was incorporated November 12, with a capital stock of $150,000. Among those interested are F. H. Fitch, Isaac Perkins and J. W. Haliburton, all of Carthage.

Elyria, O.—A company to build an electric railway to connect Oberlin and Elyria has been formed here, with a capital stock of $100,000. Among the principal stockholders are W. B. Bedortha, of Oberlin, W. B. Thompson, of Lorain, and Parks Foster, of Elyria

Hull, Que.—A Montreal engineer is making surveys for the proposed power house for the new electric railway.

Indianapolis, Ind.—Grafton Johnson and John A. Polk, of Greenwood, have applied to the Johnson County Commissioners for a right of way for an electric line between Indianapolis and Franklin.

Ironton, O.—A five mile electric railway is projected between Pomeroy and Middleport, O. Frank E. Holliday, of Ironton, O., is interested. The line will be built in the spring.

Mackinac Island, Mich.—A franchise has been granted by the Council to John H. Roberts, representing a Grand Rapids company, for an electric railroad around the island, along with a telephone and electric light system.

Newark, N. J.—At a meeting, lately held here, of representatives of the Union Traction Company and the Newark, Rutherford & Hackensack Electric Railway Company, it was agreed that the latter company should be absorbed by the former, Delos E. Culver and Henry H. Copeland becoming members of the directorate.

Niagara Falls, Ont.—It is reported that Joseph Tait and John Flett, of Toronto, L. C. Raymond, of Welland, and others are seeking incorporation as the Niagara River Tramway Company, to build and operate a cable tramway over the Niagara River. The headquarters of the company are to be at Niagara Falls, and the capital stock is placed at $40,000.

Ottawa, Ont.—The promoters of the proposed Ottawa & Brockville electric railway are applying for a charter. It is said that a bonus of $100,000 will be asked from the city of Ottawa.

St. Thomas, Ont.—The street railway is reported to have been purchased by Henry Everett, of Cleveland, who will convert it into an electric road in the spring.

Shelburne Falls, Mass.—There is a movement on foot for an electric railway from Shelburne Falls to Coleraine. Several Boston capitalists and C. A. Marcy, J. B. Clark and Arthur A. Smith, of Coleraine, are interested.

South Paris, Me.—A new electric road, soon to be constructed, will be the Norway & Paris Street Railway. The capital stock will probably be $25,000. The following have been chosen directors of the company: Geo. L. Beale and Freeland Howe, of Norway; John F. Hill and Geo. E. Macomber, of Augusta; H. L. Shephard, of Rockport.

Trenton, N. J.—The New York & Philadelphia Traction Company, whose offices are at the corner of State and Montgomery Streets, has received franchises to pass through Hillsborough, Millstone and East Millstone, making a complete franchise now from Kingston to Bound Brook.

Westport, Conn.—Steps have been taken for the incorporation of the Westport & Southport Street Railway Company, whose promoters intend to run electric cars from Lyon's Plains to Saugatuck, thence to connect with the system of the Bridgeport Traction Company.

Personals.

Mr. S. L. Nicholson, of Philadelphia, was in New York last month.

Mr. J. H. Bickford, of Salem, Mass., made a business trip to New Orleans during the month of November.

Mr. Joel Hurt, president of the American Street Railway Association, was in New York City last month.

Mr. F. S. Kenfield, of the *Street Railway Review*, was married October 24, at Rock Island, Ill, to Miss Amy Sweeney.

Mr. Charles Desmond has again assumed the editorship of the *Stationary Engineer, and the Master Steam Fitter*, of Chicago.

Mr. Everett K. Day has been appointed superintendent of the Skowhegan & Norridgewock Electric Railway, of Skowhegan, Me.

Mr. J. W. Parker, the well known representative of the Ball Engine Company, in Philadelphia, was married November 1, to Miss Albury, of Beverly.

Mr. John W. Baker, of the E. T. Burrowes Company, of Portland. Me., called at our office last month. Mr. Baker is making an extended trip through the West in the interests of his company.

Mr. S. Dana Greene, of the General Electric Company, read a paper last month at the annual meeting of the Society of Naval Architects and Engineers, on "Electricity on Shipboard."

Mr. Carl P. Young, general manager and chief engineer of the Philadelphia Electrical Equipment Company, of Philadelphia, was in New York City a few days ago, attending to the business of his new company.

Mr. C. J. Field will read a paper at the annual meeting of the American Society of Mechanical Engineers, to be held in New York City, December 3 to 7, on "The Present and Prospective Development of the Electric Tramway."

Mr. F. D. Rounds has been appointed superintendent of the Broadway & Seventh Avenue division of the Metropolitan Street Railway Company, *vice* Mr. Newell, who has been appointed superintendent of the 34th Street division.

Mr. George Cradock, of George Cradock & Company, Wakefield, England, is making a trip around the world, and landed recently in San Francisco. Mr. Cradock has spent some time in Australia, and will return to England in December via Chicago and New York.

Mr. W. S. Dimmock, superintendent of the Omaha & Council Bluffs Railway & Bridge Company, Council Bluffs, Ia., called at the Chicago office of the JOURNAL on his way home from the Convention. He spent several days at Louisville, Cincinnati, Indianapolis and Chicago inspecting the street railway systems. Mrs. Dimmock accompanied him.

Mr. Frank X. Cicott, manager Railway Department of the Pettengill-Andrews Company, of Boston and New York, will sail on the steamship "Lucania" December 1st for England. Mr. Cicott, while abroad, will confer with Dick, Kerr & Co. (Ltd.), of London, manufacturers of rails, on the subject of extending this company's American trade.

Mr. F. L. Hart has been appointed chief engineer of the Baltimore City Passenger Railway Company. Mr. Hart was formerly connected with the Third Avenue Railway Company, of New York, and has recently been engineer of operation of the Metropolitan Traction Company of New York, and is thoroughly versed in the details of cable railway construction and operation.

Mr. W. Frank Carr, who was the constructing engineer of the Roanoke Street Railway, illustrated in our last issue, has been connected with a number of electric railway enterprises. He is a native of Massachusetts, and was graduated from the Massachusetts State College, and later, in 1884, from the Institute of Technology, in Boston. After practising as consulting engineer for four years in Minneapolis, he was appointed, in 1889 assistant engineer of the Minneapolis and St. Paul street railway system, with full charge of all outside engineering work, and the drawing up of plans and estimates for thirty miles of cable railway for those cities. After the abandonment of the cable plans and the resignation of Chief Engineer Wise, Mr. Carr was appointed chief engineer of the system. Under his charge 238 miles of electric road, including the interurban line between the two cities, was built. Mr. Carr designed, for use in Minneapolis, the now well-known Shanghai T rail, rolled by the Illinois Steel Company. In the winter of 1891–92 Mr. Carr went South on account of ill health, and on April 1, 1892, was appointed general manager and engineer of the Roanoke Street Railway Company and Roanoke Electric Light & Power Company. He severed his connection with the Roanoke companies last August, and expects to return North in the spring. Mr. Carr is a member of the American Society of Civil Engineers.



W. FRANK CARR.

Mr. H. E. Hunt, of the Hunt Air Brake Company, Pittsburgh, Pa., was in New York City last week on business connected with the organization of his company for the manufacture of street car air brakes. Mr. McGuire, of the Pittsburgh Reduction Company, whose office is in the Havemeyer Building, New York, will look after the New York business of the new company.

Mr. Robert Beall, who was mentioned in our list of attendants at the Atlanta Convention, as a director of the Metropolitan Railroad Company, of Washington, D. C., is, instead, a director of the Washington & Georgetown Railroad Company, of Washington, D. C. Mr. Beall was formerly a director of the Metropolitan Railroad Company, but resigned this office about two years ago.

Mr. E. P. Vining has been appointed general manager of the Market Street Railway Company, of San Francisco and leased lines. This is the first appointment which has been made to this position since the consolidation of the road, Mr. M. D. Stein having held the position of active manager of the transportation department, which office has been abolished. Mr. Vining is well and favorably known in traffic circles, having been connected for a number of years with the Union Pacific Railway, and manager of the Western Trunk Line Association.

Mr. John Graham, whose portrait we present herewith, has been general manager of the Wilkesbarre & Wyoming Valley Traction Company since its organization, and is one of the largest stockholders in the company. He was born in Cumberland County, Pa,, August 4, 1843, and is of Scotch-Irish descent. He remained on a farm until twenty-three years of age, at which time he moved to Newville, Pa., and was appointed teller in the First National Bank of that place. This position he held until 1876, after which he engaged in the tanning business. Mr. Graham served in the Pennsylvania Legislature during the session of 1883 and 1885, representing his native county of Cumberland. In the latter year he made his first venture in street railways, purchasing, with two friends, the Bloomfield City Street Railway, of Bloomfield, Ill., for $150,000, reselling the road the same year for $200,000. Since that time Mr. Graham has devoted his attention almost exclusively to street railway affairs, and is widely recognized for his ability and general knowledge of the street railway business. He went to Wilkesbarre in November, 1890, and a few months later, with several friends, organized the Wilkesbarre & Wyoming Valley Traction Company. Associated with Mr. Graham in the organization of this company was the Hon. J. J. Patterson, who is still a director in the company, but who has moved to Lancaster, Pa., and is largely interested in street railways in that city. Mr, Graham's history since 1890 has been that of the company of which he is general manager.



JOHN GRAHAM.

New Publications.

Illustrated Catalogue and Price List of the Lunkenheimer Company, Cincinnati, O.

The Lunkenheimer specialties are well known for the high standard of superiority which they have always held. The gate and other valves, the lubricators, cocks, etc., of this company have been mentioned in our columns, and our readers are well acquainted with their characteristic features. The company's 1895 catalogue, which is just issued, is a handsome publication and shows forth clearly the features which have contributed to the popularity of these appliances.

Catalogue of the Barney & Smith Car Company.

The Barney & Smith Car Company, of Dayton, O., is one of the oldest companies in the business, having been established in 1849. The facilities of this company for supplying the highest grade of car work have been described in these columns. The company has recently published a handsome catalogue illustrating a number of different types of street cars manufactured at its works for street railway companies. The catalogue shows cars of all types, including freight and mail cars, and the interiors of a number of the cars are illustrated.

Modern Methods of Handling Fuel as Practiced in Locomotive Coaling Stations, Electric Light and Steam Railway Power Plants. Published by the Link-Belt Engineering Company, of Philadelphia and New York.

This is a very handsome catalogue, and contains engravings of different types of coaling stations belonging to street railway and other companies. Among the street railway installations illustrated are: The boiler room of the 33d Street power station of the Philadelphia Traction Company, two views, the ash conveyor of the same station, and two views of the power station of the Electric Traction Company, of Philadelphia. The Link-Belt Engineering Company has also equipped with coal handling machinery a large number of other street railway stations, as well as many plants for other coal using concerns. The pamphlet is also illustrated by engravings of the works of the

Link-Belt Machinery Company and of the Link-Belt Engineering Company.

Stresses in Girder and Roof Trusses, for Both Dead and Live Loads, by Simple Multiplication, With Strain Constants for One Hundred Cases. By F. R. Johnson. Spon & Chamberlain, New York, 1894. Price $2.50.

This book, while not intended for the general reader, is an extremely useful one for civil and mechanical engineers, architects and draughtsmen who find it necessary to calculate the stresses in girder and roof trusses. It is intended to simplify these calculations, and to assist practical engineers and draughtsmen who have little time for mathematical investigation. The stress constants for both dead and live loads need only to be multiplied by the panel load to give the maximum stress in any member of the truss which may be mentioned. The work is apparently compiled with great care. The detail figures, as far as possible, have been determined in two or three different ways, and the results of this, of course, add greatly to the value of the book. Such books as this are of great assistance in reducing to a minimum the labors of working engineers.

Electric Light and Power. By Arthur F. Guy. Published by Biggs & Company, London. 346 pp. Price $2.00.

This book embodies a great deal of practical information on central station work, and the principles underlying the action of apparatus have been discussed, the author explains, only so far as to enable the reader to grasp the laws that govern their action. The subjects treated include motive power, with a discussion of the relative values of the gas engine and different types of steam engines and water wheels for operating dynamos, electrical generating machinery, arc and incandescent lighting with a comparison of the cost of these methods of illuminating and by gas, and the distribution of electric power. The relative costs of installation and operation of different types of apparatus are treated at considerable length, and a number of interesting comparisons are made of different systems and methods of practice. Electrical development in the lighting has been slower in England than in this country, if we can judge from the statement made that, up to the end of 1893, the city of London had a total of only 349,000 sixteen candle power incandescent lamps. Of the three methods of driving dynamos—by belts, ropes and direct connection—the central stations seem to be about equally divided, though the present tendency, the author states, is toward direct driven, high speed engines coupled to low speed armatures. Whether this is also the trend of practice in railway stations is not mentioned, but we notice that rope driving is used in one of the two large railway installations, that of the Liverpool Elevated Railway, and belts in the other, the City & South London Railway. But little space is devoted to electric traction, and in this department of electrical development, the author states that England is a long way behind America, though in heavy and large engineering work it acts as pioneer. The greatest field for electric traction at present in England, it is thought, lies in the construction of tubular underground electric railways. The book is written in a clear and attractive style and is illustrated by a number of diagrams.

Equipment Notes.

The Gold Car Heating Company, of New York, is equipping 180 cable cars of the Third Avenue Railway Company, of New York, with car heaters.

Westinghouse, Church, Kerr & Company announce the removal of their New England office from 620 Atlantic Avenue to Exchange Building, 53 State Street, Boston.

The Brooklyn Railway Supply Company, of Stamford, Conn., has recently delivered a snow sweeper to the Broadway & Seventh Avenue Railway Company, of New York.

Charles J. Mayer, of Philadelphia, Pa., who deals in electrical railway supplies, has removed to Room 1211 Betz Building. Mr. Mayer has charge of the Middle States sales department for the R. D. Nuttall Company, of Allegheny, Pa.

The C. W. Hunt Company, of New York, reports that Messrs. Pardee & Young, coal dealers, of Fall River, Mass., have awarded it the contract for a coal elevator and two automatic railways for coal wharves, which the latter are erecting.

The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., writes us that the office of its New England agency, which was formerly located at 620 Atlantic Avenue, Boston, Mass., has been removed to Exchange Building, 53 State Street, Boston, Mass.

Charles A. Baldwin & Company, bankers, at 40 and 42 Wall Street, are making a specialty of street railway securities, and persons interested may find it profitable to communicate with them. The house has, we understand, many rich clients who are interested in trolley development.

George Cradock & Company, of Wakefield, Eng., whose ropes have been making excellent records on this side of the Atlantic, report the record of 172 weeks or 196,764 miles for one of its cables on the Fitzroy line in Melbourne. Some remarkable records in Dunedin, New Zealand, by the ropes of this company were given in our last issue.

The Clayton Air Compressor Works, of 26 Cortlandt Street, New York, has sent us a copy of its newest publication on the "Uses of Compressed Air." This list cites about seventy different applications of air under pressure, and is a most convincing commentary upon modern advancement in engineering, manufacturing and industrial lines.

The Western Electric Company, of New York City, has been appointed the wholesale agent for the hot pressed steel pinions manufactured by the United States Projectile Company, of Brooklyn. This arrangement supersedes the old one under which C. S. Knowles, of Boston, was acting as sales agent. The Western Electric Company proposes to push vigorously the sale of these pinions.

C. S. Stearns & Company have just started in business, at 9 Haynes Street, Hartford, Conn., as manufacturers' agents and dealers in street railway supplies. The firm is composed of C. S. Stearns and E. R. Gilbert. Mr. Gilbert is already well known to the trade through his former connection as traveling salesman of the Eddy Electric Company. The new firm is in a good position to handle to good advantage the products of Western manufacturers.

Charles E. Chapin, manufacturers' agent and dealer in general electrical supplies, has so increased his business recently that he has been obliged to take larger quarters on the first floor at 136 Liberty Street, in the Electrical Exchange Building. Among the recent large contracts taken are two complete electrical plants for export. Mr. Chapin has recently secured the sole agency of the Perfection woven wire gauze brush, especially adapted for large railroad generators.

The Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y., is doing a large business in all of its departments. Mr. Dobbs, general manager of the company, reports special activity in the snow sweeper, stove, trimming and register departments. The excellent service given by the Lewis & Fowler snow sweepers last winter has been referred to in these columns, and has brought its return in a large number of orders, which it has filled during the summer and autumn.

The Penn Bridge Company, of Beaver Falls, Pa., is building a bridge across the Monongahela River at Glenwood, Pa., for the new line to Homestead and McKeesport, of the Second Avenue Traction Company, of Pittsburgh. The bridge has a center span of 520 ft., two spans of 300 ft. each, beside viaduct approach at each end. The company is also building an extensive bridge with five spans for the Wilkesbarre & Wyoming Valley Traction Company, as mentioned elsewhere in this issue.

The Graham Equipment Company, of Providence and Boston, has published a circular, calling attention to a very striking remark in the paper read by E. C. Foster, general manager of the Lynn & Boston Street Railway Company, at Atlanta, in regard to using a tram rail. The Graham Equipment Company calls attention to the fact that a great deal of the waste of money in roadbeds has been due to the use of too heavy trucks, and points the obvious moral to buy spring suspended trucks and save in the roadbed.

The Storm Manufacturing Company, of Newark, N. J., is sending out to its customers a miniature of the H. & C. patent ice and sleet cutting trolley wheel, in the shape of a paper weight. It is a reproduction of the wheel about two inches in diameter. It is the only wheel, the manufacturers claim, which will entirely remove ice from the wires and allow the same speed to be made in sleet and ice storms as in good weather. John H. Graham & Company, of 113 Chambers Street, New York City, are the sole agents for this wheel.

William Hazleton, 3d general agent for the United States of the Société Anonyme Industrielle Des Établissements Arbel, has presented us with a very neat paper weight in the form of one of the Arbel wheels for street railway service, which he has just received from the home office at Rive-de-Gier (Loire), France. Mr. Hazleton expected to receive a large number of these paper weights in time to distribute them as souvenirs at the Atlanta Convention, but they were delayed in the Custom House so long that he was not able to have them at Atlanta.

The R. A. Crawford Manufacturing Company, of Pittsburgh, Pa., has recently shipped to New Orleans sixty-six patent pick-up car equipments with rope net. The company also reports orders for all the cars of the McKeesport & Wilmerding Street Railway Company, of McKeesport, Pa., with its folding pick-up fender, and all the cars of the Paterson Central Railway Company, of Paterson, N. J. The company has also received the order for all the cars of the Paterson Railway Company. R. A. Crawford is enthusiastic over the favorable reception which his fender is receiving.

W. P. Seguine, of the Frost Veneer Seating Company, has recently invented a waterproof and heatproof glue, which promises to be of great value, not only in car construction, but in all places where a waterproof glue would be valuable. Mr. Seguine has been experimenting in this line for many years, and has subjected the glue to a series of severe tests, under all of which it has given very favorable results. The right to use this glue for veneer has been secured by the Frost Veneer Seating Company, but the right to use it in other industries is still the property of Mr. Seguine. We understand that the product is inexpensive to manufacture.

Edward F. Austin, former sales agent, in Pittsburgh, of the Altoona Manufacturing Company, recently assigned, has taken charge of the Pittsburgh office of the Phœnix Iron Works Company, of Meadville, Pa., manufacturers of the well known Dick & Church engines, boilers, feedwater heaters, etc. Mr. Austin reports the sale of a 15 × 18 engine, to Jones & Laughlin; three 100 H. P. boilers for the Schenley Park Casino. These boilers are particularly designed for safety, etc., and are of special make all through. He also reports several smaller sales, and states that inquiry is increasing from all localities, and that he looks forward to an increase of the trade in the boiler and engine business.

The John Stephenson Company, Ltd., of New York, has been kept busy recently turning out the cable cars for the Metropolitan Traction Company's Columbus Avenue line in New York. This car

is of the "Broadway" type, and is illustrated and described elsewhere in this issue. The Stephenson Company also mentions, among other recent orders, some electric cars for Allentown, Pa, Yonkers, N. Y., and the Nassau electric road, of Brooklyn, N. Y. The company has also received orders for cars from Bridgeport, Conn., Lorain, O., and elsewhere. The company has no difficulty in maintaining its business, owing to the high standard of work which has come to be recognized as characteristic of the Stephenson cars.

Robinson's Patent Trolley Wheel manufactured and sold by the Wallace Electric Company is making many friends. The independent contact ring, one of its principal features, allows an easy passage on sharp curves, without it jumping the trolley wire. Wood's specialties, such as the flexible pole bracket, adjustable switches and crossovers and the trailer connector are favorites and are well liked by those using them. The Wallace Electric Company, of Chicago, is general sales agent for the manufacturers of the Brilliak incandescent lamp. This lamp is made with an anchored filament especially adapted to withstand the severe conditions which lamps are subjected to in street railway service. Although the Brilliak is a new comer it is meeting with great success, and the factory is kept busy filling orders now on hand.

J. H. Bickford, of Salem, Mass., has under way the construction of nine miles of line between Long Island City, N. Y., and Flushing, extending through the villages of Woodside, Winfield, Newtown and Corona. The road will be double track as far as Newtown Village, and the whole line is to be built especially for rapid transit. As the road leaves the village of Corona it passes across the "meadows" for a distance of a mile and three-eighths on a trestle work structure, which will have some interesting engineering features. Power to operate this line will be provided from the station of the Steinway Railway Company, and the line will be operated as a part of that company's system. Mr. Bickford also has under way the construction of the Manchester (N. H.) Street Railway, which will include about fifteen miles of line.

The Safety Car Heating & Lighting Company, of New York, has recently equipped eighty electric cars of the Columbus (O.) Street Railway Company with its system of lighting by Pintsch gas. This is the first instance in this country, so far as we are acquainted, of the use of gas for lighting electric cars, although its use on steam railways and cable railways is very extensive, as our readers well know. The reason which led the management of the railway company to adopt gas in place of electricity for lighting, we understand, was the desire to provide its patrons with a perfectly steady and certain light, and one which would not go out in case of interruption of power, or if the trolley should leave the wire. The result of this installation will be watched with interest. The company is also equipping the Columbus Avenue cars of the Metropolitan Traction Company, of New York, with lighting equipments.

The Berlin Iron Bridge Company, of East Berlin, Conn., writes us that it has just completed the new machine shop for the American Hard Fibre Company, at Newark, Del. This building is 50 × 226 ft., the roof being made of steel, and covered with the Berlin Iron Bridge Company's anti-condensation, corrugated iron roof covering. The New England Electrolytic Copper Company, at Central Falls, R. I., has also just completed an addition to its works. This addition is made entirely of iron and steel, furnished by the Berlin Iron Bridge Company. This company will also furnish the new power station for the United Electric Light & Power Company on East 28th Street, New York City. This power house is 100 × 200 ft., the engine room is 100 × 80 ft., and the boiler room is 56 × 100 ft., the whole covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron roofing. The coal pockets in the boiler room have a capacity of 3,000 tons.

The Philadelphia Electrical Equipment Company is a new enterprise, formed on October 21, and has its offices and works located at 816-18-20-22 Cherry Street, Philadelphia, Pa. So far the electrical business has been divided very much into the three general branches, viz., construction department, supply department and repair department, these branches usually being owned by separate persons, and operated independently of each other. This company has consolidated the three in one, and believes the consolidation will inure to the benefit of all interested, because the mistakes of those not experienced will be avoided. Again, as the company will buy supplies in large quantities, at the lowest market cash prices, and as it has no expensive agents to pay, it can give the trade the benefits. Certainly, quick deliveries and low prices, with a full guarantee, should win. The company's project, with the many years' practical experience of C. P. Young, the business ability of J. R. Rettew, together with the finest mechanics and none but the best tools in the market, afford ample grounds upon which to guarantee everything to be absolutely right when it leaves the works. The JOURNAL welcomes it, and wishes it great success in its new undetaking.

The New Process Raw Hide Company, of Syracuse, N. Y., has received a letter from H. S. Cooper, general manager of the Schenectady Street Railway Company, enclosing an order for two more pinions. The letter concludes: "The pinions have done excellently well. On May 10 we equipped an open car with steel pinions; on May 28 we equipped an identical car with raw hide of your make. To-day, the steel pinions are worn out, and have also worn out the axle gears in which they mesh, while the raw hide pinions are not nearly worn out, and the axle gears in which they mesh are not worn at all perceptibly. Both these cars have run steadily over identically the same route, and have carried very closely the same number of passengers, and averaged the same mileage, 100 miles per day. As you know, our road is a very hard one on gears, as it is all curves and grades, with the curves all on grades 6, 7½, 10 and 12 per cent., and some of them pretty long ones. We are well pleased with the results, the more especially as the writer was somewhat dubious at first as to the using of raw hide on single reduction machines, although his experience with them on double reduction had been very satisfactory."

Stern & Silverman, of Philadelphia, Pa., report closing a nice contract last month with the Pikesville, Reistertown & Emery Street Railway Company, of Baltimore, Md. This is a new company just entering the field. Three tandem compound, 250 H. P. Ball & Wood engines will be used. The electric plant will consist of three Westinghouse K. W. generators, and the steam plant of four 200 H. P. Brownell Company boilers, with a ninety foot, self supporting stack. All the pipe fitting, placing of the pumps, etc., will be done under the direct supervision of Stern & Silverman. The officers of the Pikesville, Reistertown & Emery Street Railway Company are: President, James Parr; vice-president and general manager, Charles Webb; engineer, W. D. McQuestion Stern & Silverman have also been awarded a contract by the Scranton (Pa.) & Pittston Traction Company for the building of four and a half miles of track between Pittston and Avoca, Pa. The rails are to be fifty-six pound, ties two feet centers. The same firm has also secured the contract for the furnishing of car bodies and trucks, as well as motors. The motors are to be two thirty horse power Westinghouse se.ies motors to each car. The contract also includes the furnishing and erection of all overhead material and the construction of the road complete.

The Mather Electric Company, of Manchester, Conn., has just concluded arrangements with Manning, Maxwell & Moore, of New York, and the Niles Tool Works, of Hamilton, O., for a large amount of new machine tools which will be installed in the Manchester plant at once. These tools are especially adapted for the building of large direct connected and belted generators which the Mather Company is now making quite a specialty of. The plant at Manchester has been running overtime with full force for the last two months, and the company now has orders on hand to keep its entire plant busy from four to five months. The company reports on hand an especially large number of orders for its new type multipolar generators for railway work. The company has now in course of construction in its shop six 200 K. W. and fifteen 100 K. W. belted generators, besides a number of large direct connected generators. The company has closed a contract with the Ithaca Street Railway Company, of Ithaca, N. Y., for a 100 K. W., new type multipolar railway generator. Other users of Mather generators, who have recently written to the Mather Company expressing their most favorable opinion of these machines, are the Gardner Electric Street Railway Company and the Hartford & West Hartford Street Railway Company.

The Philadelphia Engineering Company, of Philadelphia, Pa., has just completed contracts with the Carnegie Gas Company, of Pittsburgh, for three 30 × 60 in. gas compressors. Each is driven by a 32 × 60 in. Philadelphia-Corliss engine of the company's rolling mill type. The company has also contracted with the Pittsburgh Natural Gas Company, of Pittsburgh, for a pair of 30 × 60 in. gas compressors, each driven by a 24 × 60 in. Philadelphia-Corliss engine, also a pair of 30 × 60 in. gas compressors for the Ohio Valley Gas Company, each driven by a 26 × 60 in. Philadelphia-Corliss engine. The company has just contracted with Marshall Brothers, of Philadelphia, for an 800 H. P., tandem compound, condensing engine, of the rolling mill Corliss type, to drive the tin plate mills. It is also just shipping for the Chamberlain Coal Company, of Pottsville, Pa., two 34 × 60 in. Philadelphia Corliss hoisting engines, complete with drums, brakes, etc.; also two 14 × 36 in. heavy Corliss engines for the same company, to be used for its coal breaker. It is also shipping to the Standard Steel Works, of Burnham, Pa., a fifteen ton, revolving, open hearth steel furnace, together with gas producers, piping and chimneys. The company reports that its works are operated full force night and day, and prospects are very good for plenty of trade in the future.

The Joseph Dixon Crucible Company, of Jersey City, N. J., reports an active interest in its dressing for leather belts. No one using leather belts can afford to be indifferent to their care. There is a certain amount of elasticity in all good leather belting, but time and continued hard work seem to destroy or at least weaken its power. Then comes the question whether it is better to simply tighten the belt or use some form of dressing. Experience of many very practical observers seems to favor the use of a good dressing, as tightening the belt strains it and calls for more engine power, but, of course, one should be careful what sort of dressing is used. Dixon's belt dressing and leather preservative, was the only article that would start the big driving belt used at the Paris Exposition in 1878, and keep it from slipping, and the company has excellent testimonials from users in this country, of its value. The Jos. Dixon Crucible Company, has manufactured a pure linseed oil and graphite paint for over twenty-five years and has some very convincing testimonials of its value. At the Montreal meeting of the American Society of Mechanical Engineers, an interesting paper was read on methods for preserving metal used in pipes, roofs, bridges, poles, construction work, etc. In conclusion, the whole question of how best to protect iron and steel from corrosion in all the varying conditions that the wants and usages of to-day demand, seems to resolve itself into several "Donts'," as the best method of answering it, to wit: Don't have any scale on the metal. Don't paint it with anything but pure linseed oil and oxide of lead or graphite paints. Don't forget that frequent inspection and care are very necessary. Don't let the cost and interest accounts be the governing factors in the case of protecting any metal structure on whose continuity and strength human life and safety depend. In comparing the two paints recommended, the Jos. Dixon Company claims that a properly made graphite paint should prove more durable and a better protector than oxide of lead. Graphite has a strong affinity for metal surfaces, and experienced painters claim that even where light colors

are desirable, graphite paint should be used as a priming coat. Again, graphite is impervious to the action of heat, cold, sea air, acid or alkali fumes, which are more or less destructive agents to lead paints.

The Consolidated Car Heating Company, of Albany, N. Y., among its other large orders, numbers one of 1,200 electric heaters to the People's Traction Company, of Philadelphia, which will equip 300 of its cars. We believe this is the largest order ever given, in this or any other country, for electric heaters, and we wish to extend congratulations to H. N. Ransom, through whose untiring effort this order was secured. It certainly speaks wonders for his ability as a salesman. Among the orders recently taken by Mr. Ransom are forty car equipments to the Buffalo Street Railway Company, ten car equipments to the Cleveland Electric Railway Company, and ten to the South Covington & Cincinnati Street Railway Company. The electric heater of the Consolidated Car Heating Company is the only electric heater that received an award at the World's Fair. A medal and diploma were given it for efficiency and economy of operation, combined with admirable regulation of temperature. The heater is now in use in 100 cities and towns of the United States and Canada, and on over 1,300 cars. The Consolidated Car Heating Company writes us that an error was made in the statement of the electrical equipment of the Poughkeepsie City & Wappingers Falls Street Railway Company, in our November issue. This company, supplied all of the heaters in use on this road, and not another car heating company, as stated. The Consolidated Car Heating Company is extending its business rapidly, and its heaters are very popular on all the roads where they have been installed. The West End Railway Company, of Boston, has also ordered 149 cars equipped with the electric heater manufactered by the Consolidated Company. This is perhaps the most important order yet given in electric heating, and was obtained by the Consolidated Company only after the most rigorous practical tests in competition with electric heaters offered by five other companies. The Consolidated Car Heating Company has just awarded the contract for the addition to its factory, which will practically double its capacity. Its rapidly increasing business in electric heating appliances, and the requirements of its compressed gas lighting business have necessitated increased facilities for manufacturing. Charles A. Sheldon has resigned as assistant division superintendent of the Michigan division of the Lake Shore & Michigan Southern Railroad, to accept a position with this company. He will have charge of the compressed gas lighting department of the Consolidated Company, which is about to introduce the Pope system, interchangeable with the Pintsch throughout the United States. Mr. Sheldon is a graduate of Yale, class of 1890, and has been with the Lake Shore road since graduation, four years ago, having risen through several grades to the responsible position of assistant division superintendent. He has shown great ability in railroad matters, and his many friends will be glad to learn of the important position which he now assumes with the Consolidated Car Heating Company.

WESTERN NOTES.

The Louis K. Comstock Company, of Chicago, has opened a branch office in the Hodges Building, at Detroit, Mich.

The Partridge Carbon Company, of Sandusky, O., has issued a new catalogue giving prices and other information of its dynamos and motor brushes.

The Crescent Electric Company, of Chicago, repairers of electrical machinery, is unusually busy. This company makes a specialty of street railway work.

Messrs. Haschke & Creelman, of Chicago, manufacturers of all sizes of storage batteries, say that their business is constantly improving and the number of inquiries increasing largely.

The International Register Company, of Chicago, is in receipt of several orders from various roads for its registers which seem to be gaining rapidly in favor with street railway managers.

The Stanwood Manufacturing Company, of Chicago, is running full time on orders for the Stanwood car steps, the demand for which is constantly increasing. The shipments for the past month have been unusually large.

The McGuire Manufacturing Co., of Chicago, during October reports that it received orders for 690 of its Columbian magazine cast iron street car heaters and fourteen electrial combination snow sweepers. This looks as if the electric railways in the colder regions expect to do business this coming winter.

The Wadhams Oil & Grease Company, of Milwaukee, Wis., is sending out a "second edition" of its souvenir aluminum match boxes, which were distributed at the Atlanta Convention. The supply on hand at Atlanta was soon exhausted by the large demand for what proved to be a very useful souvenir.

F. E. Donohoe, of Chicago, Western agent for the American Electrical Works, Providence, R. I., has just closed a contract for considerably over 900,000 lbs. of wires for the West and North Side Street Railway Companies of Chicago. This is, no doubt, one of the largest orders for wire on record, and amounts, in the aggregate, to $118,000.

The Jenney Electric Motor Company, of Indianapolis, Ill., it is stated, has given up the idea of moving its plant to Springfield, O., owing to the fact that the bonus offered the company there has failed to materialize. The business of this company has greatly outgrown its present quarters, and the company has several sites now under consideration.

The Mark Railway Equipment Company, of Chicago, has just finished the delivery to the Chicago City Railway Company of some 100,000 of its double brace plates, and also a large order of joint braces for cable construction. The company reports the outlook for spring business as being very flattering. This company makes a specialty of track equipment.

The Fleming Manufacturing Company, of Fort Wayne, Ind., has issued a new catalogue, giving details of its street railway snow plows, which are designated as the "Reversible" for electric and cable roads, and the "Walkaway" for horse roads. The most striking feature of this catalogue is the list of street railroads in the United States and Canada, each using from one to twenty-five of the Fleming Company's snow plows. This list occupies no less than ten columns of the company's catalogue.

The Meaker Manufacturing Company, of Chicago, manufacturer of the well known Meaker line of registers, expects to be in its large, new shops at South Waukegan, Ill., by December 15. This company is getting out an elegant line of overhead material, consisting of trolley wire hangers, clamps, crossovers, switches, etc., which it will be prepared to offer within a very short time. The company will also manufacture a fine line of metal trimmings and other street railway and electrical specialties.

The Lodge & Davis Machine Tool Company, of Cincinnati, O., has just issued a handsome circular illustrating and describing its full line of universal and plain milling machines. The company writes that this catalogue will be sent to any address upon application. The Quincy Mining Company, of Hancock, Mich., extensive mine operators, has just placed an order with this company for an outfit of tools, including seven lathes, two full Universal radial drills, etc., to be used in repairing and manufacturing mining machinery.

The Link Belt Machinery Company, of Chicago, reports good business with the Standard boiler which it is manufacturing. Among the recent orders for this boiler are equipments for the Chamber of Commerce, Detroit, Mich.; Evanston Illuminating Company, Evanston, Ill., Northwestern Yeast Company, Chicago, Ill.; Lehigh Valley Coal Company, Wilkesbarre, Pa.; Carnegie Library, Braddock, Pa.; Pittsburgh High School, Pittsburgh, Pa., Morgan Building, Buffalo, N. Y., and the Institute for Feeble Minded, Polk, Pa.

James Leffel & Company, of Springfield, O., have recently contracted for a large equipment of wheels and connections for the Columbus (Ga.) Consolidated Street Railway Company. At the power station of this road will be installed four sixty-eight inch Samson wheels, manufactured by James Leffel & Company, giving an aggregate of 700 H. P. Other installations made by this company in street railway power houses have been at Anaconda, Mont.; Tampa, Fla., and elsewhere. The regulation of these wheels is effected by both mechanical and electrical governors, not both in the same plant, and has been found to be very close with varying load on the wheels.

Mr. Van Dorn, of the Fitzgerald-Van Dorn Company, of Lincoln, Neb., has been in Chicago some days overseeing the delivery of automatic drawbars and attachments for the motor cars of the Metropolitan Elevated. These equipments are claimed to be the largest, strongest and most compact of any ever constructed, each equipment weighing over 1,100 lbs. per car, and when coupled automatically there is only one-sixteenth of an inch play between them. The wearing parts of these couplers are more than ten times greater than on any other bar constructed. They cannot break or get out of order, and are, consequently, expected to last almost indefinitely. Mr. Van Dorn says his company has done a very satisfactory business with surface roads this year, and is well pleased with the outlook.

J. Holt Gates, of Chicago, is installing six Card motor equipments for the Elkhart & Goshen Railroad, also a Mather generator. For the Bloomington (Ill.) City Railway he holds the contract for a 100 K. W. Mather railway generator and two Card motors, and at Fremont, O., for two Card motors. The Card Electric Company's factory is now entirely completed, and in active operation. This company's series parallel controller using quick-break switches is a new departure in street railway controllers, and is giving good satisfaction. Mr. Gates reports the sale of thirty-six motors, dynamos and generators in the month of October. The Elwell-Parker Electric Company, of which he is the Western representative, makes a specialty of direct connected alternators, as well as the heaviest class of railway generators. Mr. Gates has five salesmen on the road, as well as an engineering corps, and reports business very promising.

The Elwell-Parker Electric Company, of America, has just begun business, with headquarters at Cleveland, O. The company has undertaken the manufacture of heavy electrical machinery, and has already turned out its first machine. The company's systems in England are under the control of the Electric Construction Corporation, Ltd., one of the largest concerns in that country. A specialty will be made of low period, direct connected and belted alternating current dynamos, and the equipment of overhead roads on a plan similar to that used on the Liverpool overhead road, which was equipped by the English company. This road was the first in the world to adopt electricity for the adoption of overhead trains. The company will also make large sizes of direct current generators for lighting and power work. The company has facilities for turning out several thousand horse power of machines every month. J. Holt Gates, of Chicago, has taken the Western agency.

The McGuire Manufacturing Company, of Chicago, has orders for November delivery, which show a large improvement in street railway business throughout the country, some of the orders being from the following parties, viz: Consolidated Traction Company, Jersey City, 22 Columbian trucks and 117 of its Columbia A 1 S.; Norwalk Street Railway Company, Norwalk, Conn., 13 Columbian trucks; American Car Co., St. Louis, Mo., 12 adjustable traction trucks; Augusta Street Railway Company, Augusta, Ga., 10 A 1 suspension trucks; Allegheny Traction Company, Pittsburgh, Pa., 10 A 1 suspension trucks (being a duplicate order); Consolidated Electric Railway

Company, Los Angeles, Cal., 40 A 1 suspension bicycle trucks; the Chicago City Railway Company, 60 Columbia trucks; Northeast Street Railway, Kansas City, Mo., 10 Columbian trucks, and the Inter-County Street Railway Company, 7 trucks, 1 Columbian truck for export, 1 A 1 suspension, Walker Manufacturing Company, 6 A 1 suspension trucks, Citizens' Street Railway Company, Memphis, Tenn.; Toledo Consolidated Street Railway Company, Toledo, O., 2 combination track sweepers and snow plows; Citizens' Street Railway Company, Indianapolis, Ind., 2 combination snow plows, and the La Crosse City Railway Company, LaCrosse, 1 combination snow plow. It also reports orders for nearly 700 heaters for the month of October. This is certainly a good evidence of reviving business.

The Ohio Brass Company, of Mansfield, O., as a result of the quality and completeness of the line of its construction devices has had a steadily increasing trade for the past year, and now numbers among its patrons many electric railroads in the country. The latest two devices which this company has added to its line, viz., The Jewell trolley sling and the reversible and adjustable track brush holders bid fair to find favor among the street railway men. Both of these articles have stood the test resulting from long use, and wherever they have been tried have given satisfaction. This company reports sales of considerable size for the month of October to the following named roads: The North Chicago Street Railway, Chicago; the Sandusky, Milan & Norwalk Street Railway, Norwalk, O.; the City & Suburban Railway, Baltimore, Md.; the Syracuse Street Railway Company, Syracuse, N. Y.; the Buffalo, Kenwood & Tonawanda Electric Railway, North Tonawanda, N. Y.; the Baltimore Traction Company, Baltimore, Md.; the Lafayette Street Railway, Lafayette, Ind.; the Dunkirk & Fredonia Street Railway Company, Fredonia, N. Y.; the Galesburg Electric Motor & Power Company, Galesburg, Ill.; the Pittsburgh Electric Railway, Pittsburgh, Kan.; the Marion City Railway Company, Marion, Ind.; the Springfield Railway, Springfield, O.; the West Chicago Street Railway, Chicago, Ill,: the People's Electric Railway, Rochester, Pa.; the Charlotte Street Railway, Charlotte, N. C.; the Durango Railway & Realty Co., Durango, Colo.; the Carbondale & Forest City Passenger Railway, Carbondale, Pa.; the Market Street Railway, San Francisco, Cal.; the Shamokin & Mt. Carmel Railway, Mt. Carmel, Pa.; the Sioux City Traction Company, Sioux City, Ia.; the Pottstown Passenger Railway, Pottstown, Pa.; the Newark & South Orange Street Railway, Newark, N. J.; the Terre Haute Street Railway, Terre Haute, Ind.; the City Railway, Dayton, O.; the Fort Wayne & Belle Isle Railway, Detroit, Mich.; the Chicago General Railway Company, Chicago, Ill.; the Elyria & Lorain Electric Railway, Lorain, O.; the Metropolitan Street Railway, Kansas City, Mo.; the Middletown-Goshen Traction Company, Middletown, N. Y.; the Columbus Street Railway, Columbus, O.

List of Street Railway Patents.

U. S. Street Railway Patents Issued October 16, 1894, to Novembbr 13, 1894, Inclusive.

October 16.

Sand-Delivering Mechanism for Street Cars—Alexander Parrant, Worcester, Mass. No. 527,446.

A sand receptacle with the sliding gate and delivery chute, the gate operating lever, the contact shoe movable and sliding on the end of said lever, the lift spring attached to said lever, a cam on the wheel axle, and means for shifting said contact shoe endwise into and from engagement with said cam, for the purpose set forth.

Apparatus for Signaling the Approach of Street Cars—Garland B. St. John, Kalamazoo, Mich., assignor of one-half to Charles D. Fuller, same place. No. 527,461.

This consists of an insulated vertical wire and horizontal cross wire attached thereto, one end of which projects across the path of a trolley pole; a vertical end of wire in position to come in contact with the cross wire when the latter is swung by the car passing in one direction, and a signal wire passing through a group of signals to a ground plate at the outer end and connected with the wire at the outer end.

Snow Plow for Street Railways—Francis W. Dean, Cambridge, and William E. Mathews, Boston, assignors to the Taunton Locomotive Manufacturing Company, Taunton, Mass. No. 527,523.

A V shaped plow arranged to partially inclose the lower portion of one end of the vehicle body, and connected to said vehicle body by a system of parallel motion links; and means having provision for raising and lowering said plow from the vehicle platform, without changing the substantial parallelism of said plow relative to the railway track.

Trolley—William H. Bache, Bound Brook, N. J. No. 527,546.

The trolley has a socketed support, and a bracket consisting of two sections branched to support the trolley wheel between them, and having arms or projections together constituting a split pintle adapted to the socket of the support.

Conduit Electric Railway—Oliver B. Finn, Philadelphia, Pa. No. 527,601.

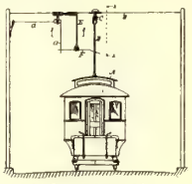
A conduit with a box having an opening in its wall, a sliding stem in said opening having a roller thereon, an insulated wire in said box having an arm rigidly connected therewith, said arm having a hooked end adapted to be engaged by a tongue on said stem, and a spring bearing against said stem.

Safety Apparatus for Street Railway Cars—James J. Andrews, Hempstead, and Theodore Mott, Far Rockaway, N. Y., No. 527,646.

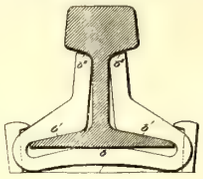
The apparatus extends forward from the platform, and a trap constructed with a convex forwardly extended lower part, and concave, rearwardly extended upper part of an arm, extends downward from the said lower and convex part, with means for transversely pivoting the arm to the front of the bracket.

Railway Chair—Edward Nennstiel, Johnstown, Pa. No. 527,712.

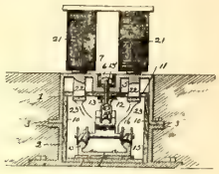
A railway chair made of a single piece of resilient metal, which is adapted to engage with the ends of the rails as shown, said chair having a preponderance of metal above the flanges of the rails, and a curved base, the side portions which adjoin the base being thinner and of greater resiliency than the other parts of the chair.



NO. 527,461.



NO. 527,712.



NO. 527,873.

Car Fender—Herman B. Ogden, Brooklyn, N. Y. No 527,715.

A car fender, comprising two frames hinged together and adapted to be hung on a car, a roller supported beneath the lower frame, and an extension end on the lower frame.

October 23.

Life Guard for Street Cars—John F. Ryan, Toronto, Canada. No. 527,813.

The life guard frame is pivotally connected at its rear end to the under side of the platform, which is raised by a foot lever or pedal.

Support for Trolley Wires—Frederick C. Fisk, Buffalo, N. Y. No. 527,840.

This consists of twin parts riveted together and having in their contracting inner faces similar inclined grooves, which register with each other to form an inclined passage extending entirely through their length. A sleeve is adapted to surround and carry the line wire and is provided with inclined flanged wings adapted when brought together for sliding and wedging engagement with the inclined passage between the twin parts, the whole being adapted to be secured to an insulating bell.

Transformer System for Electric Railways—Maurice Hutin and Maurice Leblanc, Paris, France, assignor to the Société Anonyme pour la Transmission de la Force par l'Électricité, same place. No. 527,857.

Power is transmitted from a primary circuit or line to a secondary circuit by electric induction. The intermediation of a closed magnetic circuit between the primary and secondary is dispensed with, by generating in the primary circuit an alternating current of high frequency, and suppressing the self-induction of the secondary coil which is within inductive proximity to said primary by means specified.

Closed Conduit Electric Railway—James F. McLaughlin, Philadelphia, Pa. No. 527,873.

The closed conduit is provided with a central exposed conductor, and an interior main or supply conductor. A traveling electro-magnet straddles the exposed conductor, and a trolley in the conduit establishes the circuit between the main and exposed conductors, and carries an armature in operative relation to the magnet.

Closed Conduit Electric Railway—James F. McLaughlin, Philadelphia, Pa. No. 527,874.

Electro-magnets are hung from a motor car and pivoted to tilt in the direction of the line of travel and also at right angles thereto.

Electric Motor for Railway Cars—Norman C. Bassett, Lynn, assignor to the General Electric Company, Boston, Mass. No. 527,927.

The motor is centered upon an axle of the vehicle, trunnions are placed upon the outside of the motor vertically in line with its center of gravity, and longitudinal yokes are supported by the wheel base of the vehicle to which yokes said trunnions are pivotally connected.

Switch Actuating Mechanism—Adam Matz, Cincinnati, O. No. 528,005.

The switch consists of a switch tongue, a pivoted tripping lever therefor and connected thereto, a locking pawl for said lever, under spring tension, a tripping dog, carried by the car, and means on the car, connected to said dog, for throwing the same into or out of engagement with the trip lever, or pawl.

Car Fender—Henry P. Weale, Boston, assignor of two-thirds to George L. Richards and Henry E. Turner, Malden, Mass. No. 528,048.

A life guard apparatus comprising a support on the car pivoted to swing in a horizontal plane, a fender pivoted to said support forward of the latter's center of oscillation so as to swing vertically, and means for moving said fender up and down comprising a vertically sliding and rotatable rod stationarily located on the car and having a slotted arm, and devices carried by the horizontally swinging support including a rod engaging said slotted arm.

Car Fender—Sylvanus D. Wright, New York. No. 528,057.

A car fender, comprising a movable screen frame, means for lowering the same, and spring pressed side wings loosely connected with the sides of the said screen frame and adapted to be unlocked on the downward movement of the screen frame.

TROLLEY WIRE SWITCH PLATE—Gustavus A. Huben, Springfield, O. No. 528,101.

A trolley switch with a metallic frame, having an enlarged mouth or opening, and a trolley wire entering the same, and elastic cushions arranged on each side of said trolley wire.

OCTOBER 30.

TROLLEY CATCHER—Woodson D. Cobb, Fort Worth, Tex. No. 528,149.

This is a pivotal trolley wheel with a spring actuated supporting frame, a catch for connecting the pole to said frame, a trip arranged at the free end of the pole for engagement with a trolley wire upon the dismounting of the trolley wheel from said wire, and connections between the trip and said catch.

CONDUIT ELECTRIC RAILWAY—Julius L. Hornig, St. Louis, Mo., assignor of one-half to Theodore H. Wurmb, same place. No. 528,205.

This is a combination of a main conductor, a continuous insulated holder for said conductor, a detachable trolley carried by said vehicle and guided by said conductor holder, a contact carried by said trolley and suitable electrical connections.

CAR FENDER—William G. Kerr, Providence, R. I. No. 528,298.

Guides are adjustably secured to a car body, shanks are movable in said guides, and a fender having side arms is pivoted to said shank to move vertically. There are means for supporting the fender in the plane of said shanks, and a device for depressing the forward end of the fender.

CABLE GRIPPER—James Whitall, Chicago, Ill. No. 528,313.

There is a suitable frame having a cam, a gripping jaw engaged by the cam and capable of moving relatively thereto in the direction of the length of the cable, said jaw having a yielding friction pad adapted to engage the cable, and rollers adapted to engage and bite the cable when the friction pad is compressed.

CONDUIT SYSTEM FOR ELECTRIC RAILWAYS—John B. Linn, Cleveland, O., assignor of one-half to Oliver S. Kelly, Springfield, O. No. 528,330.

A slot rail is formed of beams having a groove therein, a conductor is in the bottom of said groove and a channel iron is in the top of said groove. Contacting boxes are arranged between said beams and are also provided with grooves to form a continuation of the grooved slot rail.

GRIPPER FOR CABLE RAILWAYS—Benjamin Brownstein, Philadelpnia, Pa. No. 528,359.

The grippers consist of sections joined together to move laterally, and there are oppositely arranged spring actuated jointed rods on the sections to restore them to alignment and a lever to operate the jaws.

CLOSED CONDUIT ELECTRIC RAILWAY—James F. McLaughlin, Philadelphia, Pa. No. 528.379.

This is a closed conduit with a main or supply conductor housed therein, a sectional working conductor composed of sections in the conduit, and exposed sections seated in the top of the conduit and electrically connected to the sections in the conduit, and magnetically operated switches pivoted to the main conductor, formed with switch plates in operative relation to the underground sections of the working conductor and with armatures close to the top of the conduit.

SAFETY DEVICE FOR ELECTRIC CARS—John M. Kelly, Rochester, N. Y. 528,438.

This is a fender hinged at its rear end to the car, and a pivoted catch adapted to be connected with the free or forward end of the fender, said catch located in position and adapted to be operated by the foot of the motorman to drop the fender.

CLOSED CONDUIT FOR ELECTRIC RAILWAYS—William E. Stearns, Berlin, Conn., assignor by direct and mesne assignments, of one-third to David L. Bradt, John P. Coghlin and Frank O. Plummer, Worcester, Mass.

This is the combination of a compressible resilient insulating envelope, an electric conductor inclosed therein, and a traveling trolley plate having a downwardly extending perforated offset portion for shedding water, said plate carrying a series of trolley wheels co-operating with said conductor.

NOVEMBER 6.

TROLLEY WIRE CLIP—J. W. Perry, Philadelphia, Pa. No. 528,561.

A simple clip detachably connected to the wire. May be released without disturbing same.

STORAGE BATTERY—C. J. Reed, Philadelphia, Pa. Nos. 528,647–528,648.

Constructed in such manner that the electrodes of opposite polarity will be located as closely as possible without actual contact. Also the provision of means whereby, on the disintegration of active material, there will be little or no liabilily of the short circuiting of adjacent plates. Also to provide a battery having a maximum surface or area in as small or compact space as possible.

TROLLEY CATCHER—A. S. Osborn, Rochester, N. Y. No. 528,685.

The trolley when accidentally detached from conducting wire is automatically drawn down beneath the same, so as to escape contact with span wires.

INSULATING COMPOUND—Oscar Stiles, Omaha, Neb. No. 528,744.

A material more especially adapted to provide an insulating cover for wires, bars, or plates used in electrical appliances and to provide same with an insulated coating.

FENDER AND BRAKE FOR STREET CARS—J. S. Detrick, Baltimore, Md. No. 528,766.

The car is automatically stopped independently of the ordinary brake mechanism.

TROLLEY LINE BREAKER—C. H. Dey and J. M. Anderson, Boston, Mass, No. 528,767.

A trolley line breaker or insulating joint of a construction capable of being replaced in part, while the electric current is on the trolley line.

BOND FOR ELECTRIC RAILWAYS—H. B. Nichols and F. H. Lincoln, Philadelphia, Pa. No. 528,788.

The objects are to provide a simple and effective air and water tight joint or connections of a bond with rails for electric traction purposes and to provide a bonding joint for the rails of electric railways, in which the members are readily applied to rails, and metallic matter in molten condition is introduced and permitted to expand to establish air and water tight connection of bond wire with rails.

MOTOR FOR STREET CARS—H. S. Park, Chicago, Ill. No. 528,796.

A motor in which excessive weight for motor car will be avoided and a motor of nominal power only is needed for the propulsion. A secondary motor accumulates power when car stops or is running slowly and such power is applied to assist in starting car.

RAILWAY CAR—C. H. Barrows, Willimantic, Conn. No. 528,845.

The propelling mechanism is constructed in a manner to exert the required traction power for propulsion of car with a current from a comparatively light battery.

RAILWAY ELECTRIC SWITCH—W. V. Ash and J. H. Ash, Newark, N. J. No. 528,898.

The object is to provide mechanism by which a car approaching a switch in the rails may automatically throw the switch if it is improperly placed, hold it locked while passing over it, and afterwards release it and return it to its normal position.

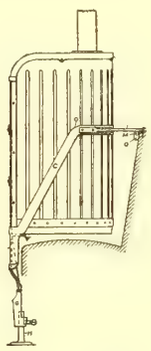
NOVEMBER 13.

TROLLEY—B. F. Lare and C. M. Greer. No. 528,949.

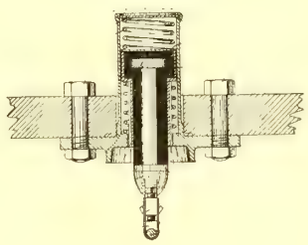
Very simple and efficient fork.

INTERSECTING ELECTRIC RAILWAY TRACK—Mark Lowd, Salem, Mass. No. 528,959.

The object is to produce a crossing adapted for electric railways, in which the current is conveyed to the car by discontinuous conductor sections which are energized in succession by the movement of the car along the track.



NO. 529,158.



NO. 529,058.

ELECTRIC RAILWAY SWITCH—R. A. Baldwin, South Norwalk, Conn. No. 529,011.

Switching apparatus for automatically moving the switch point of a railway track upon the approach of a car.

CAR FENDER—J. McCarthy, Newark, N. J. 529,041.

The fender or guard is horizontal and has a reciprocating sliding motion.

CAR FENDER—F. D. Weber, Brooklyn, N. Y. No. 529,052.

Consists of a fender attached to the car frame in front of the truck, on a level with the car platform. Has a lower auxiliary fender or receiver extending in front of the upper fender.

TROLLEY WIRE HANGER—J. M. Anderson. No. 529,058.

Used to suspend wires under bridges.

STREET CAR HEATER—M. K. Bowen, Chicago, Ill. No. 529,158.

Stove and casing are supported above the seat.

CAR FENDER—E. B. Graff, Baltimore, Md. No. 529,260.

Adapted to fit either end of a car. Has cushions, springs and light reception bed.

STREET CAR FENDER—H. C. Kennedy and G. W. Roletter, Philadelphia, Pa. No. 529,275.

Made V shape. Carried below the platform. Does not project beyond the same. Throws the object to either side.

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. THE STREET RAILWAY PUBLISHING COMPANY, HAVEMEYER BUILDING, NEW YORK.

What is Thought of Our Souvenir Edition.

"It is a striking example of the wonderful development of trade journalism in this country."—*Pacific Electrician.*

The Souvenir number of the STREET RAILWAY JOURNAL was certainly one of the handsomest and most complete trade journals ever issued from the press.—*Electric Power.*

"THE STREET RAILWAY JOURNAL has made its tenth anniversary the occasion for issuing a special number, containing an account of the Atlanta meeting of the American Street Railway Association. The number shows very great enterprise on the part of the owners of this publication."—*Locomotive Engineering.*

"LANGUAGE would fail us in the attempt to describe the magnificence of the souvenir number. All that the arts of photography, engraving, press work and coated paper can do has apparently been done to add to the splendor of this number. Altogether this achievement of our contemporary indicates prosperity, for which congratulations are in order."—*American Engineer and Railroad Journal.*

"OUR enterprising contemporary, the STREET RAILWAY JOURNAL, has lately issued a splendid example of artistic typography in the shape of a souvenir number, published in honor of its tenth anniversary, and of the Atlanta meeting of the American Street Railway Association. * * * * The whole forms a body of rare and useful information, indicative of the substantial character of trade journalism."—*Scientific American.*

"A SUPERB number is issued by the STREET RAILWAY JOURNAL, of New York City, in honor of its tenth anniversary and of the Thirteenth Annual Convention of the American Street Railway Association, held last week at Atlanta, Ga. The prosperous appearance of this journal evidences that its able and faithful labors in its special field have not been unappreciated. It also presents further testimony of the enduring and substantial character of legitimate trade journalism."—*Manufacturers' Record.*

"THE souvenir number of the STREET RAILWAY JOURNAL, which was published in honor of the tenth anniversary of that journal, is undoubtedly the largest and most elaborate number ever issued. The articles it contains are interesting and timely. The illustrations, which are numerous, are excellent in every respect. Considerable space is devoted to the American Street Railway Association and Atlanta, where its thirteenth annual convention has just been held. The street railways of the Southern cities are described and illustrated, some thirty pages being taken up".—*Electrical Industries.*

"THE STREET RAILWAY JOURNAL made the occasion of the Convention at Atlanta last month the excuse for issuing a souvenir number that reflected great credit upon the publishers, and that gave to those attending that Convention a great deal of valuable information. This issue also marked the tenth anniversary of the JOURNAL'S publication. The JOURNAL is always handsome, always interesting and always prosperous, but this issue was especially attractive. The excellence of its reading matter and illustrations was equaled only by the artistic display of its advertising pages and its general typographical appearance, which is saying much."—*Inventive Age.*

"MANY of our readers, no doubt, have seen and appreciated the souvenir number of our esteemed contemporary, the STREET RAILWAY JOURNAL, issued last month, in honor of its tenth anniversary, and of the Atlanta meeting of the American Street Railway Association. The number was a brilliant triumph of enterprise and the printer's art, and none are more heartily pleased with the success of the special effort than the *Car.* It was in itself a compliment to the trade the STREET RAILWAY JOURNAL so ably represents, and the *Car* is proud and happy in being connected with that special field of commercial enterprise that makes such an achievement possible by its generous support."—*Car.*

"THE STREET RAILWAY JOURNAL issued a souvenir number, October, 17, in honor of its tenth anniversary and of the Atlanta meeting of the American Street Railway Association. It contains a sixteen page article on Atlanta, a ten page article on the Association, a thirty page article on the street railway systems of Southern cities and a twenty page article on the history of the street railway industry. All of these are handsomely illustrated, the number containing over 400 illustrations, among which are more than 125 portraits of street railway men. The number contains 122 pages, and altogether is very creditable to the enterprise of the publishers."—*National Car and Locomotive Builder.*

"THE STREET RAILWAY JOURNAL commemorates its tenth anniversary and the Atlanta meeting of the American Street Railway Association with a souvenir number that is really remarkable as an artistic production. It is printed on plate paper throughout and most beautifully illustrated with half-tone engravings. Its reading pages are full of interesting matter, and the issue will be a valuable one to preserve for reference. In every way it is the finest example we have ever seen of the printers' and engravers' art, and illustrates the substantial character of trade journalism. Among the many features contained in the reading pages is a short history of the street railway industry, which is fully illustrated.—*Electrical Age.*

"THE STREET RAILWAY JOURNAL, of New York, celebrates its tenth anniversary by issuing a souvenir number of some 120 pages profusely illustrated. The first twenty-five pages are devoted to the American Street Railway Association, which held its thirteenth annual convention in Atlanta, Ga., this week, and to views of that city. A tour is then made of the most prominent Southern cities, and a few pages illustrative of the street railway system of each are given. A history of the journal itself follows, and after that comes "A Short History of the Street Railway Industry," which is very comprehensive. In all respects it is a very worthy effort, and will, no doubt, be appreciated by the street railway men of the country."—*Railway Review.*

"THE magnificent mammoth souvenir of the STREET RAILWAY JOURNAL, celebrating its tenth anniversary, contains 122 large quarto pages of reading matter, plus ninety-two pages of advertising, exclusive of cover. A large part of this space is occupied with matter pertaining to the annual convention of the American Street Railway Association, accompanied by portraits and brief personal sketches of the men who are most prominent in the organization. Other articles describing the city of Atlanta and other Southern cities, with a catalogue of the exhibits, a list of applicants for space and the amount of space awarded to each, the leading articles all handsomely illustrated (there are over 400 of these illustrations), make this one of the most remarkable numbers ever issued in the history of trade journalism.

"A history of street railways is another feature of this souvenir number that ought not to be missed in these reviews, but justice can not be done to it in the space here afforded. In an elegantly illustrated article of 14,000 words, the writer has presented a more comprehensive epitome of the origin and progress of the great street railway industry, than has been put in print in any serial publication. The first street railway car ever built is illustrated, and from this to the modern street car and the electro-motor of to-day, a great many rapid steps are reviewed."—*Engineering Magazine.*

SOME FOREIGN COMMENTS.

"THE STREET RAILWAY JOURNAL.—On the occasion of the tenth anniversary of its publication, and that of the Atlanta Convention of the American Street Railway Association, this important, voluminous and really admirable journal has published a unique number, containing a splendid résumé of the scientific, technical and industrial progress made by street railways, all brought up to the latest date.

"This issue, in addition to setting forth many modifications of apparatus, systems and of various installations, also presents to the reader photographs and biographical sketches of the various inventors, promoters and managers in the industry. Ordinary praise is not sufficient for such a publication, but we can truly say that it is equal to the best that can be hoped for in the line of typographical art and expert scientific and business editorship."—*L' Elettricità* (Milan).

"THE above facts we take from the STREET RAILWAY JOURNAL, which celebrates the tenth year of its existence by a souvenir number which must excite the admiration of all journalists, in whatever part of the world they may be situated. This issue contains 122 pages of matter and 105 pages of advertisements. It is printed throughout (editorial matter and advertisements) on thick glazed paper. Both the typography and the illustrations are of the very highest quality, and are unapproached by any technical journal in this country. The whole issue is a reflex of the activity, enterprise and success that marks the American street railroad of to-day. In spite of very serious difficulties, and not a few mistakes, the electric tramway has crowded out all competitors, and is now the prominent feature of American social life. By its aid the citizen deserts the tenement house of the town and speeds at the rate of twelve to twenty miles an hour to a suburban home, where he can live a healthier and a purer life. A new industry and a new source of investment have arisen, and it is not strange that it should support a monthly journal of great artistic merit. The number before us is intimately connected with the meeting of the American Street Railway Association at Atlanta, and contains a large number of portraits of prominent members. It is noticeable how many of these are young men who appear to have risen on the flowing tide and attained positions which, in this country at least, are usually occupied by their seniors."—*Engineering* (London).

"OUR cousins 'across the pond' give us good example and many a hint on many a subject, and on none more than that of journalism and periodical literature. I have before me the Souvenir number of the STREET RAILWAY JOURNAL, New York, It celebrates the tenth anniversary of its existence in a veritable *édition de luxe*, abounding in smart letterpress, interesting and artistic illustrations and attractive advertisements. The present number is devoted especially to blowing that excellent and melodious instrument, its own trumpet—a performance which its merit fully justifies—and to a description of the Thirteenth Annual Convention of the American Street Railway Association, at Atlanta, Ga.

"It does not, however, confine itself to these congenial subjects, but gives a most interesting sketch of the progress of street railways in the States from 1832—when the first passenger street car was launched on the iron road in New York—to the present time. It does *not* forget to remind us that, compared with the progress of the industry in America, England's tortoise-like advance has been almost imperceptible, and it very justly lays this at the door of the 'famous Act of Parliament,' passed in 1870, ' which has done so much to retard the development of street railroading in the mother country.'

"Ah well! Brother Jonathan, we move—slowly, no doubt, but we *do* move—and in spite of the disastrous decision of the House of Lords as to the proper interpretation of the said Act, the next ten years will, I venture to prophesy, show as much comparative progress in electric traction here as the last decade has witnessed in America.

"I only wish we had a 'Street Railway Journal' to help wake things."—*Lightning* (London).

QUOTATIONS OF STREET RAILWAY STOCKS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany Railway	100	1,250,000	Q Feb.	1½	1893	116	116½
Watervleit Turnpike & R. R. Co.	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Albany Railway, 1st Mort.	1865	34,000	J. & J.	5	1905	101½	.....
" " " 3d Mort.	1875	28,500	J. & J.	7	1895	101½	.....
" " " 4th Mort.	1880	11,500	M. & S.	6	1905	100	.....
" " " 5th Mort.	1888	38,000	M. & S.	5	1913	101	.....
" " " Consol Mtg	1890	388,000	J. & J.	5	1930	103½	.....
" " " Debenture.	1891	200,000	M. & N.	6	1901	117	.....
Watervliet Turnpike & R. R., 1st Mort.	1889	350,000	M. & N.	6	1919	111	113
Watervliet Turnpike & R. R., 2d Mort.	1889	150,000	M. & N.	6	1919	111	112
North & East Greenbush Horse R. R. Co.	1892	30,000	M. & N.	5	1911	.....	.....

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Nov. 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.	25	2,500,000	Sem-an	4	.....	71½	72
City & Suburban Ry. Co.	50	3,000,000	.....	1	.....	47	48
Central Pass. Ry. Co.	50	300,000	.....	...	.....	70	71
Balto. Traction Co. (Cable).	25	5,000,000	Quart.	1	.....	16½	17

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Central Pass. Ry.	1882	250,000	J. & J.	6	1912	110	112
" " " cons. mort.	1892	500,000	.....	5	.....	110	111
City & Sub. Ry. Co. gen. mort	.....	3,000,000	J. & D.	5	1922	111	111¼
Balto. Traction Co. (Cable).	1889	1,500,000	M. & N.	5	1929	107¼	107¾
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D.	5	1942	107¾	108
" " "	1891	1,250,000	M. & S.	6	1901	104	104½
City Pass. R. R. Co.	1891	2,000,000	"	5	1911	112	112½

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange, Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.	50	$6,400,000	J. & J.	4	1887	84	85
West End Com'n	50	9,085,000	J. & J.	3	1890-1892	59	60

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Nov. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Brooklyn City R. R. Co.	10	6,000,000	Q.—J.	2	.....	166	.....
Brooklyn Traction Co., pref.	100	3,000,000	.....	...	1893	72	.....
" " common.	100	6,000,000	.....	...	1893	15	.....
Coney Island & Brooklyn R. R. Co.	100	500,000	Oct. 1.	4	.....	.....	150
Long Island Traction Co.	100	30,000,000			1893	12	.....

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Broadway R. R. Co.	.....	350,000	J. & J.	5	6 m. notice	100	.....
Brooklyn Traction Co.	1893	3,000,000	.....	...	.....		
Coney Island & Brooklyn R. R. Co., 1st bonds.	.....	300,000	J. & J.	5	Jan. 1909	103	.....
Coney Island & Brooklyn R. R. Co., certificates.	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st.	.....	125,000	F. & A.	7	Aug. 1897	.....	107
South Brooklyn Central R. R. Co., 2d	.....	150,000	F. & A.	6	July, 1941	100	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	113	115

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Nov. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.	50	$100,000	J. & J.	0	.....	.....	73
Enterprise Ry. Co.	25	250,000	.....	...	.....	.....	5

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co.	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.	.....	50,000	J. & J.	5	1906	.....	.....

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 108 LaSalle Street, Chicago, Ill., Nov. 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City	100	$9,000,000	Q.—J.	3	.....	325	330
Chicago Passenger	100	1,000,000	A. & O.	2½	.....	160	.....
North Chicago City	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street	100	5,500,000	J. & J.	4	.....	264	265
West Division City	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street	100	13,189,000	Q.—F.	1½	.....	131¾	132½

BONDS.	Date of Issue	Amount Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City	.....	4,619,500	J. & J.	4½	.....	101⅛	101¼
Chicago Passenger	1883	400,000	F. & A.	6	1903	109½	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	105	.....
" " "	.....	1,850,000	M. & N.	4½	1927	100¼	100½
North Chicago Street 1st mort	.....	2,413,000	J. & J.	5	1906	.....	103½
West Chicago Street	.....	4,100,000	M. & N.	5	.....	103	103¾
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	100	101½
" " " Deb. 6's	.....	2,000,000	J. & D.	6	.....	103	103½

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Nov. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati	50	$8,250,000	Q.—J.	5	.....	108⅛	108½
Mt. Adams & Eden Park	50	1,600,000	Q.—J.	5	.....	108½	108½
Mt. Auburn Cable	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry	100	500,000	.....	...	.....	.....	60
" " " Pref.	100	100,000	.....	6	.....	.....	99¼
Cin. Newport & Cov. St. Ry.	100	3,000,000	.....		.....	26	27

BONDS.	Date of Issue	Amount Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati St. Ry.	.....	50,000	J. & J.	7	July, 1895	101⅛	104
" " "	.....	50,000	J. & J.	7	July, 1896	104	106
" " extended	.....	100,000	J. & J.	4	.....	99¼	100
" " "	.....	150,000	J. & J.	5	.....	100¾	101¼
Mt. Adams & Eden Park	.....	50,000	A. & O.	6	July, 1895	101	103
" " "	.....	50,000	A. & O.	6	July, 1900	107½	110
" " "	.....	100,000	A. & O.	6	July, 1905	110½	111½
" " 10-20's	.....	200,000	J. & D.	6	Je. '94-1924	102½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	105	105½
Cin. Inclined Plane Ry.	.....	125,000	J. & J.	7	July, 1899	.....	108
" " " "	.....	300,000	J. & J.	6	Jan. 1914	.....	106
Mt. Auburn Cable	.....	200,000	J. & D.	5	June, 1907	.....	90
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap. '93-1908	.....	.....
S. Covington & Cincinnati.	.....	250,000	M. & S.	6	Mar. 1912	114	115
S.Cov.& Cin. 2d Mort. gold 6's	.....	250,000	J. & J.	...	1932	114	115
Cin., Newport & Cov. 5's	.....	3,000,000	J. & J.	5	.....	94½	95

CLEVELAND STOCKS AND BONDS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
The Cleveland Electric Ry. Co.	100	12,000,000	.....	....	1893	51¾	52
The Cleveland City Ry. Co.	100	8,000,000	.....	....	1893	60	65

BONDS.	Date of Issue	Amount Out-standing	Interest Paid.	%	Principal Due.	Bid.	Ask'd
The Cleveland Electric Ry. Co.	1893	2,000,000	M.—S.	5	1910	100	102⅛
" " City " "	1893	2,349,000	.....			100	102

DETROIT STOCKS.—Corrected by CAMERON CURRIE & Co., Bankers and Brokers, 82 Griswold Street, Detroit, Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Fort Wayne & Belle Isle Ry. Co.	100	$250,000	.....	...	.....	200	.....
Detroit Citizens Street Ry. Co.	100	2,000,000	.....	...	.....	.....	100
Wyandotte & Detroit River Ry.	100	200,000	.....	...	.....	100	110

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co.....	100	1,000,000	J. & J.	4	.....	210	225
Holyoke Street R. R.....	100	250,000	J. & J.	4	.....	200	225
Northampton Street R. R.....	100	50,000	.....	...	.....	150	160

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Nov. 21.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry., Co., pref...	100	$2,000,000	A. & O.	5	Jan. 1891	90	91
Louisville St. Ry. Co., com....	100	4,000,000	.....	...	Jan. 1891	35	36

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	103	103½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	116	117
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	116	117
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	85	90

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$600,000	J. & J.	4	.....	45	47
New Haven & W. Haven R. R. Co	25	.....	.....	...	.....	...	.....
New Haven & Cent'lle H. R. Co.	.....	.....	.....	...	.....	....	.....
Hartford & Wethersfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
New Haven Street Ry. Co.....	1894	600,000	J. & J.	5	Jan. 1919	.....	100
New Haven & W. Haven R. R. Co	1892	500,000	M. & N.	5	Nov. 1912	100	102
Winchester Ave. R. R. Co. Deb.	1894	100,000	M. & S.	6	Mar. 1909	100	.....
Bridgeport Traction Co.....	1893	2,000,000	J. & J.	5	July, 1923	95	100
Hartford & Wethersfield Horse R. R. Co., Deb. Series A.....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series C.....	.....	100,000	M. & N.	5	May, 1910	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 188 Common Street, New Orleans, La., Nov. 23. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.....	100	1,200,000	Quart.	1½	1867	120½	122
Crescent City R. Co.....	100	1,150,000	"	3	.866	75	.....
Canal & Claiborne R. R. Co..	40	240,000	Semi.	2½	1888	38	42
New Orleans City & Lake Co.	100	1,500,000	Quart.	2½	1860	105	110
Orleans R. R. Co.....	50	185,000	"	2	1868	30	40
St. Charles Street R. R. Co..	50	600,000	"	2½	1863	57	59

Bonds.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1892	150,000	M & N	6	1912	101½	.....
Crescent City R. R. 1st Mort.	1883	75,000	M & N	6	'95-'99	101	.....
do do new	1886	40,000	M & N	6	1896	101½	.....
do do	1893	2,000,000	J & J	6	1943	90	93
N. O. City R. R. Co.....	1879	416,500	J & D	6	1903	117	120
N. O. & Carrollton R. R. Co..	1882	250,000	F & A	6	'97-'06	.....	.....
N. O. City & Lake R. R. Co., 1st Mort.....	1893	1,725,000	J & J	5	1943	95	95½
St. Charles Street R. R. Co...	1881	105,000	J & D	6	'95-'01	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co. Members Montreal Stock Exchange, 9 St. Sacrament Street, Nov. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry. (old stock)	50	$2,000,000	M. & N.	4	May, '91.	157½	157½
" " (new stock)	50	2,000,000	.....	...	May, 94.	155½	156

BONDS.	Date of Issue	Amount Outstanding.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....
	1893	700,000		4½			

NEW YORK STOCKS AND BONDS.—Corrected by JAMES MCGOVERN & Co. 6 Wall St., New York, Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	29	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	183½	186
Cen'l Park, North & East River	100	1,800,000	Q.—J.	2	.....	162	165
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	165	.....
Dry Dock, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.....	136	140
42d & Grand St. Ferry.....	100	748,000	Q.—F.	4½	.....	310	320
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	47	52
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	250	300
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	139	141
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	205	210
Third Avenue.....	100	5,000,000	M.—N.	4½	.....	186	187
23d St.....	100	600,000	Q.—F.	2½	.....	300	.....
Ninth Avenue.....	100	800,000	Q.—J.	1½	.....	145	.....
Union Railway Co.....	100	2,000,000	.....	...	.....	.....	160

Bonds.	Date of Issue	Amount.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	110	113
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	106	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	106	.....
Broadway Guaranteed 1sts....	.....	1,125,000	J. & J.	5	July 1924	107	.....
" 2ds interest as rental	.....	1,000,000	J. & J.	5	July, 1905	105	.....
Broadway Consolidated.....	.....	7,650,000	J. & J.	5	 1943	112	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	111	.....
Central Crosstown—1st mort..	.....	250,000	M. & N.	6	Nov., 1922	119	.....
Dry Dock, E. B'way & Battery. 1st mort.....	.....	.....	J. & D.	5	 1932	110	.....
Scrip (can be called at par)..	.....	1,200,000	F. & A.	6	Aug. 1914	100	101
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort. income bonds.....	.....	1,200,000	J. & J.	6	1915	.....	53
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	100	105
Houston, W. St. & Pav. F'ry, 1st	.....	500,000	J. & J.	7	July, 1894	100	.....
Second Avenue, 1st mort.....	.....	1,600,000	M. & N.	5	Nov., 1909	102	.....
Third Avenue.....	.....	7,000,000	J. & J.	5	Jan., 1937	119¼	119½
23d Street.....	.....	250,000	M. & N.	7	May, 1893	100	.....
Union Railway Co.....	.....	2,000,000	F. & A.	5	Feb, 1942	.....	.....

PHILADELPHIA SECURITIES.—Corrected by HUHN & GLENDINNING 143 South Fourth st. (Bullitt Building), Philadelphia, Nov. 20. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Citizens'.....	50	$500,000	Q.—J.	4	1858	272	274
Continental.....	50	1,000,000	J.—J.	6	1873	128	130
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	329	331
Germantown.....	50	1,500,000	Q.—J.	2¼	1858	112	113
Green & Coates...	50	500,000	Q.—J.	3	1858	126½	128
Hestonville...	50	2,050,000	.....	...	1859	62½	63
Lombard & South.....	25	500,000	A.—O.	8	1861	90	91
People's Traction Co.....	50	10,000,000	.....	...	.....	55	55½
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	165	166
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	81	82
*Philadelphia Traction (50 pd.)	50	7,000,000	M.—N.	3	1883	104½	104¾
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	230	235
Second & Third.....	50	1,060,200	Q.—J.	5	1853	215	216
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	230	231
Union.....	50	1,250,000	J.—J.	9½	1864	195	200
West Philadelphia...	50	750,000	J.—J.	10	1857	195	200
Metropolitan (N.Y.) Traction	100	30,000,000	Q.—F.	1	.....	107½	108
Baltimore Traction.....	25	5,000,000	.....	1	1889	16¾	17
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	52	54
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	25	29
Pitts. & Birmingham Trac. Co. *Ex. Allotments.	50	3,000,000	J.—J.	...	.....	12⅛	12¾

BONDS.	Date of Issue	Amount Outstanding	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	107¼	108¾
" " Imp.	1892	1,250,000	M.—S.	6	1901	101	102
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	100¾	102
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	105	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	103½	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	105	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Nov. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....
BONDS.	Date of Issue	Am't Out-stand-ing.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 306 Times Bldg., Pittsburgh, Pa., Nov. 22. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co.	50	1,500,000	.....	...	.....	20½	21
Citizens' Traction R. R. Co	50	3,000,000	J. & J.	3	.....	59	60¾
Pitts. & Birmingham R. R. Co	50	3,000,000	.....	...	.....	14¼	14
Pittsburgh Traction R. R. Co.	50	2,500,000	.....	3	.....	....	63½
Federal St. & Pleasant Valley	25	1,400,000	J. & J.	...	.....	21	21⅝
Pittsburgh, Allegheny & Man	50	3,000,000	.....	...	.....	38¼	39
West End R. R. Co.	50	1,000,000	J. & J.	1	.....	21	.....
Second Avenue R. R. Co.	50	1,000,000	J. & J.	2	.....	50	.....
Penn Incline Plane Co.	50	250,000	.....	...	.....	....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.. ..	.....
Fort Pitt Incline Plane Co.	50	60,000	.....	...	.....	....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	....	.....
Pittsburgh Incline Co.	100	100,000	J. & J.	5	.....	....	.....
Duquesne Traction Co.	50	3,000,000	.....	...	.....	27	27¼
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co.	1887	1,250,000	A. & O.	5	1927	106	.....
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1927	105	106
Pitts. & Birmingham Traction Co.	1892	.....	.....	5	.....	95	95½
Pleasant Valley Ry.	1892	1,250,000	J. & J.	5	1919	....	100
P., A. & M. R. R. Co.	1891	1,500,000	J. & J.	5	1931	103½	104
Duquesne Traction Co.	1890	1,500,000	J. & J.	5	1930	102	102¾
Second Ave. Electric R. R. Co		500,000	J. & J.	5	1923	....	.....
Central Traction Co.	1889	375,000	J. & J.	5	1919	....	.....
Union R. R. Co.	1881	100,000	A. & O.	5	1901	....	.....
West End R. R. Co.		500,000	J. & J.	5	1922	104	.....
Birmingham, Knoxville & Allentown Tract. Co.	.....	.....	.....	6	.....	....	.....
Suburban Rapid Transit.	.....	.....	.....	6	.....	....	.....
Fort Pitt Incline Plane Co.	1881	30,000	.....	6	1901	....	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	....	.....
Penn Incl'e Plane Co. 1st Mort	1883	125,000	.....	6	1903	....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	....	.....
Pittsburgh Incline Co.	1889	200,000	J. & J.	6	1910–19	....	.....

PROVIDENCE STOCKS AND BONDS.—Corrected by CHACE & BUTTS Bankers, Providence, Nov. 19.

Company	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
United Traction & Electric Co.	100	.....	.....	...	.....	.. ..	.....
BONDS.	Date of Issue	Amo'nt Out-stand'g	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
United Traction & Electric Co.	1893	8,000,000	M & S	5	1993	95	100
Newport St. Ry. Co.	.....	50,000	J & D	5	1910	100	.....

ROCHESTER, BUFFALO, PATERSON, COLUMBUS, WORCESTER AND BOSTON STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Nov. 19.

Company.	Par.	Capital.	Period.	% last div	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.	100	5,000,000	.....	...	1890	38	39
Buffalo (N.Y.) Ry.	100	6,000,000	.....	...	1891	65½	66½
Paterson (N. J.) Ry.	100	1,250,000	.....	...	1891	12	15
Columbus (O.) St. Ry.	100	3,000,000	Q.—F.	1	1892	46	47
North Shore Traction Co. (Boston) Pref.	100	2,000,000	A.—O.	6	1892	84	86
do do Common.	100	4,000,000	.....	...	1892	24	25
Worcester Traction Co. Pref	100	2,000,000	F.—A.	6	1892	80	82
do do Common.	100	3,000,000	.....	...	1892	15	17
Consol. Trac. Co. (N. J.)	100	.....	.....	...	1893	32	34
BONDS.	Date of Issue	Amount Out standing.	Inter-est Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y.) Ry.	1890	3,000,000	A & O	5	1930	98	99
Buffalo (N.Y.) Ry.	1891	5,000,000	F & A	5	1931	101	102
Paterson (N. J.) Ry.	1891	850,000	J & D	6	1931	90	95
Newark (N. J.) Pass. Ry.	1890	6,000,000	J & J	5	1930	100	101
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	97	98
Consol. Trac. Co. (N. J.)	1893	.....	J & D	5	1933	89	90

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Nov. 23.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
California St. Cable Co.	100	1,000,000	Monthly	...	.....	100	105
Geary St., Park & Ocean R.R. Co	100	1,000,000	Monthly	...	.....	85	100
Market Street Cable Co.	.....	18,750,000	.....	...	.....	38⅝	39
Oakland, S. L. & Haywards.	.....	.....	.....	...	.....	.....	1/0
Presidio & Ferries R. R. Co.	100	1,000,000	.....	...	.....	.....	12¼
Sutter St. R. R. Co.	.....	2,000,000	Quart'ly	...	.....	.....	.....
Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cal. St. Cable R. R.	.....	.....	J. & J.	5	.....	107½	.....
Geary St., Park & Ocean.	.....	650,000	A. & O.	5	.....	104	106½
Market Street Cable Co.	.....	3,000,000	J. & J.	6	1913	120	.....
Omnibus Cable Co.	.....	2,000,000	A. & O.	6	1918	116	116½
Park & Ocean R. R.	.....	250,000	J. & J.	6	1914	112	.....
Park & Cliff House R. R.	.....	350,000	J. & J.	6	.....	93	100
Powell Street R. R.	.....	700,000	M. & S.	6	1912	107	.....
Sutter St. Cable Co.	.....	900,000	M. & N.	5	.. ..	104½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Broker, Rialto Building, 218 N. 4th St., Nov. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cass Ave. & Fair Grounds.	100	2,500,000	.....	...	1876	60	62
Citizens'	100	1,500,000	Oct. '93	4	1887	80	90
Jefferson Avenue.	100	112,000	Dec. '88	2	1885	125	135
Lindell	100	2,500,000	.....	...	1890	106	108
Missouri	100	2,000,000	Q.—J.	2	1891	200	210
People's	50	1,000,000	Dec. '89	50c	1889	20	25
St. Louis	100	2,000,000	J. & J.	3½	1890	148	150
Fourth Street & Arsenal	50	150,000	.....	...	1872	5	10
Union Depot	100	4,000,000	Jan. '94	8	1890	150	200
St. Louis & Suburban	100	2,500,000	... .	...	1891	22½	23
Southern, Pfd.	.....	800,000	Jan. '94	3	.....	80	85
" Com.	.....	700,000	.....	...	.....	15	25
BONDS.	Date of Issue	Amount Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Cass Avenue & Fair Ground.	1892	1,800,000	J. & J.	5	1912	98	100
Citizens' Cable	1887	1,500,000	J. & J.	6	1907	105	107
Fourth St. & Arsenal	1888	50,000	J. & J.	6	1898–1903	98	100
Lindell	1890	1,500,000	J. & J.	5	1895–1910	102	103
Missouri Cable	1887	500,000	M. & S.	6	1907	100	102
People's 1st mort.	1882	125,000	J. & D.	6	1902	99	100
" 2d mort.	1886	75,000	M. & N.	7	1902	100	102
People's Cable	1889	800,000	J. & J.	6	1889–1914	90	95
St. Louis Cable	1890	1,500,000	M. & N.	5	1900–1910	101	103
Union Depot	1890	4,000,000	A. & O.	6	1900–1910	105	106
Southern	1884	200,000	M. & N.	6	1904	103	105
Southern	1889	300,000	M. & N.	6	1909	100	104
St. Louis & Suburban	1891	1,400,000	F. & A.	5	1921	85	87
St. Louis & Suburban (incomes)	1891	300,000	.....	6	.....	40	60

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Nov. 21. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	280	.....
Metropolitan R. R.	50	750,000	Q. J.	2	1864	80	.....
Columbia R. R.	50	400,000	Q. M.	1	1870	59	.....
Belt R.R.	50	500,000	Q. J.	...	1875	....	35
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	33	40
Georgetown & Tenallytown.	50	200,000	.....	...	.....	.....	85
BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Wash'tf & Geo'tn conv't. 1st.	'83-'99	3,000,000	J. & J.	6	1899-1929	130	140
" " " 2d.	.....	500,000	J. & J.	6	1903–1943	130	140
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	103	103½
Belt	.....	500,000	J. & J.	6	1921	80	85
Metropolitan R. R. convert.	.....	200,000	J. & J.	5	1901	102	105

Financial.

THE Syracuse & East Side Railway Company has increased its capital stock from $200,000 to $250,000. The liabilities of the company amount to $135,000.

$ $ $

THE North Side Street Railway Company, of Fort Worth, Tex., was sold November 20, by order of the court, to the Fort Worth Street Railway Company.

THE Globe Street Railway Company, of Fall River, carried 4,718,671 passengers during the year ending September 30, 1894, as against 4,475,720 for the previous year.

$ $ $

THE Tonawanda Street Railway and Tonawanda Electric Railway are being consolidated under the name of the Buffalo, Tonawanda & Niagara Falls Electric Railroad Company.

$ $ $

THE receiver of the Flushing & College Point Electric Railroad Company is seeking to interest capital, and to reorganize the company on the basis of extensions in Flushing Village.

$ $ $

THE trustees of the Street Railway & Illuminating Properties, of Boston, have purchased and canceled 586 shares of preferred stock, paying an average price of $102.35. This makes a total of 17,693 shares purchased to date.

$ $ $

THE Worcester Consolidated Street Railway Company reports as follows for the month of October: Gross earnings $32,379.64 against $25,110.90 last year; operating expenses, $16,482.61, against $22,-340.32; net income, $15,897.03 against $2,770.58, an increase of $13,126.45.

$ $ $

THE Citizens' Traction Company, of Pittsburgh, Pa., reports a net income of $182,587.56 for the year ending October 31, 1894, against $189,098 for the previous year, this year's earnings being equal to 6.086 per cent. on the capital stock. The present officers and directors were re-elected.

$ $ $

THE Chicago General Street Railway Company reports operations for six months ending October 31, as follows: Gross receipts, $34,779.95; operating expenses (including suspense account), $18,-404.23; net income and cash on hand, $16,395.72; number of cars operated in May and June, five, the remaining four months seven, on four miles of double track.

$ $ $

THE report of the Eighth Avenue Railroad Company, of New York City, for the quarter ending September 30, shows: Gross earnings from operations, $204,511; operating expenses, $145,652; net earnings, $58,858; other incomes, $6,907; gross income, $65,766; fixed charges, $23,750; net income, $42,016; cash on hand, $26,131; profit and loss, surplus, $29,000.

$ $ $

THE New England Street Railway Company reports gross passenger receipts for October, of $18,070, as against $15,668 last year, an increase of $2,402. The gross receipts for the ten months and three days ending November 3, were $205,631, as against $191,102 last year, an increase of $14,529. These figures cover the operation of the company's New Haven and Plymouth lines.

$ $ $

THE annual report of the Worcester (Mass.), Leicester & Spencer Street Railway Company, for the year ending September 30, shows gross receipts of $77,862.30; operating expenses, $50,847.20; salaries, office expenses and fixed charges, $14,286.14; net earnings, $12,728.96. The company has paid in dividends during the year, $18,750, has carried 1,586,843 passengers, and its cars have run 296,490 miles.

$ $ $

THE Cayadutta Electric Railroad Company reports for the ten months ending April 30 (when the road was leased to the Fonda, Johnstown & Gloversville Railroad Company) as follows: Gross earnings from operation, $51,019; operating expenses, $39,012; net earnings, $12,006; fixed charges, $24,092; deficit for the year. $12,086. Total, $12,504; cash on hand, $389; betterments, $61,596.

$ $ $

IT is reported that prominent stockholders of the Metropolitan Elevated Railway Company, of Chicago, have acquired control of the Chicago & South Side (Alley Elevated) Company. It is locally believed that the North and West Side Companies are behind this matter, and that they will use the Alley Elevated road to secure connections to the South Side, thus competing in the territory of the Chicago City Railway Company.

$ $ $

FOR the quarter ending September 30, the Central Cross Town Railroad Company, New York, reports: Gross earnings from operation, $125,318; operating expenses, $94,161; net earnings, $31,156; other income, $1,190; gross income $32,547; fixed charges, $26,-254; net income, $6,092; cash on hand, $22,288; profit and loss (surplus), $10,723. The net income for the same quarter last year was $6,313.

$ $ $

FOR the quarter ending September 30, the Second Avenue Railroad Company, of New York City, reports: Gross earnings from operation, $284,593; operating expenses, $190,853; net earnings, $93,740; other income, $625; gross income, $94,365; fixed charges, $44,-169; net income, $50,196; cash on hand, $77,561; profit and loss (surplus), $61,459. The net income for the same quarter last year was $55.099.

THE Metropolitan Railroad Company, of Washington, D. C., has decided to bond its property in the sum of $1,700,000 for the purpose of defraying the expenses incident to the construction of an underground electric system throughout its lines. It is said that the system to be used is that of the General Electric Company, which is claimed to be a decided improvement over the Buda-Pesth system of underground conduits, and which has already been adopted by the Metropolitan Street Railway Company, of New York, on its Lexington Avenue lines.

$ $ $

THE property of the Northeast Railway Company, of Kansas City, is to be sold to pay bonds issued in 1889. The Jarvis-Conklin Mortgage Trust Company has a judgment for $292,702.60, with interest and costs. On November 1, 1889, the railway company gave the plaintiffs $260,000 in 6 per cent., twenty year bonds, secured by mortgage and by a large amount of real estate in Kansas City. It was stipulated that if at any time the interest were not paid within three months after it was due the property should be sold.

$ $ $

THE annual report of the Worcester (Mass.) Consolidated Street Railway Company for the year ending September 30, 1894, shows gross earnings of $354,999.55 against $337,657.32, last year, and operating expenses of $284,214.92, leaving a net income of $70,784.63. Deductions from earnings are: Interest, $27,621.42; taxes, $15,613.56; rentals, $2,243.54; total, $45,478.52; net income, $25,306.11. The total number of passengers carried during the year was 7,293,410, against 7,192,883 last year. The number of miles run during 1893–1894 was 1,434,887, against 1,208,854, the year previous.

$ $ $

MESSRS. HAMBLETON & COMPANY, of Baltimore, Md., say of the Baltimore Traction Company: "The earnings are daily increasing, and the management has instituted rigid economies, without in any way affecting the efficiency of the system, and net results are very satisfactory. The company earned in October, $89,989.56, gross, against $83,765.56 for the same month last year, and the net earnings show an increase of $12,490. * * * * The lines of the company's North Baltimore division are showing wonderful gains. * * * This division is earning $50,000 per annum over fixed charges."

$ $ $

THE Ottawa (Ont.) Electric Railway Company has decided to issue $187,700 of new capital stock, in addition to its present capital of $625,600, the proceeds to be used to cancel the floating indebtedness, and to provide for extensions of the system. Present stockholders will have the right of subscribing to the new stock at par on or before December 15, the amount undertaken to be sold by the directors to the highest bidders. There appears to be no question about the stockholders eagerly taking the new issue, as the present stock is changing hands at from 165 to 180 per share, and the company paid 8 per cent. dividends in 1893-1894. The company has no funded indebtedness.

$ $ $

THE Third Avenue Railroad Company, of New York City, reports for the two years ending October 31, 1893 and 1894, as follows: Received from car passengers in 1894, $2,007,804.83; in 1893, $1,653,-539.33; increase, $354,265.50. Operating expenses in 1894, $1,070,-965.66; in 1893, $1,188,235.01; decrease, $117,269.35. Other income, $26,633.11 in 1894, and $92,303.13 in 1893; decrease, $65,670.02. Gross income in 1894, $964,472.28; in 1893, $557,607.45; increase, $405,864.-83. Taxes and bond interest in 1894, $328,467.74; in 1893, $248,539.-30; increase, $79,928.44. Net income in 1894, $635,004.54; 1893, $309,068.15; increase, $325,936.39. Dividends, 1894, $560,000; 1893, $240,000; increase, $320,000. Surplus, 1894, $75,004.54; 1893, $69,-068.15. The report is signed by Alfred Lazarus, secretary. The company has declared a dividend of 4 per cent. on its capital stock, payable November 28.

$ $ $

THE *Daily Stockholder* (Phila.) announces that Vice-President Frank Thompson and Director A. J. Cassatt, Clement A. Griscom and Wm. Elkins, of the Pennsylvania Railroad Company, and P. A. B. Widener, president of the Philadelphia Traction Company, will be in the directory of the Consolidated Traction Company, of New Jersey, upon its proposed reorganization this month, and that the remaining members of the Board will be Thomas Dolan, of Philadelphia, president of the United Gas Improvement Company; John D. Crimmins, John I. Waterbury, president of the Manhattan Trust Company, and Thomas F. Ryan, treasurer of the Metropolitan Traction Company, all of New York; E. F. C. Young and B. M. Shanley, of Jersey City; and Gen. W. J. Sewell, of Camden. This board will be one of great financial strength, and it may reasonably be inferred that the interests of the Pennsylvania Railroad Company and the Consolidated Traction Company, in New Jersey, will not henceforth be antagonistic.

$ $ $

THE Manhattan Railway Company reports that for the quarter ending September 30, the gross earnings of all the elevated railroad lines in this city aggregated $2,049,810, a decrease of $329,610, as compared with the corresponding period of a year ago. The gross operating expenses were $1,250,635, and the net earnings were $799,175, a decrease of $279,439. After payment of all fixed charges there remains a surplus of $176,448, which is a decrease from the surplus of

a year ago of $292,467. The company's balance sheet shows: Assets —Cost of road, $55,030,610; cost of leases, $14,014,000; other permanent investments, real estate, $2,381,929; supplies on hand, $283,710; due by agents, $13; due by others, $10,166; due by companies and individuals, $26,573; cash on hand, $393,818; leases on call, $640,000; estate Jay Gould, secretaryship, $300,000; sundries, $37,588. Total, $73,118,409 Liabilities—Consolidated capital stock, $30,000,000; funded debt, $36,078; interest on funded debt due and accrued, $414,946; dividends unpaid, $18,862; due for wages and supplies, taxes, etc., $796,758; due companies and individuals, $30,246, convertible bond certificates, $88,035; Manhattan 4 per cent. bonds, special account, $300,000; profit and loss (surplus), $5,349,644. Total, $73,118,409.

$ $ $

IT is reported that all the street railway and electric lighting interests of Toledo, O., are to be consolidated, Charles A. Coffin, president of the General Electric Company, and Norman B. Ream, vice-president of the Toledo Consolidated Street Railway Company, being the principal parties behind the consolidation. Local papers state that the various companies will go into combination on the following basis:

Consolidated Street Railway Company	$3,000,000
Toledo Electric Street Railway Company	1,400,000
Toledo Electric Company	350,000
Western Electric Company	200,000
Total	$4,950,000

$ $ $

It is stated that the new organization will have a capital stock of $5,000,000. The proposition is to do away with all but two power houses, one for power and one for lighting.

$ $ $

THE reports of the two railroad companies which comprise the Brooklyn Traction Company system, for the quarter ending September 30, are as follows:

ATLANTIC AVENUE.

	1894.	1893.
Gross earnings	$252,275.87	$234,227.07
Operating expenses	158,571.63	160,758.07
Net earnings	93,704.14	73,489.00
Income from other sources	22,773.42	19,463.15
Gross income	116,477.56	92,952.15
Fixed charges (including taxes).	71,781.79	50,908.78
Net income	44,695.77	42,043.39

BROOKLYN, BATH & WEST END.

	1894.	1893.
Gross earnings	$58,572.77	$53,698.18
Operating expenses	26,080.61	28,876.85
Net earnings	32,492.16	
Income from other sources	980.38	
Gross income	33,472.54	24,821.33
Fixed charges (including taxes).	15,251.62	10,908.84
Net income	18,220.92	13,908.84

$ $ $

THE Metropolitan Traction Company has issued a statement of the company's condition on October 1, 1894, which shows capital stock issued, $27,301,650; net cash in bank and due in open accounts from other companies, $3,362,532; balance represented by investments in stocks and bonds of other companies controlled and operated by the Metropolitan Traction Company, $23,939,018; total, $27,301,650. The Metropolitan Street Railroad alone is earning 5 per cent. on investments. The company owns the Columbus & Ninth Avenue cable road, the Lexington Avenue cable road and the Lenox Avenue underground electric road. The Columbus Avenue road will, it is said, be operated as a through cable road by November 15, in connection with the Broadway road. Both the Lexington Avenue and the Lenox Avenue roads are being built, and will probably be finished before the first of the year. When the lines are completed the company will own and control 143 miles of road. The 120 miles in operation show an increase in net earnings for September last over September, 1893, of over $50,000. The bonds and stocks of these companies in the treasury of the Metropolitan Traction Company are: Columbus & Ninth Avenue first mortgage 5 per cent. bonds, $3,000,000; Columbus & Ninth Avenue capital stock, $3,000,000; Lexington Avenue & Pavonia Ferry Railroad Company's first mortgage 5 per cent. bonds, $5,000,000, and $5,000,000 capital stock of the same company, making a total of $16,000,000.

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Reorganization in Savannah.

The Savannah Electric Railway Company has announced the following plan of reorganization: $600,000 5 per cent. bonds will be issued to take up the $800,000 of 6 per cent. bonds now on the property; $250,000 of new 5s together with 25 per cent. of the company's common stock, and 25 per cent. of stock of the Brush Electric Light Company will be exchanged for the $250,000 6 per cent. bonds of the Savannah Electric Railway Company. The $250,000 of the Savannah Street Railway Company's bonds will be exchanged at par for the new 5s, and the $300,000 on the consolidated property will receive 25 per cent. in the new bonds. The surplus bonds and the Brush Electric Light stock will be used to pay all outstanding obligations. The present management will remain in control.

Street Railway Traffic in New York City.

The tabulation of the annual reports of the New York City and Brooklyn surface and elevated railroad companies reveals a number of interesting facts. It appears that the adoption of the cable and electricity upon the surface lines has brought about an increase of speed which (perhaps in connection with the much more brilliant lighting systems of gas and electricity) has drawn an immense amount of traffic away from the elevated lines. The Manhattan Railway Company has lost nearly 20,000,000 passengers and $1,000,000 in gross earnings, a very large part of which went to the credit of the Metropolitan Street Railway Company and to the Third Avenue Railroad Company.

Nearly all the surface railways operated by horses showed a decrease during the year, owing partly to the hard times and partly to competition of improved motive powers.

In Brooklyn the elevated roads lost about 8,000,000 passengers, while the surface lines gained nearly as many, although the total traffic, both of New York City and Brooklyn, showed some decrease over that of the previous year, owing, doubtless, to the financial troubles.

A Nickel Plated Road.

"Are the rails and engines all nickel plated?" is asked, time and again, by parties who are contemplating a trip West over this now famous and popular route. "If not, where did it get its name of Nickel Plate?" That is the question! Where did it get its name? It has justly earned its great popularity by reason of its smooth roadbed, elegant equipment, superb dining cars, fast time, and above all, by its giving to the public the *lowest rates* of any *first class* line between the East and West. Popular low rate excursions are of frequent occurrence, and every attention is shown its patrons for their comfort and pleasure. Through palace sleeping cars are run between Boston, New York and Chicago, over the Fitchburg, West Shore and Nickel Plate roads. All information as to *low* rates, through sleeping cars, etc., may be obtained of your nearest ticket agent, or by addressing F. J. Moore, General Agent, Nickel Plate Road, 23 Exchange Street Buffalo, N. Y. **

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During the period covered by the World's Fair, the Lake Shore & Michigan Southern Railway came into great prominence as the route of the Exposition Flyers. These were the fastest long distance trains ever placed in service on any line of railway. They made the run from Chicago to New York in the remarkable time of twenty hours. Great importance attached to this event. The eyes of the railroad and the traveling world watched the performance of these trains; newspapers devoted columns to, and poetry and stories were written about them. They were recognized as one of the leading features in connection with the great Columbian Exposition. They aptly and powerfully illustrated the merits of this great line as a passenger route.

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A SUPPLEMENT TO

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1894.

AMERICAN STREET RAILWAY INVESTMENTS

A SUPPLEMENT TO THE STREET RAILWAY JOURNAL

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AMERICAN STREET RAILWAY INVESTMENTS

A SUPPLEMENT TO THE STREET RAILWAY JOURNAL

EDITION OF 1894.

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NOTICE.

The publishers, having taken the utmost care to insure accuracy in the compilation of this supplement, will not hold themselves responsible for errors. It is earnestly requested that their attention be called to mistakes of any kind in order that they may be corrected in subsequent issues, or in the Street Railway Journal.

The Municipal Transportation Industry.

Fifteen years ago the street railway industry in this country was in its infancy. A few shrewd and far sighted capitalists were quietly at work securing the franchises and building the lines which were to develop into the magnificent systems of the present day. In the principal cities only was there any attempt to operate on a large scale, and street railway securities were treated by the general investor with indifference, if not with contempt, as representing, like gas company stocks, local enterprises, "possibly safe, but quite insignificant."

This feeling was not wholly unjustifiable. It has always been impossible for horse railways to carry the number of people who wish to ride, to carry them safely and pleasantly, and to operate with high economy. At the best they have been but a makeshift, and their managers have for many years hoped for better things. Moreover, these horse railway properties have rarely *paid* dividends, not because unprofitable, but because their net earnings have been necessarily devoted to building the extensions and making the improvements imperatively demanded by an impatient public. Such properties, therefore, have been less attractive to the cautious investor, anxious for a sure and regular income, than to the capitalist looking to the future.

The introduction of the cable system in San Francisco, Chicago and Kansas City went far to open the eyes of "outsiders" to the possibilities in this field. Gross receipts doubled and trebled with the advent of clean and swiftly moving cars. Operating expenses dropped from 80 per cent. to 60 per cent. of the gross receipts, and the net earnings returned excellent dividends upon the large additions to the capital investment. The cable system, however, was available only in the most crowded districts of the larger cities, as the first cost of construction was not justified, except with great density of traffic. The horse still wearily plodded through the streets of most of our larger cities, until, in 1888, electricity was first successfully applied to street railway propulsion on a moderately large scale.

The past six years have witnessed a development in this field unprecedented among industrial enterprises. Not only have nearly all the previously existing horse railway systems adopted electricity as a motive power, but extensions have been pushed in every direction through suburban territory whose development would otherwise have been retarded for years. New electric roads have been built in cities and towns which could hardly support a horse railway. Interurban lines are building, and more than twenty thousand electric cars are now in operation under nearly ten thousand miles of trolley wire. The cable system retains its place where already installed in crowded city streets, and a few new lines are building where electric rights cannot be obtained; but horses are rapidly disappearing, never to return.

The street railway industry to-day attracts the brightest minds in the realms of engineering, finance and railroad management. Consolidations have been effected by which struggling and barely profitable lines have been welded into "systems" which compare favorably with the smaller steam railway enterprises, whether gauged by mileage, by earnings, or by capitalization. Investors are learning that there are several elements of safety in this field which are not found in other transportation or industrial enterprises. Destructive competition is rarely a menace to these consolidated street railway properties serving single municipalities. The various methods of attracting business from rivals, common in steam railway management, are here unknown. The business is done for cash and not on the credit system which has wrecked so many industrial enterprises. And, finally, the operation of these properties is carried on, not over an extensive territory, but under the direct daily observation of thousands of people more or less interested in bringing about the utmost perfection of service.

One thing is now lacking—a quick and ready market for street railway securities. This cannot be obtained without greater publicity than has hitherto been possible. When it is known, not only that the securities are safe, but that they are instantly salable, in case of necessity, their value will be greatly enhanced. Five years ago "American Street Railway Investments" could not have been published. To-day we acknowledge with the utmost pleasure and satisfaction, the hearty co-operation and valuable assistance which we have received at the hands of the street railway managers throughout the country.

BROOKLYN, N. Y.

MUNICIPAL STATISTICS AND INFORMATION.

Location.—Brooklyn is located on the East River, at the extreme western coast of Long Island and is directly opposite New York City. It is the county seat of Kings County.

Population.—The population of Kings County in 1880 was 599,495, and in 1890, 838,547, an increase of 39.9 per cent. The total present population of the city and suburbs is approximately 1,000,000.

Railroad Connections.—Brooklyn is served by the Long Island Ry. system, and by various minor roads to Coney Island. Thirteen lines of ferry boats connect the city with New York and with the Western trunk lines at Jersey City. The great steamship lines of New York City, many of which have warehouse facilities on the Brooklyn water front, furnish a foreign market to the large manufactured product of the city.

Manufacturing Interests.—A capital of about $162,000,000 is employed in the various manufacturing industries of the city, the principal productions being refined petroleum, boilers, castings and other manufactured iron, wire, lace, buttons, paper, felt goods, carpets, glass, chemicals, sugar and molasses, coffee and spice, confectionery, cordage and twine, slaughtering products, paperhangings, furnishing goods, boots and shoes. About 109,000 hands are employed in these industries, receiving in wages about $65,000,000 per annum, and the value of the manufactured product is about $269,000,000 per annum.

Banking Capital.—There are now (1894) 5 national banks with a combined capital and surplus of about $4,000,000; 17 state banks, with capital and surplus of about $5,000,000; 8 trust companies, with capital and surplus of $9,000,000; 13 savings banks, with surplus of about $10,000,000; and 1 private bank. The total banking capital is approximately $28,000,000, equivalent to about $35 per capita population.

Assessed Valuation.—The assessed valuation of real estate is (1893) $486,531,506, the property being assessed at about 70 per cent. of its real value. The assessed valuation of the personal property is $19,523,170. The total valuation of real and personal property is $506,054,676.

Municipal Debt.—The municipal debt of the city less sinking funds is (1894) $48,034,214.

Tax Rate.—The tax rate is (1893) $28.50 per $1,000.

STREET RAILWAY SYSTEM—Descriptive.

Brooklyn is served by an extensive system of elevated and surface railways, which have aided very largely in its development, and which form a network over the entire city, and the western portion of Long Island. The elevated system is 25 miles in length and carries about 50,000,000 passengers per annum. The surface system is now about 200 miles in length (350 miles of track), and carries nearly 125,000,000 passengers per annum. A large proportion of the surface lines are already equipped with the trolley electric system, and the remainder are rapidly being converted to the same system of motive power. In addition to the heavy local, suburban and New York patronage of Brooklyn's street railway system, it obtains during the summer season an immense amount of pleasure travel to Coney Island and the various resorts on the Long Island coast, this being a profitable and constantly growing source of revenue. The street railway mileage is controlled as follows:

	Owns	Operates
Long Island Traction Co. (controls 245.2 miles)....		
Brooklyn Heights R. R. Co.....	1.2	245.2
Brooklyn City R. R. Co.....	199.1	
Brooklyn, Queens Co. & Suburban R.R. Co.	44.9	
Broooklyn Traction Co. (controls 56 miles).....		
Atlantic Ave. R. R. Co.....	42.7	56.0
Brooklyn, Bath & West End R. R. Co.....	13.3	
Coney Island & Brooklyn R. R. Co.....	24.8	24.8
Brooklyn City & Newtown R. R. Co.....	21.4	21.4
Van Brunt St. & Erie Basin R. R. Co.....	3.0	3.0
Total.....	350.4	350.4

STREET RAILWAY SYSTEM—Present Companies.

Long Island Traction Co.—Chartered, Mar. 10, 1893. Annual meeting first Tuesday in Mar. This company was organized for the purpose of controlling various street railway properties in Brooklyn through ownership of stock, and is not an operating company. The dividends upon its stock are derived from the surplus earnings over and above interest and guaranteed dividend charges of the operating companies which it controls.

The company owns the entire capital stock ($200,000) of the Brooklyn Heights R. R. Co. and the entire capital stock ($2,000,000) of the Brooklyn, Queens County & Suburban R. R. Co., and these securities together with cash in treasury and the sum of $4,000,000 deposited with trustees form its present assets.

The Brooklyn Heights R. R. Co. owns and operates 1.17 miles of cable railway, and leases and operates the entire property of the Brooklyn City R. R. Co., consisting of 199.1 miles of track, with equipment, etc., under a 999 year lease, by the terms of which the lessee guarantees fixed charges, and dividends at the rate of 10 per cent. per annum on the $12,000,000 capital stock of the lessor; the payment of this rental being further secured by a fund of $4,000,000 invested in securities approved by the Boards of Directors of both lessor and lessee and deposited with various trust companies as trustees. (See reports of Brooklyn Heights R. R. Co. and Brooklyn City R. R. Co.) The Brooklyn Heights R. R. Co. also operates the Brooklyn, Queens County & Suburban R. R. Co. which is a consolidation (in January, 1894) of several companies previously operating in Brooklyn over an aggregate mileage of 44.9 miles of track. (See report.)

Capital Stock.—Common stock, authorized and issued (April, 1894) $30,000,000, shares fully paid up and non-assessable; par value $100 per share. No preferred stock or funded debt.

Operation.—See report of Brooklyn City R. R. Co.

Officers.—Pres. D. F. Lewis, V. Pres. E. W. Bliss, Sec. & Treas. C. P. Smith, Gen. Man. W. A. H. Bogardus.

Brooklyn Heights Railroad Co.—Chartered, April 1, 1887. Annual meeting second Tuesday in January.

Capital Stock.—Common stock, authorized and issued (January, 1894), $200,000; par value $100 per share. The entire capital stock of this company is owned by the Long Island Traction Co.

Funded Debt.—First mortgage bonds, authorized and issued. $250,000, coupon, but may be registered; dated Apr. 1, 1891, due 1941 (see Note); denom. $1,000; int. 5 p. c., payable Apr. and Oct., at office of People's Trust Co., of New York, trustee of mortgage.

Note.—The company has guaranteed the interest on the bond issues of the Brooklyn City R. R. Co. (which see).

Leased Roads.—The company operates the property of the Brooklyn City R. R. Co. under a 999 year lease, and in consideration therefor, guarantees the payment of the lessor's fixed charges and a dividend of 10 p. c. on its capital stock ($12,000,000). The company also operates the Brooklyn, Queens County & Suburban R. R. Co.

Operation.—The Brooklyn Heights R. R. Co. took possession of the Brooklyn City R. R. Co. on June 6, 1893, only 25 days before the close of their financial year, and the statistics of operation for both companies are therefore combined in the report of the Brooklyn City R. R. Co. (which see).

Balance Sheet.—Date June 30, 1893.

Assets.		Liabilities.	
Cost of road equipment	$451,019	Capital stock.....	$200,000
		Funded debt.....	250,000
Current assets.....	276,278	Bills payable.....	31,900
		Other liabilities.....	184,429
		Profit and loss.....	60,968
Total.....	$727,297	Total.....	$727,297

Plant and Equipment.

	Owned.	Leased.
Miles of main line.....	.66	95.5
" second track.....	.50	87.3
" sidings.....	.01	16.3
" track measured as single track.....	1.17	199.1
" " operated by horses.....		29.1
" " " " electricity.....		175
" " " " cable.....	1.17	

Gauge, 4 ft. 8½ in.; 45 lb. to 160 lb. girder rail, 8 grip cars.

Officers.—Pres. D. F. Lewis, V. Pres. E. W. Bliss, Gen. Man. W. A. H. Bogardus, Sec. & Treas. C. P. Smith General office, 168 Montague St.

The Brooklyn City Railroad Co.—Chartered, Dec. 17, 1853, under N. Y. General Railroad Law of 1850. Annual meeting second Monday in January. The following companies have been at various dates consolidated with this company: Bushwick R. R. Co., Brooklyn Crosstown R. R. Co., Calvary Cemetery, Greenpoint & Brooklyn R, R. Co., New Willlamsburgh & Flatbush R. R. Co.. Greenpoint & Lorimer Street R. R. Co., Grand Street & Newtown R. R. Co. and South Brooklyn Street R. R. Co.

Lease.—The entire property and franchises of the company were leased on February 4, 1893, to the Brooklyn Heights R. R. Co. for 999 years. Possession given to lessee on June 6, 1893. The lessee guarantees the company's fixed charges and a dividend of 10 p. c. per annum on its capital stock, $12,000,000.

Capital Stock.—Common stock authorized, and issued (April, 1894), $12,000,000, shares paid fully up and non-assessable; par value $10 per share. Guaranteed 10 p. c. dividends payable quarterly, Jan. Apr., July, Oct.

Funded Debt.—First mortgage bonds, authorized and issued, $6,000,000; coupon, but may be registered; dated July, 1891, due 1941, (see Note) denom. $500 and $1,000; int. 5 p. c., payable Jan. and July, at office of the company and Long Island Bank. Trustee of mortgage, Kings County Trust Co. of Brooklyn.

Note.—The first mortgage bonds may be called for payment in 1916 at company's option.

The company has assumed the principal and interest of the following bond issues.

Brooklyn Crosstown R. R. Co.—First mortgage bonds $200,000, due July 1, 1908; denom. 1,000; int. 5 p. c., payable Jan. and July.

Calvary Cemetery, Greenpoint & Brooklyn R. R. Co.—First mortgage bonds, $200,000, due June 1, 1907; denom, $1,000; int. 6 p. c., payable June and Dec.

New Williamsburgh & Flatbush R. R. Co.—First mortgage bonds, $200,000, due 1897; denom $1,000; int. 7 p. c., payable Feb. and Aug.

Greenpoint & Lorimer Street R. R. Co.—First mortgage bonds, $125,000; due 1910; denom. $1,000; int. 6 p. c., payable May and Nov.

MA

BROOKLYN, N. Y

Showing the Street Railw

Long Island Traction Company



	Owns.	Operates.
Long Island Traction Co. (Controls 245.2 miles).		
Brooklyn Heights Railroad Co.	1.2	245.2
Brooklyn City Railroad Co.	199.1	
Brooklyn, Queens County & Suburban Railroad Co.	44.9	

OF

, AND VICINITY,

Systems Controlled by the

d the **Brooklyn Traction Company.**



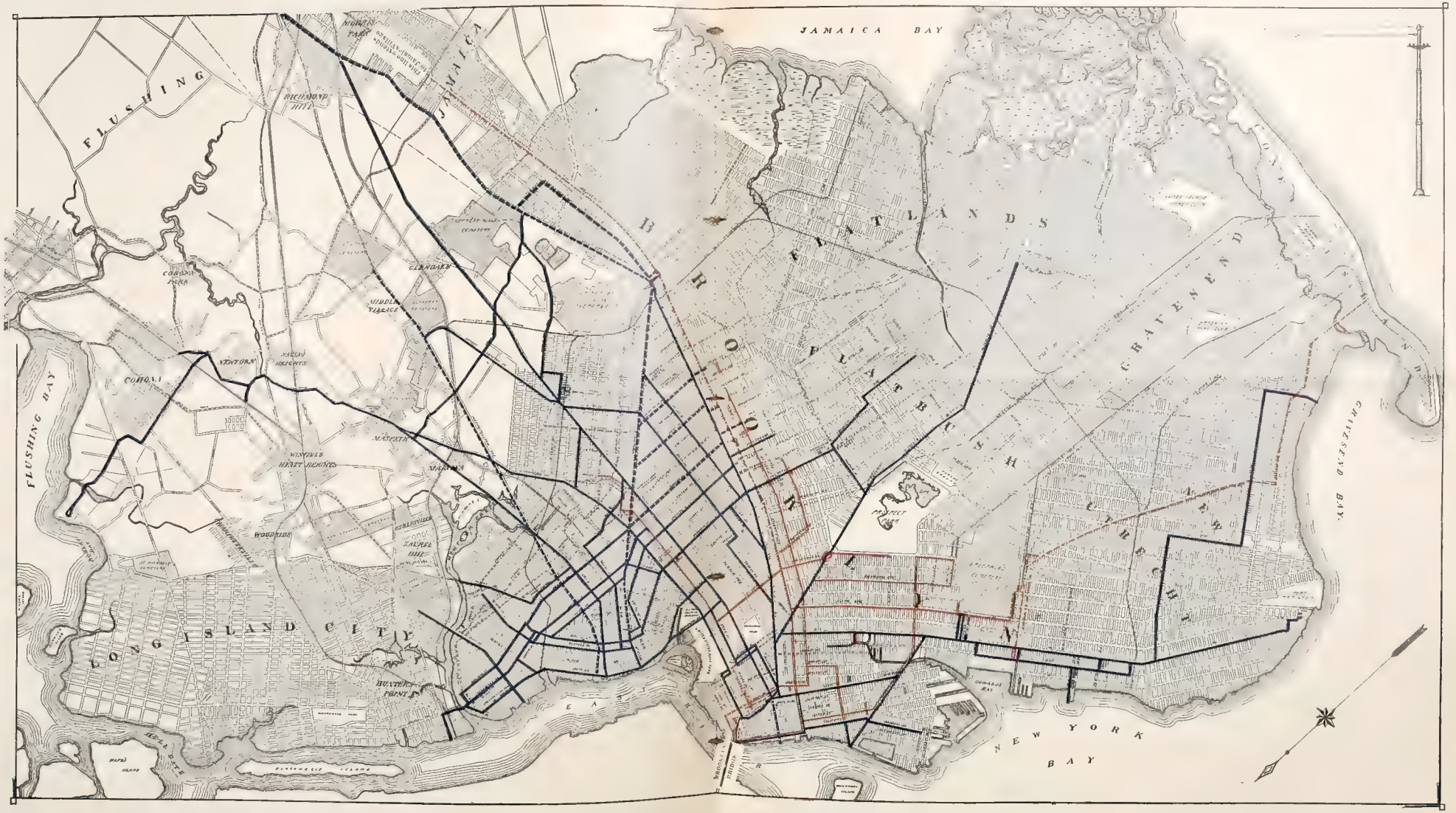
		Owns.	Operates.
Brooklyn Traction Co. (Controls 56 miles).			
*Atlantic Avenue Railroad Co.	————	42.7	56.0
Brooklyn, Bath & West End Railroad Co.	- - - - - -	13.3	

*Portion Leased to Long Island Railroad Co.

MAP OF
BROOKLYN, N. Y., AND VICINITY,

Showing the Street Railway Systems Controlled by the

Long Island Traction Company and the **Brooklyn Traction Company.**



Long Island Traction Co. (Controls 245.2 miles).	Owns.	Operates.
Brooklyn Heights Railroad Co.	1.2	245.2
Brooklyn City Railroad Co.	199.1	
Brooklyn, Queens County & Suburban Railroad Co.	44.9	

Brooklyn Traction Co. (Controls 56 miles).	Owns.	Operates.
*Atlantic Avenue Railroad Co.	42.7	56.0
Brooklyn, Bath & West End Railroad Co.	13.3	

*Portion Leased to Long Island Railroad Co.

Grand Street & Newtown R. R. Co.—First mortgage bonds, $200,000; due 1906. denom. $1,000; int. 5 p. c., payable Apr. and Oct.

Operation.—Combination report of Brooklyn Heights R. R. Co. (which see for explanation) and Brooklyn City R. R. Co. for both years.

Year ending June 30,	1892	1893
Receipts from passengers	$3,771,244	$4,092,127
" other sources	29,285	38,502
" total	3,800,529	4,130,630
Operating expenses	2,923,615	2,969,814
Earnings from operation	876,915	1,160,815
Deductions from earnings.		
Interest on bonds	206,532	216,815
" " floating debt	45,430	
Taxes	152,397	169,113
Net income	472,556	774,887
Other "	51,025	7,141
Total income	523,581	782,027
Dividends paid	480,000	660,000
To surplus account	43,581	122,027
Total surplus account	559,892	780,882
Per cent. O. E. to total receipts	76.9	71.9
" " dividends paid (B. C. R. R.)	8	8⅔
Stock receiving dividends. "	6,000,000	6,000,000 9,000,000

Balance Sheet.—Brooklyn City R. R. Co. only. Date, June 30, 1893.

Assets		Liabilities	
Cost of road	$10,945,279	Capital stock	$9,000,000
" equipment	3,409,261	Funded debt	3,925,000
Current assets	1,065,340	Bills payable	1,100,688
		Other liabilities	674,279
		Profit and loss	719,914
Total	$15,419,880	Total	$15,419,880

Plant and Equipment.—Miles of main line, 95.5, of second track, 87.3, of sidings, 16.3, total track, 199.1; operated by electricity, about 174. Gauge, 4 ft. 8½ in.; 50 lb. to 65 lb. tram and girder rail; 4,500 horses, 1,200 horse cars, 400 motor cars, 100 trail cars, Gen. Elec. dynamos, Gen. Elec., West. and Curtis motors, L. & F., Pullman, St. Louis, Stephenson, Brill and Jones cars, L. & F., Johnson and Penn. Steel Co.'s rails.

Officers.—V. Pres. E. D. White, Treas. Thos. P. Swin. General office, 178 Montague St.

Brooklyn, Queens County & Suburban Railroad Co.—Chartered, Nov., 1892. This is a consolidation (1893) of the Broadway R. R. Co. of Brooklyn, (inc. 1858), the Broadway Ferry & Metropolitan Avenue R. R. Co., (inc. 1892), and the Jamaica & Brooklyn Road Co. (inc. 1880). This property is operated by the Brooklyn Heights R. R. Co. as a part of the system controlled by the Long Island Traction Co.

Capital Stock.—Common stock, authorized and issued, $2,000,000; par value $100 per share. The entire capital stock is owned by the Long Island Traction Co.

Funded Debt.—First mortgage gold bonds, authorized, $3,500,000, issued, $2,240,000, in escrow (see Note); $1,260,000; coupon, but may be registered; dated May 1, 1894, due 1941; denom. $1,000; int. 5 p. c., payable (gold) Jan. and July, at office of the company and the New York Guarantee & Indemnity Co. of New York, trustee of mortgage.

First consolidated mortgage gold bonds, authorized, $4,500,000, issued, $2,500,000, coupon, but may be registered; dated May 1, 1894, due 1941 (see Note); denom. $1,000; int. 5 p. c., payable (gold) May and Nov. at office of the company and the Central Trust Co. of New York, trustee of mortgage.

Note.—Of the unissued first mortgage bonds now in the treasury, $350,000 are reserved to retire the bonds of the Broadway Co., and $910,000 for equipment by electricity.

Of the unissued consolidated mortgage bonds ($2,000,000) $1,750,000 may be used for extensions and equipment and $250,000 for the general purposes of the company.

The consolidated mortgage bonds may be called for payment in 1916 at the company's option.

The company has assumed the principal and interest of the following bond issues of constituent corporations:

Broadway R. R. Co. of Brooklyn, first mortgage bonds, $250,000; due at company's option (6 months' notice); denom. $1,000; int. 5 p. c., payable Jan. and July.

First mortgage guaranteed bonds of the Yates Avenue & Flatbush R. R. Co., $100,000; due at company's option (6 months' notice); denom. $1,000; int. 5 p. c., payable Jan. and July.

Jamaica & Brooklyn Road Co. First mortgage bonds, outstanding, $240,000; due Jan. 1930; denom. $1,000; int. 5 p. c., payable Jan. and July.

Operation.—The following is a combination report for the years ending June 30, 1892-93 of the reports of the several companies now consolidated into the Brooklyn, Queens County & Suburban R. R. Co.

Year ending June 30,	1892	1893
Receipts from passengers	$542,469	$562,096
" other sources	17,393	17,318
" total	559,861	579,414
Operating expenses	449,506	445,955
Earnings from operation	110,356	133,459
Deductions from earnings.		
Interest on bonds	51,833	45,711
" and commissions		11,200
Taxes	17,683	15,142
Rentals		925
Net income	40,840	60,481
Dividends paid	42,000	10,500
To surplus account	def. 1,160	sur. 49,981
Total surplus account	def. 77,942	sur. 100,499
Per cent. O. E. to total receipts	80.4	77.0
" " dividends paid	8	2
Stock receiving dividends (B'klyn R. R. Co.)	525,000	525,000

Plant and Equipment.—Miles of main line, 22.4; of second track, 21.7; of sidings, .9; total track, 44.9; operated by horses, 32.1; by electricity, 12.8. Gauge, 4 ft. 8½ in.; 450 horses, 230 horse cars, 21 motor cars, 9 trail cars. Gen. Elec. dynamos and motors.

Officers.—Pres. C. M. Englis, V. Pres. C. M. Wicker, Sec. H. T. Bragg, Asst. Treas. B. J. Mullin, Gen. Man. W. A. H. Bogardus, Supt. C. E. Harris, Elec. T. M. R. Meikleham. General Office, 21 Broadway.

Brooklyn Traction Co.—Chartered, Jan. 13, 1893. Annual meeting, third Thursday in Oct. This company was organized for the purpose of controlling various street railway properties in Brooklyn through ownership of stock and is not an operating company. The dividends upon its stock are derived from the surplus earnings over and above interest charges of the operating companies which it controls.

The company owns the entire capital stock of the Atlantic Avenue R. R. Co. of Brooklyn, which in turn owns that of the Brooklyn, Bath & West End R. R. Co., which has been changed from a steam to an electric railway.

The Atlantic Avenue R. R. Co. owns and operates 38.9 miles of track in Brooklyn and operates under lease 3.8 miles, all of which is now equipped by electricity. (See report.)

The Brooklyn, Bath & West End R. R. Co. operates 13.3 miles of track from Brooklyn to Coney Island.

Capital Stock.—Common stock, authorized and issued (April, 1894) $6,000,000, shares fully paid and non-assessable; par value $100 per share. Preferred stock, authorized and issued (April, 1894) $3,000,000, shares fully paid and non-assessable; par value $100 per share. Conditions of preference 6 p. c. cumulative dividends. Preferred stock is subject to call at 110 and accrued dividends. Dividends payable January and July at company's office.

Officers.—Pres. J. P. Ilsley, Sec. & Treas. C. Ford Stevens.

Atlantic Avenue Railroad Co.—Chartered, May 1, 1872. Annual meeting fourth Tuesday in April. This road as it stood May 1, 1872, with its roadbed, superstructure and equipment of every kind was purchased on that date from the Brooklyn & Jamaica Railway Co., subject to $456,800 outstanding indebtedness and certain leases from and to other corporations. On June 1, 1877, the company leased to the Long Island R. R. Co. for a term of years, all that portion of its road (less 250 ft.) lying in Atlantic Avenue east of Flatbush Avenue in Brooklyn to Jamaica, reserving the right to run cars along the southerly side of Atlantic Avenue as far as Washington Avenue. The company has acquired the capital stock of the South Brooklyn Central R. R. Co.; also the rights, franchises, road and equipment of the City Division of the Prospect Park & Coney Island R. R. Co., and of the Brooklyn, Bath & West End R. R. Co.

Capital Stock.—Common stock, authorized and issued (Jan. 1894), $2,000,000; par value $50 per share. The entire capital stock is owned by the Brooklyn Traction Co.

Funded Debt.—On May 1, 1894, $4,609,500 as follows:

General mortgage bonds, authorized and issued, $759,000; dated Oct. 1, 1889, due 1909; denom. $1,000; int. 5 p. c., payable Apr. and Oct., at Nat'l City Bank of Brooklyn; trustee of mortgage, Brooklyn Trust Co., of Brooklyn.

Consolidated mortgage gold bonds, authorized, $3,000,000; issued, $1,546,000; in escrow (see Note) $1,454,000; coupon, but may be registered; dated Oct., 1891, due 1931; denom. $1,000; int. 5 p. c., payable Apr. and Oct., at Nat'l City Bank of Brooklyn; trustee of mortgage, Brooklyn Trust Co., of Brooklyn.

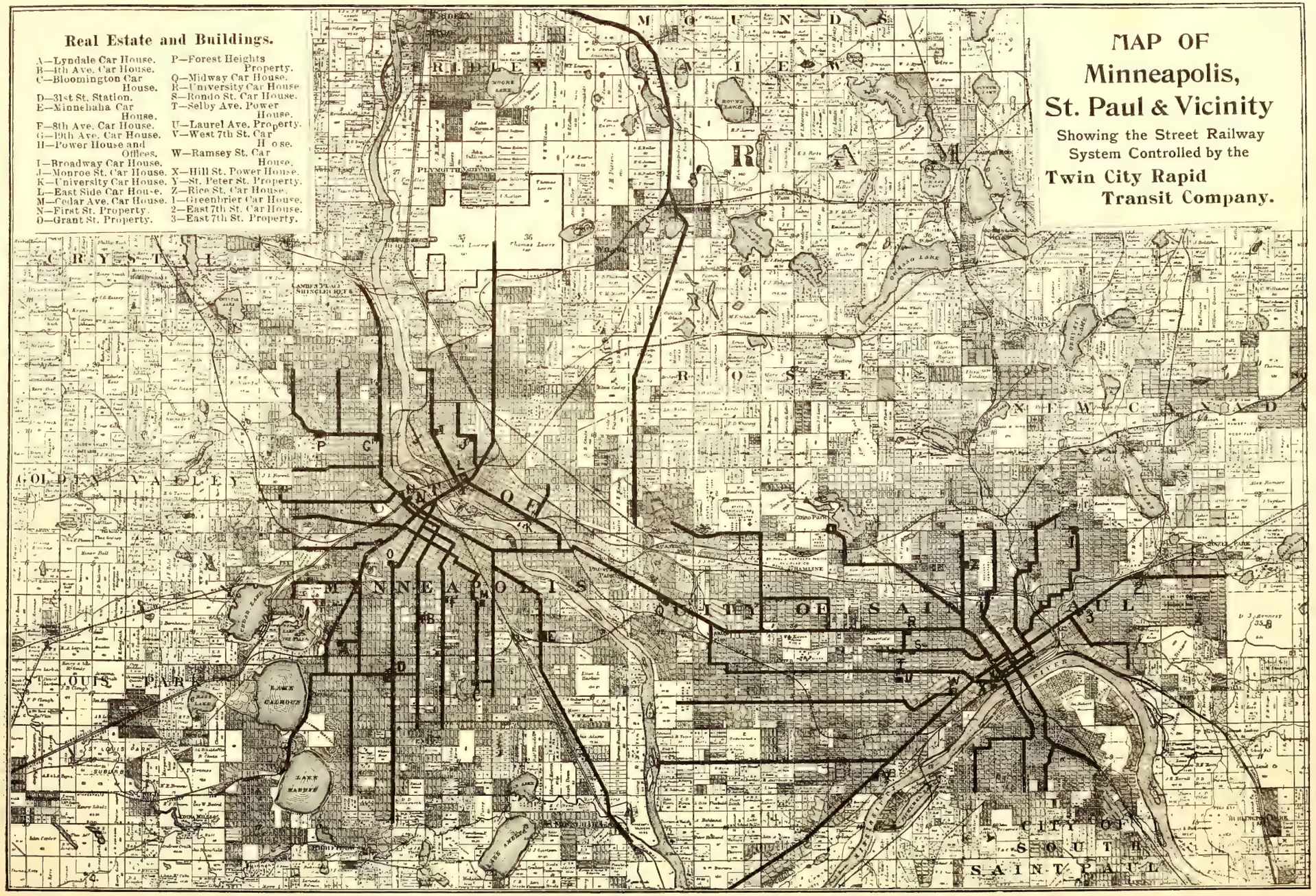
Improvement mortgage gold bonds, authorized and issued, $1,500,000, coupon, but may be registered; dated Jan., 1, 1894, due 1934; denom. $1,000; int. 5 p. c., payable Jan. and July, at Nat'l City Bank of Brooklyn; trustee of mortgage, Central Trust Co. of New York. This issue funds the floating debt created by the change of motive power and other improvements.

Real estate mortgages $109,500.

Note.—$1,454,000 of the consolidated mortgage bonds are held in escrow to retire the outstanding general mortgage bonds ($759,000) at maturity, and the following obligations of constituent companies:

South Brooklyn Central R. R. Co., first mortgage bonds, $125,000; dated Aug. 1, 1877, due 1897; denom. $500; int. 7 p. c., payable Feb. and Aug. Second mortgage bonds, $150,000; due Aug. 1, 1897; denom. $500; int. 6 p. c., payable Feb. and Aug. Real estate mortgage, $3,500.

Prospect Park & Coney Island R. R. Co. first mortgage bonds,


Real Estate and Buildings.
A—Lyndale Car House.
B—4th Ave. Car House.
C—Bloomington Car House.
D—31st St. Station.
E—Minnehaha Car House.
F—8th Ave. Car House.
G—19th Ave. Car House.
H—Power House and Offices.
I—Broadway Car House.
J—Monroe St. Car House.
K—University Car House.
L—East Side Car House.
M—Cedar Ave. Car House.
N—First St. Property.
O—Grant St. Property.
P—Forest Heights Property.
Q—Midway Car House.
R—University Car House
S—Rondo St. Car House.
T—Selby Ave. Power House.
U—Laurel Ave. Property.
V—West 7th St. Car House.
W—Ramsey St. Car House.
X—Hill St. Power House.
Y—St. Peter St. Property.
Z—Rice St. Car House.
1—Greenbrier Car House.
2—East 7th St. Car House.
3—East 7th St. Property.
MAP OF
Minneapolis,
St. Paul & Vicinity
Showing the Street Railway System Controlled by the
Twin City Rapid Transit Company.
MINNEAPOLIS
CITY OF SAINT PAUL
CRYSTAL
NEW BRIGHTON
ROSEVILLE
NEW CANADA
OLD VALLEY
LOUIS PARK
CITY OF SOUTH SAINT PAUL
LAKE CALHOUN
LAKE HARRIET
LAKE AMELIA
PLYMOUTH
RIVER

$420,000; dated May 27, 1887, due Jan. 1, 1895; denom. $1,000; int. 5 p. c., payable Jan. and July.

Operation.—Year ending June 30	1892	1893
Receipts from passengers	$774,926	$781,346
" advertising	2,733	2,662
" total	777,659	784,008
Operating expenses	700,641	670,309
Earnings from operation	77,018	113,699
Other income, rentals, etc	111,441	64,275
Gross income	188,459	177,974
Deductions.		
Interest on bonds	94,245	98,127
" " floating debt	11,913	6,098
Taxes	24,152	25,880
Rentals	3,673	7,602
Net income	54,475	40,267
Dividends paid	68,795	17,306
To surplus account	def. 14,319	sur. 22,961
Total surplus account	147,701	170,662
Per cent. dividends paid	6	1.5

Balance Sheet.—Date June 30, 1893.

Assets.		Liabilities.	
Cost of road	$3,438,832	Capital stock	$1,195,450
" equipment	775,877	Funded debt	2,999,000
Current assets	299,528	Bills payable	14,173
Other assets (stock)	153,375	Other liabilities	288,329
		Profit and loss	170,662
Total	$4,667,613	Total	$4,667,613

Plant and Equipment.

	Owned.	Leased.
Miles of main line (electric)	19.9	1.9
" second track	18.5	1.9
" sidings	.5	
" track measured as single track	38.9	3.8

Gauge, 4 ft. 8½ in.; 47 lb. to 90 lb. girder rail; 40 horses, 325 motor cars, Westinghouse dynamos and motors.

Officers.—Pres. Benj. Norton, Sec. & Treas. W. J. Richardson, Supt. H. R. Newkirk, Pur. Agt. W. M. Tobias. General office, Franklin Trust Bldg., Montague Street; Supt's. office, corner Atlantic and Third Avenues.

Brooklyn, Bath & West End Railroad Co.—Chartered, Jan. 22, 1879. Annual meeting second Tuesday in November. This railroad operates between Brooklyn and Coney Island. It was sold on Jan. 17, 1893, to the Atlantic Avenue R. R. Co., which has equipped it for operation by electricity.

Capital Stock.—Common stock, $1,000,000; par value $100 per share, all in treasury of Atlantic Avenue R. R. Co.

Funded Debt.—First mortgage coupon bonds, series A, authorized and issued, $250,000; dated Jan. 11, 1887; due 1907, but subject to call after Jan. 1, 1897; denom. $1,000; int. 5 p. c., payable Jan. and July, at office of J. & W. Seligman & Co., New York.

First mortgage coupon bonds, series B, authorized and issued, $250,000; dated Jan. 1, 1887; due 1916, but subject to call after Jan. 1, 1897, denom. $1,000; int. 5 p. c., payable Apr. and Oct. at office of J. & W. Seligman & Co., New York.

Second mortgage coupon bonds, authorized $100,000; issued $52,000; dated June 1, 1891; due 1911, but subject to call after July 1, 1896; denom. $1,000; int. 5 p. c., payable June and Dec. at office of J. & W. Seligman & Co., New York.

General mortgage coupon bonds, authorized $1,000,000, in escrow (see Note) $552,000, in treasury, $448,000; dated Oct. 2, 1893, due 1933; denom. $1,000; int. 5 p. c. payable Apr. and Oct., at office of J. & W. Seligman & Co., New York.

Note.—$552,000 of the general mortgage bonds are held in escrow to retire the first and second mortgage bonds at maturity.

Operation.—By steam, year ending June 30,	1893.
Receipts from passengers	$107,440
" " freight	1,074
" total	108,514
Operating expenses	113,510
Deficiency from operation	4,997
Interest on bonds	28,916
" " floating debt	10,845
Taxes	4,845
Rentals	95
Deficit for year	49,697

Plant and Equipment.—Miles of line, 6.64, of second track, 3.92, of sidings, 2.72; total track, 13.28. Gauge, 4 ft. 8½ in.

Officers.—Pres. John McNeill, Sec. & Treas. C. Ford Stevens.

MINNEAPOLIS AND ST. PAUL, MINN.

MUNICIPAL STATISTICS AND INFORMATION.

Location.—Minneapolis is situated in southeastern Minnesota on the Mississippi River. St. Paul is situated on the Mississippi River 10 miles below Minneapolis and is the capital of the state.

Population.—The population of Minneapolis in 1880 was 46,889, and in 1890, 164,738, an increase of 251 per cent. The population of St. Paul in 1880 was 41,473, and in 1890, 133,156, an increase of 221 per cent. The total present population of the twin cities is approximately 370,000.

Railroad and Steamboat Connections.—The two cities have intimate connections with all parts of the country through a widely ramified railway system embracing the Chicago, Burlington & Northern R. R., Chicago, Milwaukee & St. Paul R. R., Chicago & Northwestern R. R., Great Northern R. R., Minneapolis, St. Paul & Sault Ste. Marie R. R., Minneapolis & St. Louis R. R., Northern Pacific R. R., St. Paul & Duluth R. R., Wisconsin Central R. R., Chicago Great Western R. R. During the open season steamboat lines operate to all ports on the Mississippi River.

Manufacturing and Commercial Interests.—A capital of about $65,000,000 is employed in the various manufacturing industries of the two cities, the principal productions being flour, lumber, machinery, farming implements, furniture, carriages, boots and shoes, sashes, blinds, building materials. About 46,000 hands are employed in the manufacturing industries, receiving in wages about $25,500,000 per annum, and the value of the manufactured product was, in 1890, about $116,000,000. The twin cities form the greatest primary grain, flour and lumber market in the world. $12,000,000 are invested in Minneapolis saw mills, which employ over 6,000 men throughout the year, and the annual product averages about $6,000,000 in value ($8,000,000 in 1892). It is claimed that the manufacturing trade in 1892 amounted to $200,750,200, and the jobbing trade to $331,628,287, while the bank clearings aggregated $709,511,499.

Banking Capital.—There are now (1894) 14 national banks in the two cities with a combined capital and surplus of about $14,500,000; 23 state banks, with capital and surplus of about $6,300 000; 37 loan and investment companies, with capital and surplus of about $50,000,000; 6 savings banks with surplus of about $320,000; and 1 private bank. The total banking (and investment company) capital is approximately $70,000,000, equivalent to about $233 per capita population.

Assessed Valuation.—The assessed valuation of real estate in St. Paul is (1893) $109,710,896, the property being assessed at about 50 per cent. of its real value. The assessed valuation of the personal property is $16,904,398. The assessed valuation of real and personal property in Minneapolis is (1893) $140,624,490, real estate being assessed at about 50 per cent. of its actual value.

Municipal Debt.—The municipal debt of Minneapolis less sinking funds is (1894) $6,637,573. The municipal debt of St. Paul is (1894) $10,361,100.

Tax Rate.—The average rate of taxation for both Minneapolis and St. Paul, reducing both to the same basis of computation, is (1894) 2.3 p. c. on an assessed valuation of 50 p. c. of the actual value.

STREET RAILWAY SYSTEM—Descriptive.

The growth of the twin cities of Minnesota is a marvel of modern commercial history. The cities possess the advantages of the first water power and head of navigation on the great midland river of the continent. To these natural features have been added a concentration of railway lines, until the cities have become identified with the development of the entire Northwest. The street railway interests have kept pace with progress in other directions. Minneapolis and St. Paul were among the earliest American cities to adopt electricity on a large scale. The street railway system is under one control and consists of 223 miles of track, of which 217 miles are operated by electricity and 6 miles by the cable. The business centers of Minneapolis and St. Paul are nine miles apart, and through the thickly settled intervening territory an interurban line is in regular operation on a 6 minute schedule. The manufacturing and business districts of both cities are largely at or near the river. The residential sections cover a large area, and there is a constant tendency to suburban expansion. In addition to the usual suburban service, lines run out to the numerous lakes and pleasure resorts.

STREET RAILWAY SYSTEM.—Present Companies.

Twin City Rapid Transit Co.—Chartered, 1891. This company controls the entire street railway systems of Minneapolis and St. Paul, by ownership of the stock of the Minneapolis Street Railway Co., the St. Paul City Railway Co., and the Minneapolis, Lyndale & Minnetonka Railway Co.

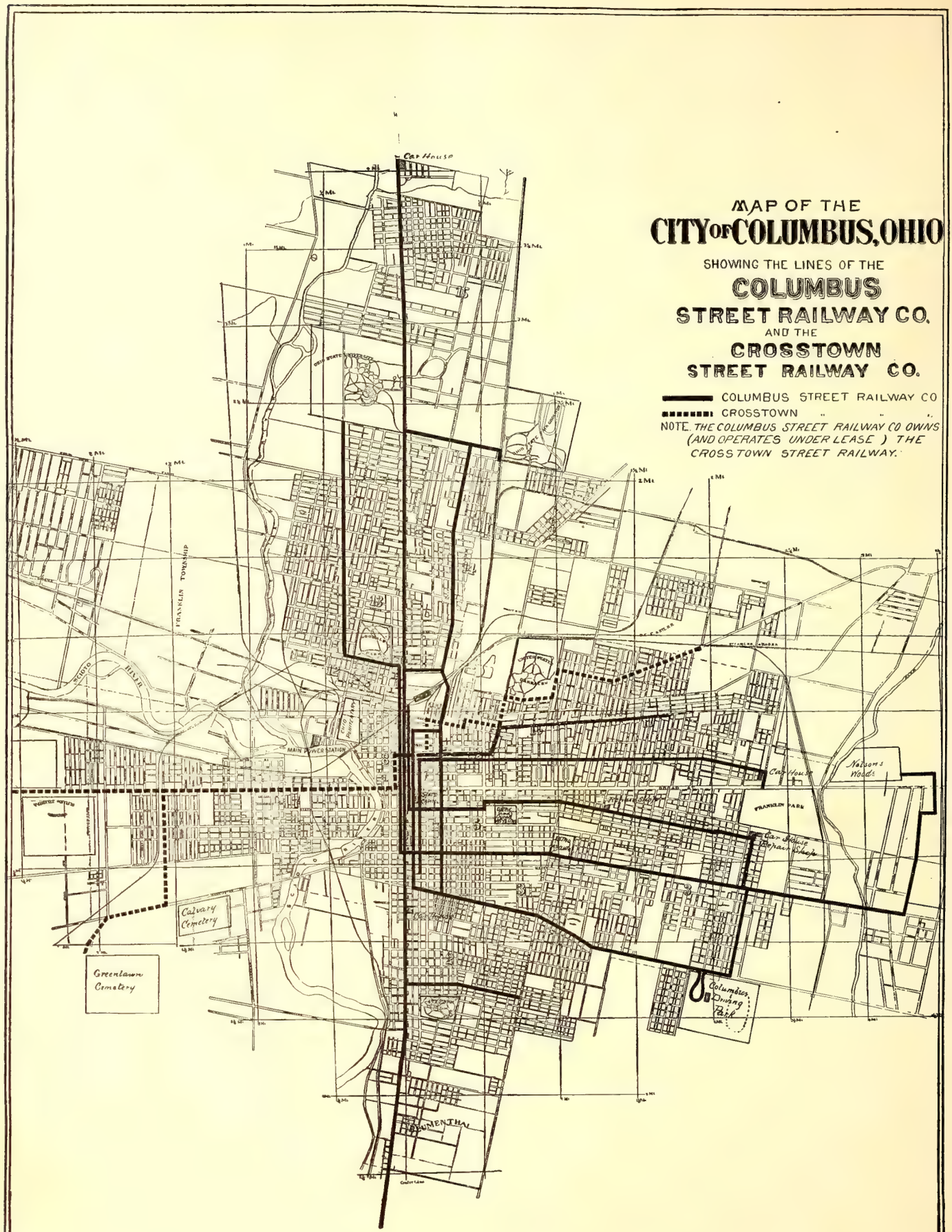
Capital Stock.—Common stock, authorized, $20,000,000, issued and outstanding (Apr. 1894), $15,010,000, in treasury $4,990,000; shares fully paid up and non-assessable; par value, $100 per share.

Funded Debt.—See Minneapolis Street Ry. Co., and St. Paul City Ry. Co.

Franchises.—This company through its ownership of the operating companies named possesses the exclusive right to operate street cars in and between the cities of St. Paul and Minneapolis.

Operation.—Consolidated income accounts, Minneapolis Street Ry. Co. and St. Paul City Ry. Co., for year ending Dec. 31,

	1891.	1892.	1893.
Receipts from passengers	$1,814,740	$2,136,657	$2,164,925
" other sources	5,853	50,922	24,232
" total	1,820,593	2,187,579	2,189,157
Operating expenses	1,081,323	1,309,274	1,264,408
Earnings from operation	739,270	878,305	924,749
Per cent. O. E. to total receipts	59.3	59.8	57.7


MAP OF THE
CITY OF COLUMBUS, OHIO
SHOWING THE LINES OF THE
COLUMBUS
STREET RAILWAY CO.
AND THE
CROSSTOWN
STREET RAILWAY CO.
COLUMBUS STREET RAILWAY CO
CROSSTOWN " " "
NOTE. THE COLUMBUS STREET RAILWAY CO OWNS (AND OPERATES UNDER LEASE) THE CROSSTOWN STREET RAILWAY.
Car House
FRANKLIN TOWNSHIP
MAIN POWER STATION
Car House
Nelsons Woods
FRANKLIN PARK
Car Repair Shops
Calvary Cemetery
Greenlawn Cemetery
Columbus Driving Park
BLUMENTHAL

Statement of operations for the four months ending May 1,

	1893.	1894.
Receipts from passengers	$674,698	$585,064
" " other sources	7,894	5,393
" total	682,592	590,457
Operating expenses	448,130	320,694
Earnings from operation	234,462	269,763
Per cent. O. E. to total receipts	65.7	54.3

The gross receipts of the properties now owned by the Twin City Rapid Transit Co. for the years 1878 to 1891 inclusive were as follows:

1878	$ 65,520	1886	669,088
1879	87,431	1887	828,138
1880	111,344	1888	985,467
1881	178,871	1889	962,645
1882	279,773	1890	1,383,866
1883	399,919	1891	1,820,593
1884	478,758	1892	2,187,579
1885	520,216	1893	2,189,157

Balance Sheet.—Consolidated balance sheet of the Minneapolis Street Ry. Co., and the St. Paul City Ry. Co., dated Dec. 31, 1893.

Assets.		Liabilities.	
Right of way	$9,040,000	Capital stock	$10,000,000
Road and equipment	11,575,280	F'd D't M. S. R. Co.	6,097,100
Real Estate	2,633,142	" " S. P. C. R. Co.	6,179,500
Current assets	451,015	Current liabilities	712,633
		Surplus	710,204
Total	$23,699,437	Total	$23,699,437

Officers.—Pres. Thomas Lowry, Sec. & Treas. C. G. Goodrich Audr. J. F. Calderwood, Gen. Man. W. J. Hield.

Fiscal Agents, J. Kennedy Tod & Co., 45 Wall St., New York.

Minneapolis Street Railway Co.—Chartered, July 1, 1873.

Capital Stock.—Common stock, $5,000,000, owned by, and in the treasury of the Twin City Rapid Transit Co.

Funded Debt.—First consolidated mortgage gold bonds, authorized, $5,000,000; issued, $4,030,000, in escrow (see Note) $970 000; coupon, but may be registered; dated Jan. 15, 1889, due 1919; denom. $1,000; int. 5 p. c., payable in gold Jan. 15 and July 15 at office of Farmers' Loan & Trust Co., of New York, trustee of mortgage. These bonds are guaranteed, principal and interest, by the Twin City Rapid Transit Co.

Certificates of indebtedness, $1,000,000, issued to Twin City Rapid Transit Co.; dated 1893, due 1895 to 1899; int. 6 p. c.

Mortgage notes, $97,100.

Note.—$970,000 of the first consolidated mortgage bonds have been reserved in the hands of the trustee to redeem the company's prior liens, as follows:

First mortgage gold bonds, outstanding, $370,000; dated Nov. 1, 1880, due 1910, but redeemable yearly at $105 and int.; denom. $1,000; int. 7 p. c., payable in gold May and Nov., at office of Farmers' Loan & Trust Co., of New York, trustee.

Second mortgage gold bonds, outstanding, $600,000; dated Nov. 1, 1883, due 1913; denom. $1,000; int. 6 p. c., payable in gold May and Nov., at office of Farmers' Loan & Trust Co., of New York, trustee.

Franchises.—The franchises of this company convey the exclusive and perpetual right to street railway operation in the city of Minneapolis.

Plant and Equipment.—Miles of main line 62.338 of second track 57.394 of sidings 2.641 total track (electric) 122.373. Gauge, 4 ft. 8½ in., 47 lb. to 78 lb. girder and T rail; 360 motor cars, 190 trail cars, 33 salters, 22 snow ploughs, 2 sweepers, 9 scrapers, 14 road wagons, 23 horses, 3 supply cars; Gen. Elec. dynamos and motors.

Officers.—Pres. Thos. Lowry, V Pres. C. G. Goodrich, Treas. M. B. Koon, Gen. Man. W. J. Hield, Audr. & Sec. J. F. Calderwood. General office, 200 3d Ave., N.

St Paul City Railway Co.—Chartered, Mar. 2, 1853.

Capital Stock, $5,000,000. Owned and in the treasury of the Twin City Rapid Transit Co.

Funded Debt.—Cable consolidated mortgage gold bonds, authorized, $5,500,000, issued $3,600,000, in escrow (see Note) $680,000, in treasury $1.220,000; coupon, but may be registered; dated Jan. 15, 1887, due 1937; denom. $1,000; int. 5 p. c., payable in gold Jan. 15 and July 15, at office of Farmers' Loan & Trust Co. of New York, trustee of mortgage. These bonds are guaranteed principal and interest by the Twin City Rapid Transit Co.

Debenture gold bonds, $1,000,000, dated May 1, 1890, due 1900; denom. $1,000; int. 6 p. c., payable in gold, May and Nov., at office of Farmers' Loan & Trust Co., of New York.

Certificates of indebtedness $1,000,000, issued to Twin City Rapid Transit Co., dated 1893, due 1895 to 1899, int. 6 p. c.

Mortgage notes, $17,500.

Note.—$680,000 of the cable consolidated mortgage bonds have been reserved by the Farmers' Loan & Trust Co. to redeem an equal amount of the company's first mortgage and first consolidated mortgage bonds, dated Oct. 1, 1882 and 1884, due 1932 and 1934, respectively; denom. $1,000; int. 6 p. c., payable in gold Apr. and Oct. at office of Farmers' Loan & Trust Co,, of New York, trustee.

The unissued cable consolidated mortgage bonds now in the treasury may be issued and sold against the actual cash cost of new construction at a rate not exceeding $15,000 per mile of track.

Franchises.—The franchises of this company convey the exclusive and perpetual right of street railway operation in the city of St. Paul.

Plant and Equipment.—Miles of main line, 55.722; of second track, 41.682; of sidings, 2.102; total track, 99.506; operated by electricity, 93.632; by cable, 5.874, Gauge 4 ft. 8½ in.; 40 lb. to 76 lb. Johnson girder and T rail; 217 motor cars, 125 trail cars, 38 cable cars, 15 snow ploughs, 12 road wagons, 18 salters, 7 sweepers, 22 horses; Allis engines, Gen. Elec. dynamos and motors.

Officers.—Pres. Thos. Lowry, V. Pres. C. G. Goodrich, Sec. A. Z. Levering, Treas. W. R. Merriam, Gen. Man. W. J. Hield. General office, 200 3d Ave., N., Minneapolis.

COLUMBUS, O.

MUNICIPAL STATISTICS AND INFORMATION.

Location.—Columbus is located on the Scioto River, in the center of Ohio, It is the capital of the state and the seat of justice of Franklin County,

Population.—The population in 1880 was 51,647, and in 1890, 88,150, an increase of 71 per cent.

Railroad Connections.—The following railroads enter the city The Baltimore & Ohio R. R., Pennsylvania R. R., Cleveland, Cincinnati, Chicago & St. Louis R. R., Cleveland, Akron & Columbus R. R., Columbus, Shawnee & Hocking R. R., Columbus, Hocking Valley & Toledo R. R., Sandusky & Columbus Short Line R. R., Norfolk & Western R. R., Toledo & Ohio Central R. R.

Manufacturing and Commercial Interests.—A capital of about $13,500,000 is employed in the various manufacturing industries of the city, the principal productions being carriages and wagons, malt liquors, lumber, agricultural implements, plows, edge tools, files, rolled iron, machinery, furniture, saddlery, harness, soap, cars and car wheels, flour, pottery, boots and shoes. The city has superior advantages for inland trade, which has attained large proportions. About 10,800 hands are employed in these industries, receiving in wages about $5,400,000 per annum, and the value of the manufactured product is about $18,300,000 per annum.

Banking Capital.—There are now (1894) 6 national banks with a combined capital and surplus of about $1,600,000; 1 state bank, with capital and surplus of about $100,000; 4 savings banks with surplus of about $374,000, and 4 private banks. The total banking capital is approximately $2,074,000, equivalent to about $24 per capita population.

Assessed Valuation.—The total assessed valuation of real and personal property is (1893) $59,060,530, equivalent to about $670 per capita population. The property is assessed at about 50 per cent. of its real value.

Municipal Debt.—The municipal debt of the city less sinking funds is (1893) $6,396,100, equivalent to about $72 per capita population.

Tax Rate.—The tax rate is (1893) $28 per $1,000.

STREET RAILWAY SYSTEM Descriptive.—

Columbus is built on both sides of the Scioto River. The site is level and the city is well laid out to secure large street railway traffic (see map). The regular traffic between the residential, business and manufacturing districts is supplemented by the travel to and from the great public, religious, collegiate and state institutions located within the city limits, and a number of driving parks, fair grounds and pleasure resorts still further increase gross receipts. The street railway system is—with the exception of a short suburban line—controlled and operated by a single corporation, although standing in the name of two companies, and the physical condition of the property has been brought to a high stage of development. It embraces 68 miles of track, which is distributed as follows:

	Owns.	Controls.
Columbus Street Railway Co.	55	64
The Crosstown Railway Co.	9	
Worthington, Clintonville & Columbus Street Railway Co.	4	4

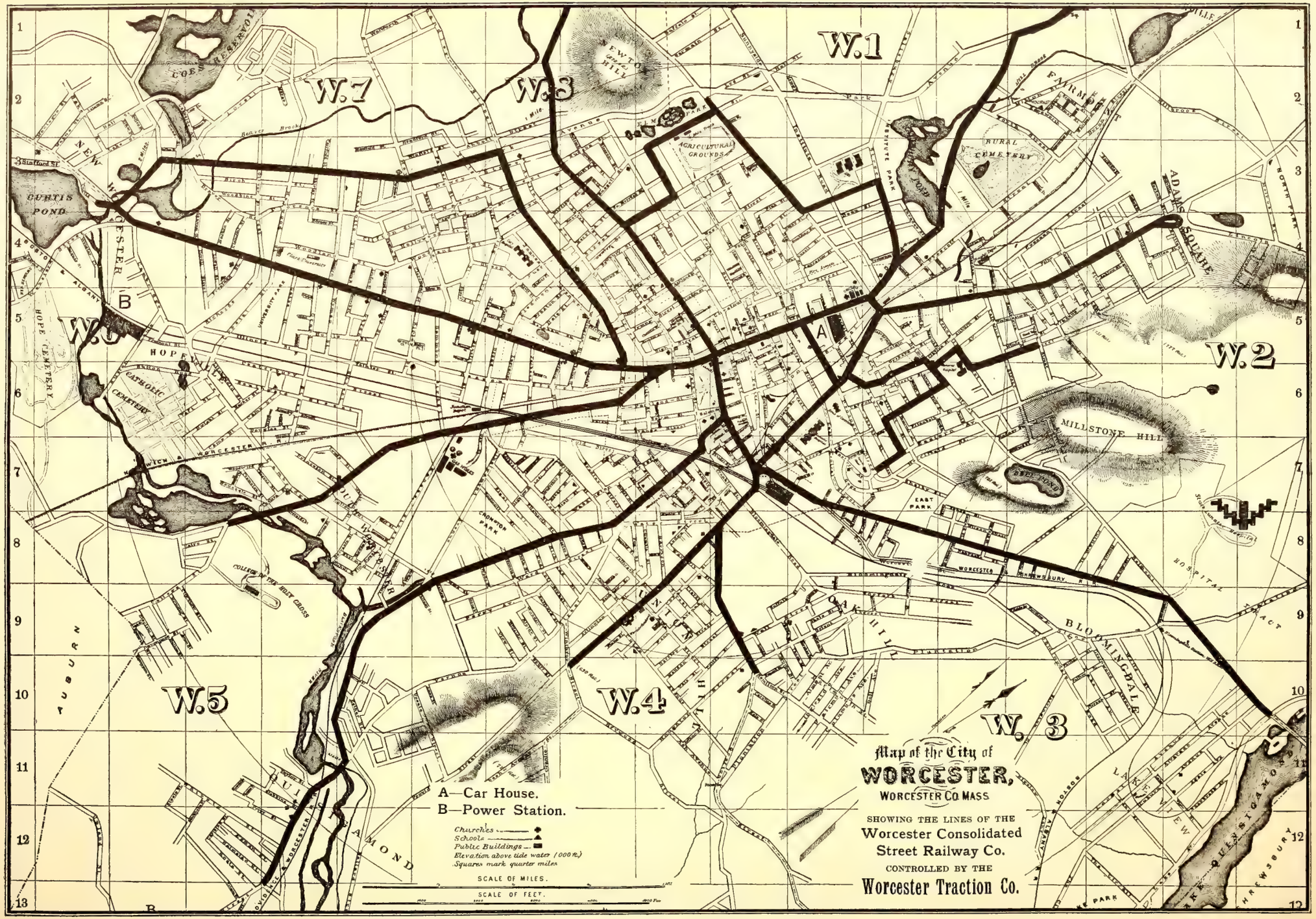
STREET RAILWAY SYSTEM.—Present Companies.

Columbus Street Railway Co.—Chartered, Apr. 25, 1892. Annual meeting first Thursday after Jan. 15. This company succeeded to the property and franchises of the Columbus Consolidatted Street R. R. Co. (incorp. 1879). by the purchase, in 1892, of its entire capital stock. The company also owns the entire capital stock of the Crosstown Street Ry. Co. (which see).

Capital Stock.—Common stock, authorized and issued, $3,000,000; par value $100 per share.

Funded Debt.—First consolidated mortgage gold coupon bonds authorized, $3,000,000; issued (Apr. 1894), $1,999,000; in escrow (see Note) $800,000; in treasury $201,000; dated July 1, 1892, due 1932; denom. $1,000; int. 5 p. c., payable Jan. and July, at office of the company and of E. W. Clark & Co., of Philadelphia; trustee of mortgage, Knickerbocker Trust Co., of New York.

Note.—$800,000 of the consolidated mortgage bonds are reserved in the hands of trustees to retire at maturity an equal amount of the Columbus Consolidated St. R. R. Co.'s first mortgage 5 p. c. bonds,


W.1
W.2
W.3
W.4
W.5
W.6
W.7
A
B
A—Car House.
B—Power Station.
Churches
Schools
Public Buildings
Elevation above tide water (1000 ft.)
Squares mark quarter miles
SCALE OF MILES.
SCALE OF FEET.
Map of the City of
WORCESTER,
WORCESTER CO. MASS
SHOWING THE LINES OF THE
Worcester Consolidated
Street Railway Co.
CONTROLLED BY THE
Worcester Traction Co.
CURTIS POND
MILLSTONE HILL
BLOOMINGDALE
LAKEVIEW
QUEENSBOROUGH
HOPE CEMETERY
CATHOLIC CEMETERY
RURAL CEMETERY
AGRICULTURAL GROUNDS
EAST PARK
ADAMS SQUARE
TUBURN
NEW WORCESTER
WORCESTER & NORTHBORO R.R.
WORCESTER & FRAMINGHAM R.R.
NORWICH & WORCESTER R.R.

dated July 1, 1889, due 1909, payable at Central Trust Co., of New York.

The company has guaranteed the principal and interest of the Crosstown St. Ry. Co.'s first mortgage bonds.

Leased Roads.—The company operates the property of the Crosstown Street Ry. Co. under a perpetual lease.

Operation.—Year ending Dec. 31, 1893.

Receipts from passengers	$532,191
" other sources	19,490
" total	551,681
Operating expenses and taxes (61.1 p. c.)	336,854
Earnings from operation	$214,827
Interest charges	163,954
Net income	$50,873

Plant and Equipment.

	Owned.	Leased.
Miles of main line	35	6.9
" second track and sidings	20	2.1
Total track (electric)	55	9

Gauge, 5 ft. 2 in.; 52 lb. to 93 lb. T and girder rail; 120 motor cars, 30 trail cars, 2,700 H. P. Buckeye and McI. & S. engines, Gen. Elec. dynamos and motors, Brill, Brownell and Stephenson cars.

Officers.—Pres. Emerson McMillin (40 Wall St., New York), 1st V. P. & Treas. E. K. Stewart, 2nd V. Pres. Robert E. Sheldon, Sec. P. V. Burrington, Gen. Supt. W. F. Kelly. General Office, 12 No. High Street.

The Crosstown Street Railway Co.—Chartered, 1893. This is a consolidation of the Glenwood & Greenlawn Street Ry. Co., and the Leonard Avenue Street Ry. Co.

Leased, Aug. 6, 1893, in perpetuity to the Columbus Street Ry. Co.

Capital Stock.—Common stock, authorized and issued, $2,000,000, all in treasury of the Columbus Street Ry. Co.

Funded Debt.—First mortgage gold bonds, authorized, $2,000,000; issued (April, 1894,), $500,000; dated June 1, 1893, due 1933; denom. $1,000; int. 5 p. c., payable June and Dec., at office of Knickerbocker Trust Co., of New York, trustee of mortgage. The principal and interest of these bonds are unconditionally guaranteed by the Columbus Street Ry. Co.

Note.—Of the $500,000 bonds already issued, $75,000 remain in the company's treasury to be issued to the Columbus Street Ry. Co. for work done by contract with the latter on the Leonard Avenue line, and $90,000 are held by trustees to retire an underlying mortgage of $75,000 upon the property and franchises of the Glenwood & Greenlawn Street Ry Co.

The unissued first mortgage bonds now in the treasury may be issued and sold to pay for authorized extensions at a rate not exceeding $30,000 per mile.

Plant and Equipment.—Miles of main line; 6.9; of second track and sidings, 2.1; total (electric) 9.

WORCESTER, MASS.

MUNICIPAL STATISTICS AND INFORMATION.

Location.—Worcester is located in nearly the geographical center of Massachusetts. It is one of the capitals of Worcester County.

Suburbs.—The cities of Leicester and Spencer are connected with Worcester by street railway lines.

Population.—The population in 1880 was 58,291, and in 1890, 84,655, an increase of 45 per cent. The population of the two suburbs named was 11,867 in 1890.

Railroad Connections.—The following railroads enter the city. Boston & Albany R. R., Boston & Maine R. R., Fitchburg R. R., New York & New England R. R., Old Colony R. R., New York, New Haven & Hartford R. R., Worcester & Shrewsbury R. R.

Manufacturing and Commercial Interests.—A capital of about $25,300,000 is employed in the various manufacturing industries of the city, the principal productions being iron and steel wares, machinery, wire goods, boilers, hardware, furniture, stoneware, tools, carpets, corsets, skates, woolen goods, boots and shoes, musical instruments, envelopes, leather belting and hose, firearms, cotton goods. Worcester has a great export trade in all its manufactured products. About 22,000 hands are employed in the manufacturing industries, receiving in wages about $11,700,000 per annum, and the value of the product is about $39,500,000 per annum.

Banking Capital.—There are now (1894) 7 national banks with a combined capital and surplus of about $3,400,000; 4 trust companies with capital and surplus of about $1,500,000; 1 savings bank with surplus of about $326,000; and one private bank. The total banking capital is approximately $5,226,000, equivalent to about $62 per capita population.

Assessed Valuation.—The assessed valuation of real estate is (1893) $66,843,200. The assessed valuation of the personal property is $17,257,805. The total valuation of real and personal property is $84,101,005, equivalent to about $1,000 per capita population.

Municipal Debt.—The municipal debt of the city less sinking funds is (1893) $2,776,002, equivalent to about $33 per capita population.

Tax Rate.—The tax rate is (1893) $15.00 per $1,000,

STREET RAILWAY SYSTEM—Descriptive.

Worcester is irregularly laid out over a broken and hilly area of large extent. It is a place of much manufacturing importance and activity. The leading industry is the manufacture of iron in various forms and its wire mills are the largest in the world. The residential and suburban sections are particularly beautiful and cover a large area. The wage earning classes are thrifty and are largely house owners. The various street car routes meet at or near the City Hall square in the center of the city on the main business thoroughfare. The street railway system has about 58 miles of track, operated by electricity. One line operates to outlying towns 10 or 12 miles distant. The total (track) mileage is controlled as follows:

	Owns and operates.
Worcester Traction Co. (controls 31.5 miles.)	
Worcester Consolidated Street Ry. Co.	31.5
Worcester, Leicester & Spencer Street Ry. Co.	14.0
Worcester & Millbury Street Ry. Co.	8.0
North End Street Ry. Co.	5.1
Worcester & Shrewsbury Street Ry. Co.	.7
Total	59.3

STREET RAILWAY SYSTEM—Present Companies.

Worcester Traction Co.—Chartered, 1893. This company was organized for the purpose of controlling various street railway properties in central Massachusetts through ownership of stock, and is not an operating company. The dividends upon its capital stock are derived from the surplus earnings, over and above interest charges, of the operating companies which it controls.

The company owns the entire capital stock of the Consolidated Street Ry. Co. of Worcester (which see for report of operation).

Capital Stock.—Common stock, authorized and issued, $3,000,000, shares fully paid up and non-assessable; par value $100 per share.

Preferred stock, $2,000,000, 6 p. c. cumulative, redeemable at 105 and accrued dividend, on 3 months' notice by the company.

Funded Debt.—The Worcester Traction Co., as such, has no funded debt, but has guaranteed the debentures ($500,000) of the Worcester Consolidated Street Ry. Co.

Officers.—Pres. C. B. Pratt, Sec. T. C. Barr, Treas. A. H. Stone. General offices, Worcester and Newark, N. J.

Worcester Consolidated Street Railroad Co.—Chartered, 1869.

Capital Stock.—Common stock, authorized and issued, $700,000, all in treasury of Worcester Traction Co.

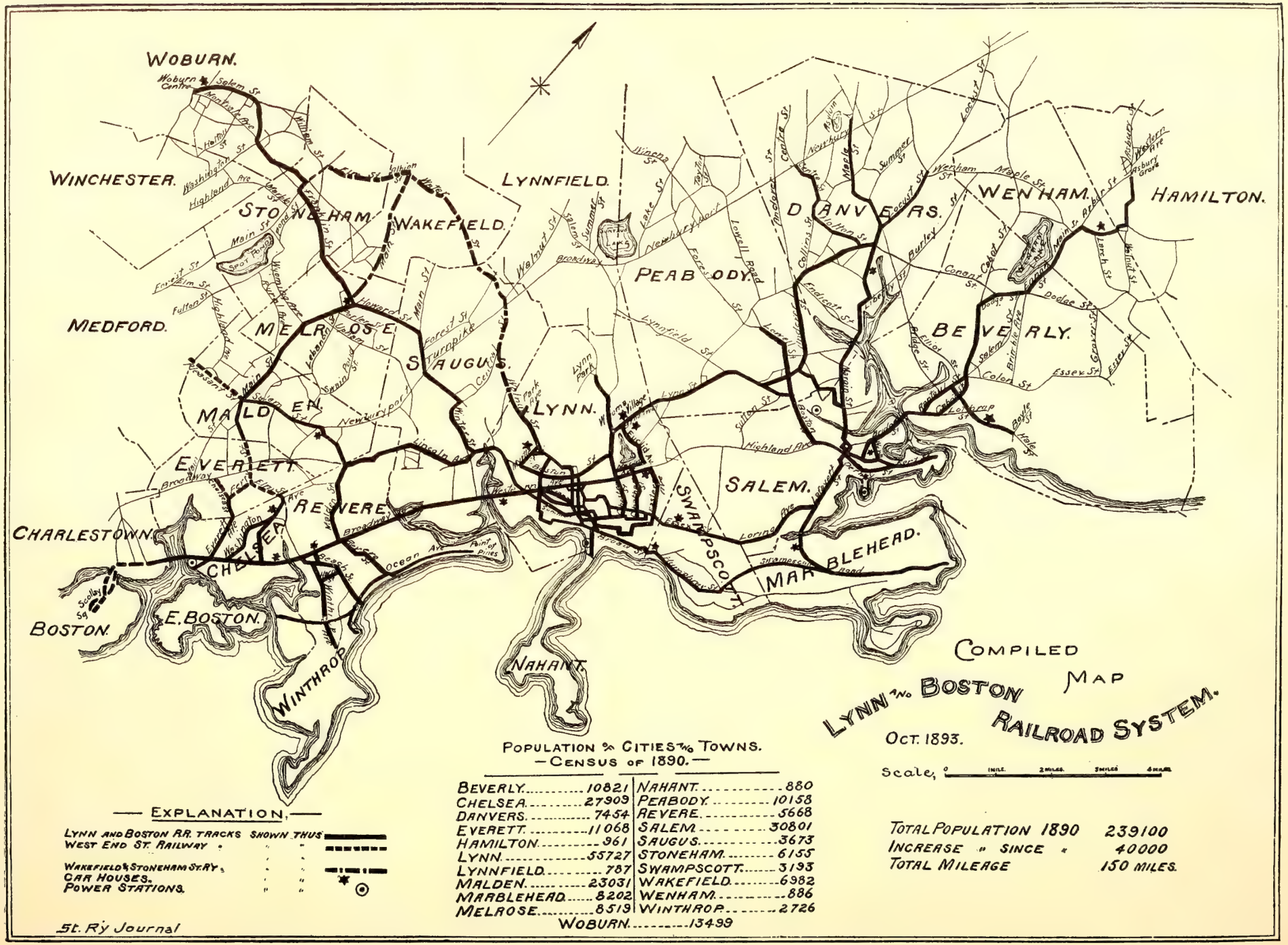
Funded Debt.—First mortgage coupon bonds, authorized and issued, $150,000; dated Aug. 1, 1887, due 1897 to 1907, at option of company; denom. $1,000; int. 5 p. c., payable Feb. and Aug. at office of company; trustee of mortgage, Obadiah B. Hadwell, of Worcester.

Debenture gold bonds, $500,000; coupon, but may be registered; dated Feb. 1, 1894, due 1914; denom. $1,000; int. 5 p. c., payable in gold Feb. and Aug., at office of company.

Note.—The debenture bonds above specified provide that this company will not issue debenture bonds beyond this amount, nor execute any mortgage, nor permit any other encumbrance or lien upon its property (except as hereafter specified), unless the payment of said $500,000 of bonds, or such part thereof as may be issued and outstanding, shall first be secured by a prior lien thereon; but the company may, without committing a breach of this agreement, mortgage its property for the purpose of renewing and securing the present issue of $150,000 of bonds now outstanding at such time as the same shall mature, and may also mortgage any extension or branch lines which it may hereafter purchase or contract to purchase to secure an issue of bonds or other obligations; limited, however, to the sum paid for the lines so purchased, or to the sum said company may hereafter pay for the necessary franchises and privileges for constructing and operating said extensions and branch lines, plus the actual cost of constructing and equipping same, including the purchase of rolling stock, construction of power houses, etc.; and limited further to the maximum of $25,000 per mile of said extensions and branch lines, and the proper proportions for less than a mile. Or the railway company may issue bonds or other obligations to the said amount for the aforesaid purpose without executing a mortgage to secure the same. The company may also place a mortgage upon all its property real and personal provided that proper precaution is made for the exchange of $500,000 of bonds, or as many of them as may be issued and outstanding for bonds secured by such mortgage bond for bond.

The company reserves the right to pay and redeem these debenture bonds upon thirty days' notice, at any time before its maturity, on payment of 2½ per cent. premium and accrued interest.

Operation.—Year ending Sept. 30,	1892.	1893.
Receipts from passengers	$314,004	$332,224
" other sources	4,469	5,433
" total	318,473	337,657
Operating expenses	247,537	258,884
Earnings from operation	70,936	78,773



POPULATION OF CITIES AND TOWNS.
—CENSUS OF 1890.—

BEVERLY	10821	NAHANT	880
CHELSEA	27909	PEABODY	10158
DANVERS	7454	REVERE	5668
EVERETT	11068	SALEM	30801
HAMILTON	961	SAUGUS	3673
LYNN	55727	STONEHAM	6155
LYNNFIELD	787	SWAMPSCOTT	3193
MALDEN	23031	WAKEFIELD	6982
MARBLEHEAD	8202	WENHAM	886
MELROSE	8519	WINTHROP	2726
WOBURN	13499		

TOTAL POPULATION 1890	239100
INCREASE " SINCE "	40000
TOTAL MILEAGE	150 MILES.

Deductions from earnings.		
Interest charges	15,912	7 640
Taxes	7,959	18,174
Net income	47,065	52,960
Dividends paid	28,000	70,000
To surplus account	19,065	def. 17,040
Total surplus account	37,960	16,342
Per cent. O. E. to total receipts	78.0	76.6
" " dividends paid	8	10
Stock receiving dividends	350,000	700,000

Balance Sheet.—Date Sept. 30, 1893.

Assets.		Liabilities.	
Cost of road	$937,564	Capital stock	$700,000
" equipment	318,681	Funded debt *a*	150,000
Cash assets	15,944	Bills payable *b*	665,474
Other assets	259,626		
		Profit and loss	16,342
Total	1,531,815	Total	1,531,815

a. Since increased by $500,000 through issue of debentures. *b.* Since reduced by proceeds of debentures sold.

Plant and Equipment.—Miles of main line 30.5, of sidings 1, total track (electric) 31.5. Gauge, 4 ft. 8½ in., 90 lb. girder; 63 motor cars, 62 trail cars. Lake Erie engines. Gen. Elec. dynamos and motors. Laclede, Jones and Stephenson cars.

Officers.—Pres. Chas. B. Pratt, Sec. & Treas. A. H. Stone, Supt. J. N. Akarman. General office, 15 Market St.

BOSTON, MASS.

MUNICIPAL STATISTICS AND INFORMATION.

Location.—Boston is situated on the eastern central coast of Massachusetts, at the confluence of several rivers with Massachusetts Bay. It is the county seat of Suffolk County.

Suburbs.—Boston is the heart of one of the richest and most beautiful residential and business districts in the United States. A large proportion of its business men find homes in the surrounding cities and towns within a radius of thirty miles from the city proper. From twenty-five to thirty of these, ranging in size from 1,000 to 60,000 inhabitants, are within ten miles of the Massachusetts State House at Boston, and are connected with Boston by street railway lines.

Population.—The population of Boston proper in 1880 was 362,839, and in 1890, 448,477, an increase of 24 per cent. The population of twenty-six cities, townships, and villages in the immediate neighborhood of Boston in 1880 was 272,878, and in 1890, 400,263, an increase of 47 per cent. The total present population of the city and suburbs is approximately 900,000.

Railroad and Steamship Connections.—Boston is the terminus of a widely ramifying railway system, which includes the Consolidated R. R., the New York & New England R. R., the Boston & Albany R. R., the Fitchburg R. R., the Boston & Maine R. R., and the Boston, Revere Beach & Lynn R. R. The railroad system of Massachusetts has probably reached a higher state of development than that of any single state in the Union. Direct lines of steamships connect Boston with Europe, the West Indies, and the principal ports of the Atlantic coast.

Manufacturing and Commercial Interests.—A capital of about $118,000,000 is employed in the various manufacturing industries of the city, the principal productions being clothing, furniture, musical instruments, cordage and twine, confectionery, coffee and spices, rubber and elastic goods, machinery, boilers, farm implements, type, boots and shoes, chemicals, fertilizers, heating apparatus. Boston is the metropolis of the New England States, and has a large foreign and domestic trade in boots and shoes, wool, fish, ice, dry goods and sugar. About 90,000 hands are employed in the manufacturing industries, receiving in wages about $55,000,000 per annum, and the value of the product is about $211,000,000 per annum.

Banking Capital.—There are now (1894) 62 national banks with a combined capital and surplus of about $77,000,000; 1 state bank, with capital and surplus of about $159,000; 10 trust companies, with capital and surplus of about $16,000,000; 13 savings banks with surplus of about $6,000,000; 2 loan companies with a surplus of about $370,000; and 49 private banks. The total banking capital is approximately $100,000,000, equivalent to about $222 per capita population.

Assessed Valuation.—The assessed valuation of real estate is (1893) $707,762.300. The assessed valuation of the personal property is $216,372,000. The total valuation of real and personal property is $924,134,300, equivalent to over $2,000 per capita population, a figure probably unequalled among American cities.

Municipal Debt.—The municipal debt of the city less sinking funds is (1894) $33,936,238.

Tax Rate.—The tax rate is (1893) $12.80 per $1,000,

STREET RAILWAY SYSTEM—Descriptive.

The street railways of Boston form one of the largest and most complete municipal and suburban transportation systems in the world. The lines radiate in all directions from the congested business heart of Boston to the suburban towns, ten and fifteen miles away. Pressure upon the facilities is even now so great as to make the rapid transit problem in Boston one of peculiar difficulty and importance. The surface lines carry nearly 150,000,000 passengers per annum, in addition to which the steam railways entering Boston have a most important and valuable suburban traffic amounting to nearly or quite 60,000,000 passengers per annum. Prior to 1888 the street railways of Boston and vicinity were operated entirely by horses, but since that time the lines have nearly all been converted to the "trolley" electric system, so that at present about 15 per cent. only of the total mileage remains in operation by horses. The street railway system of Eastern Massachusetts, comprising the lines of Boston and connecting lines in the immediate suburbs, contains about 550 miles of track.

STREET RAILWAY SYSTEM.—Present Companies.

North Shore Traction Co.—Chartered, 1892, under the laws of the State of New Jersey. This company was organized for the purpose of controlling various street railway properties in Massachusetts through ownership of stock, and is not an operating company. The dividends upon its stock are derived from the surplus earnings over and above interest charges of the operating companies which it controls.

The company owns the entire stock of the Lynn & Boston R. R. Co. (which see for report of operations).

Capital Stock.—Common stock, authorized and issued, $4,000,000, par value $100 per share. Preferred stock, authorized and issued, $2,000,000, par value $100 per share. Conditions of preference, 6 per cent., cumulative dividends, stock redeemable at 105 and accrued dividends.

Funded Debt.—None, except that of the Lynn & Boston R. R. Co.

Officers.—Pres. C. M. Wicker (15 Wall St., New York), Sec. Wm. Stiles, Treas. J. Mora Davison (23 Nassau St., New York). General office, Camden, N. J.

Lynn & Boston Railroad Co.—Chartered, April 6, 1859. Annual meeting second Wednesday in Nov. The Naumkeag Street Ry. Co., of Salem, the Lynn Belt Line Street Ry. of Lynn, and the Essex Electric Street Ry. Co., of Salem were consolidated with this company in 1892.

Capital Stock.—Common stock, authorized and issued (Jan., 1894), $1,000,000; par value $100 per share. The entire capital stock of this company is owned by the North Shore Traction Co.

Funded Debt.—The original and assumed funded indebtedness of the Lynn & Boston R. R. Co., is $1,860,000 as follows:

Lynn & Boston R. R. Co.

First mortgage bonds outstanding, $75,000; dated May 15, 1880, due 1900; int. 6 p. c., payable May and Nov.

Debenture bonds, $100,000; dated May 15, 1884, due 1900; int. 5 p. c., payable May and Nov.

Debenture bonds, $50,000; dated May 15, 1885, due 1900; int. 5 p. c., payable May and Nov.

Debenture bonds, $100,000; dated Apr. 1, 1887, due 1907; int. 5 p. c., payable Apr. and Oct.

Debenture bonds, $275,000; dated Mar. 1, 1892, due 1912; int. 5 p. c., payable Mar. and Sept.

Naumkeag Street Railway Co.

Income bonds, $36,500; due Mar. 1, 1895; int. 6 p. c.

First mortgage bonds, $215,000, due June 1, 1906; int. 5 p. c.

Debenture bonds, $49,000; due Apr. 1, 1907; int. 5 p. c.

Consolidated mortgage bonds, $726,000; due July 1, 1910; int. 5 p. c.

Debenture bonds, $28,000; due Sept. 1, 1910; int. 6 p. c.

Debenture bonds, $6,000; due July 1, 1911; int. 6 p. c.

Lynn Belt Line Street Railway Co.

First mortgage bonds, $100,000; dated May 1, 1890, due 1910; int. 5 p. c.

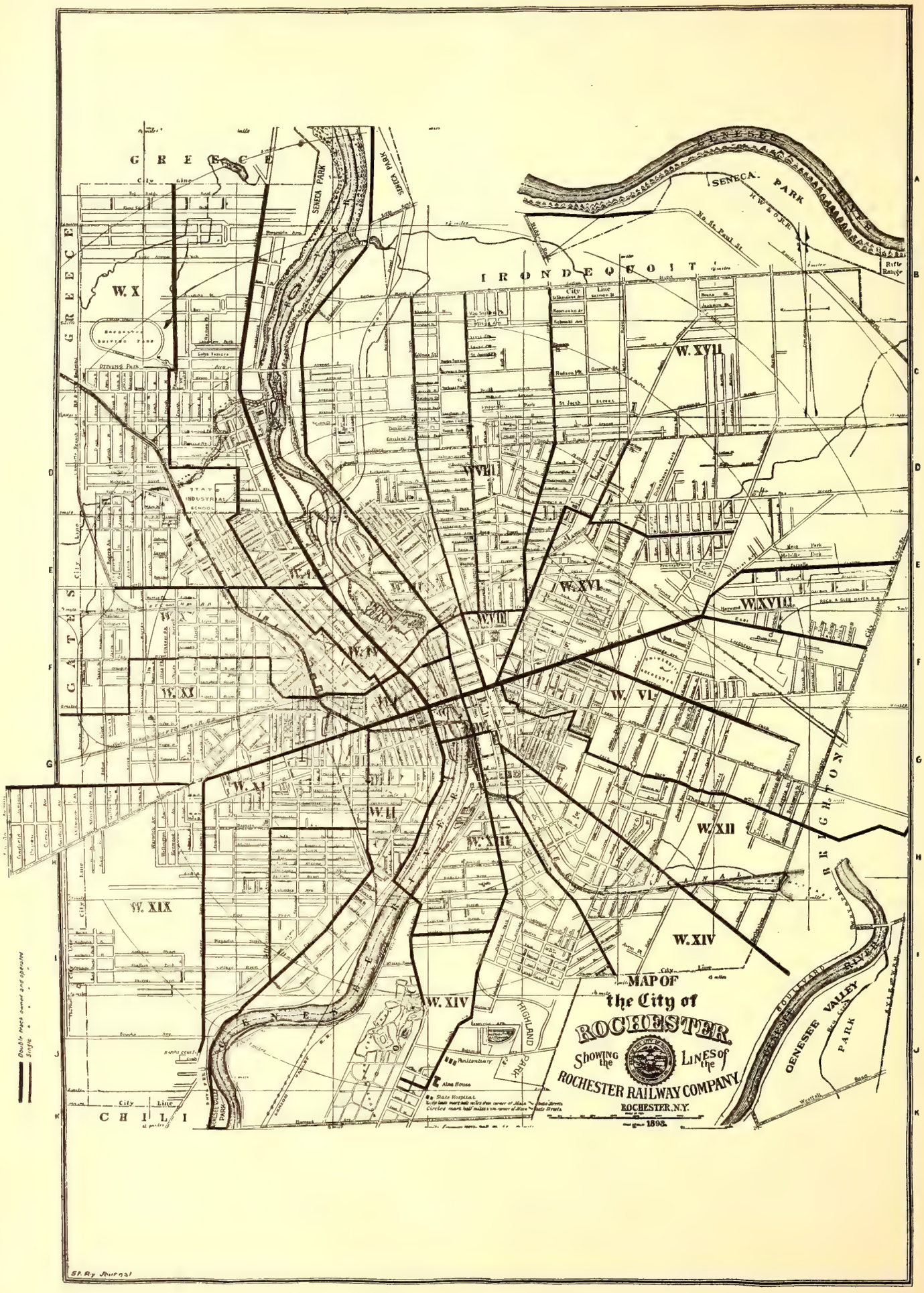
Essex Electric Street Railway Co.

First mortgage bonds, $100,000; due Jan. 1, 1911; int. 6 p. c.

Leased Roads.—The company operates the property of the East Middlesex Street Ry. Co. under a 99 year lease, dated 1893, the property of the Winnisimmet R. R. Co. under a 999 year lease dated 1880, and the property of the Boston & Chelsea R. R. Co., under a 99 year lease dated 1880.

Operation.—The following operating report for 1892 is a consolidation of the reports of the four constituent companies which were independent in that year, and of the consolidated property in 1893.

Year ending	Sept. 30, 1892	1893
Receipts from passengers	$929,208	$1,121,366
" other sources	11,572	15,287
" total	940,780	1,136,653
Operating expenses	724,059	748,494
Earnings from operation	216,721	388,159
Deductions from earnings.		
Interest on funded and floating debt	94,911	224,977
Taxes	24,154	34,196
Rentals	25,604	33,148
Net income	72,052	95,838
Dividends paid	52,000	80,000
To surplus account	20,052	15,838


MAP OF
the City of
ROCHESTER
Showing the Lines of the
ROCHESTER RAILWAY COMPANY
ROCHESTER, N.Y.
1893
GREECE
IRONDEQUOIT
BRIGHTON
CHILI
GATES
SENECA PARK
GENESEE VALLEY PARK
W. X
W. XVII
W. XVI
W. XVIII
W. VI
W. XII
W. XIV
W. XIX
W. XX
W. II
W. I
W. V
W. IV
W. VII
W. VIII
Double track owned and operated
Single " " "
City Line
Alms House
Penitentiary
State Hospital
Rifle Range
Rochester Driving Park
State Industrial School
Highland Park
Ry Journal

Total surplus account	132,240	77,748
Per cent. O. E. to total receipts	77	65.6
" " dividends paid	8	8
Stock receiving dividends (L. & B. R. R. Co.)	650,000	1,000,000

Balance Sheet.—Date Sept. 30, 1893.

Assets.		Liabilities.	
Cost of road	$4,108,757	Capital stock	$1,000,000
" equipment	743,671	Funded debt	1,860,500
Cash assets	304,810	Other liabilities	3,112,191
Other assets	893,202	Profit and loss	77,748
Total	$6,050,440	Total	$6,050,440

Plant and Equipment.

	Owned.	Leased.
Miles of main line	95.424	26.251
" second track	15.300	8.000
" sidings	6.028	
" track (electric)	116.752	34.251
" " operated by electricity	142.003	
" " " " horses	9.	

Gauge, 4 ft. 8½ in.; 40 lb. to 90 lb. tram, T and girder rail; 78 horses, 17 horse cars, 352 motor cars, 175 trail and special cars, 581 motors, 5,425 H. P. engines, 6,010 H. P. dynamos, Gen. Elec. dynamos and motors.

Officers.—Pres. Amos. F. Breed, V. Pres. & Clerk E. Francis Oliver, Treas. C. Williams, Gen. Man. Elwin C. Foster; Audr. F. E. Smith. General Office, 333 Union Street, Lynn.

East Middlesex Street Railroad Co.

Leased, on May 1, 1893, to the Lynn & Boston R. R. Co. for 99 years.

Capital Stock.—Common stock, authorized, $300,000, issued and outstanding (Sept., 1893), $297,700; par value, $100 per share.

Funded Debt.—Debenture bonds, $125,000; int. 6 p. c. Debenture bonds, $100,000; int. 5 p. c.

Balance Sheet.—Date Sept. 30, 1893.

Assets.		Liabilities.	
Cost of road	$344,518	Capital stock	$297,700
" equipment	102,106	Funded debt	225,000
Cash assets	32,329	Other liabilities	19,647
Other assets	58,884		
Profit and loss	4,509		
Total	$542,347	Total	$542,347

Plant & Equipment.—Miles of main line 13.7, of second track 2.8, of sidings 1.8, total track 18.3; operated by horses 12.3, by electricity 6. Gauge, 4 ft. 8½ in.; 42 lb. and 70 lb. rail; 185 horses, 39 horse cars, 9 motor cars, Gen. Elec. dynamos and motors.

Officers.—Pres. A. F. Breed, Sec. L. F. Arnold, Treas. D. F. Sweetser, Supt. J. E. Sewell. General Office, 35 Congress St., Boston.

ROCHESTER, N. Y.

MUNICIPAL STATISTICS AND INFORMATION.

Location.—Rochester is located in the western part of New York State, on both sides of the Genesee River, 7 miles above its mouth in Lake Ontario. It is the capital of Monroe County.

Suburbs.—The villages of Brighton and Charlotte and the suburban resorts, Ontario Beach, Summitville, Windsor Beach, Sea Breeze, Irondequoit Bay and Manitou Beach are connected with Rochester by street railway lines.

Population.—The population in 1880 was 89,366, and in 1890, 133,896, an increase of 50 per cent. The population by the state census of 1892 was 144,834. The population of the two suburban villages named was, in 1880, 1,160, and in 1890, 1,635, an increase of 41 per cent. Local estimates place the total present population of the city and suburbs at about 175,000.

Railroad Connections.—The New York Central & Hudson River R. R., with its branch and leased lines, the New York, Lake Erie & Western R. R., the Lehigh Valley R. R., the Western New York & Pennsylvania R. R., and the Buffalo, Rochester & Pittsburgh R. R. are the principal railroad systems entering Rochester. The city is also on the Erie Canal.

Manufacturing and Commercial Interests.—Rochester has a large trade with Canada in coal, and with all parts of the country in garden seeds, fruits, plants and trees. A capital of about $46,000,000 is employed in the various manufacturing industries of the city, the principal productions being clothing, beer and other malt liquors, boots and shoes, safes, lumber, patent medicines, furniture, carriages and wagons, flour, tobacco, cigars and cigarettes. About 32,000 hands are employed in these industries, receiving in wages about $17,000,000 per annum, and the value of the manufactured product is about $73,000,000 per annum.

Banking Capital.—There are now (1894) 2 national banks with a combined capital and surplus of about $1,700,000; 8 state banks, with capital and surplus of about $2,400,000; 2 trust companies, with capital and surplus of about $650,000; 3 savings banks with surplus of about $1,800,000; and 1 private bank. The total banking capital is approximately $6,500,000, equivalent to about $49 per capita.

Assessed Valuation.—The assessed valuation of real estate is (1893) $97,206,085, the property being assessed at from 60 to 80 per cent. of its real value. The assessed valuation of the personal property is $6,676,967. The total valuation of real and personal property is $103,883,052, equivalent to about $717 per capita.

Municipal Debt.—The municipal debt of the city less sinking funds is (1892) $11,568,000, equivalent to about $80 per capita.

Tax Rate.—The tax rate is (1892) $15.26 per $1,000.

STREET RAILWAY SYSTEM—Descriptive.

Rochester covers an area of 20 square miles and is divided into two nearly equal parts by the Genesee River which, in its passage through the city and suburbs, descends 300 ft. within three miles, and has three perpendicular falls of 96, 26 and 84 ft. respectively. The first is in the heart of the city and, in common with the others about two miles below, has been largely utilized for manufacturing purposes. This enormous water power has greatly promoted the growth of the city and must remain a constant and vital factor in its development. At right angles to the river, the city is traversed by Main Street, its geographical and business center. The street railway lines, consisting of 86 miles of track, are operated throughout by electricity. The service is admirable and the routes are well planned to secure the business arising from the scattered manufactories and large distances in the city proper. Outside of city limits, lines radiate to the environs and the pleasure resorts and beaches on Lake Ontario. The traffic from the latter source is a local feature of great importance, and during the pleasant seasons of the year assumes enormous proportions. The following companies operate the system:

Rochester Railway Co.	Owns and operates	77.45 miles.
Rochester Electric Railway Co.	" "	8.88 "
Rochester & Irondequoit Railroad Co.	" "	10. "

STREET RAILWAY SYSTEM—Present Companies.

Rochester Railway Co.—Chartered, Feb. 25, 1890, for 99 years with right to renewal. Annual meeting third Tuesday in Jan. This is a consolidation of the Rochester City & Brighton R. R. Co. (incorp. May 31, 1862 under N. Y. R. R. Act of 1850), the Crosstown R. R. Co., and the South Park R. R. Co. This company owns and operates the entire street railway system of the city.

Capital Stock.—Common stock, authorized and issued, $5,000,000; par value $100 per share.

Funded Debt.—First mortgage gold bonds, authorized, $3,000,000; issued, $2,000,000; in escrow (see Note) $1,000,000; coupon, but may be registered; dated Apr. 1, 1890, due 1930; denom. $1,000; int. 5 p. c., payable in gold Apr. and Oct. at office of Solicitors' Loan & Trust Co., of Philadelphia, trustee of mortgage.

Debenture gold bonds, $600,000; dated Mar. 1, 1891, due 1911, with privilege of redemption after 1901; denom. $500, int. 6 p. c., payable Mar. and Sept., at office of company.

Second mortgage gold bonds, authorized, $1,500,000, issued $750,000, in escrow (see Note) $750,000; coupon, but may be registered; dated Oct. 4 1893, due Dec. 1, 1933; denom. $1,000; int. 5 p. c., payable in gold June and Dec., at office of Security Trust Co. of Rochester, trustee of mortgage.

Note.—$1,000,000 of the first mortgage bonds are held in escrow by the Solicitors Loan & Trust Co. of Philadelphia, trustee, to retire, at maturity, $875,000 of the Rochester City & Brighton R. R. Co.'s first mortgage bonds, as follows: $200,000, 7 p. c., due Oct. 1, 1895; $500,000, 6 p. c., due Jan. 1, 1902; $175,000, 6 p. c., due Apr. 1, 1919.

$750,000 of the second mortgage bonds are held in escrow by the trustee to fund or retire at maturity the $600,000 of debenture bonds above described. The remainder of the second mortgage bonds ($750,000) have been issued and sold to pay off the floating debt.

It is provided in the first mortgage deed that the sum of $25,000 per annum from the net earnings shall be deposited with the trustee for a sinking fund.

Franchises.—The company's franchises are perpetual and exclusive upon the streets already occupied which are the principal ones in the city.

Operation.—Year ending June 30,	1892.	1893.
Receipts from passengers	$683,358	$798,761
" other sources	5,201	17,065
" total	688,559	815,827
Operating expenses	417,139	430,083
Earnings from operation	271,420	385,744
Deductions from earnings.		
Interest charges	169,756	191,309
Taxes	33,299	35,685
Accident insurance		8,750
Net income	68,365	150,000
Total surplus account	207,690	357,691
Per cent. O. E. to total receipts	60.5	52.7

Balance Sheet.—Date June 30, 1893.

Assets.		Liabilities.	
Cost of road	$8,673,559	Capital Stock	$5,000,000
" equipment	610,471	Funded debt	3,475,000
Current assets	1,424	Bills pay. and loans.	612,500
Other assets	171,000	Other liabilities	11,264
		Profit and loss	357,691
Total	9 456,454	Total	9,456,454

Plant and Equipment.—Miles of main line 43,85, of second track 31.58, of sidings 2.02, total track (electric) 77.45. Gauge, 4 ft. 8½ in., 50 miles 78 lb. girder rail construction, 26.5 miles T rail construction, 32 miles of paved streets; 24 horses, 151 motor cars, 60 trail cars, 3,000 H. P. station plant. Gen. Elec. and West. dynamos and motors. Approximate value real estate and buildings, $450,000.

Officers.—Pres. & Gen. Man. John N. Beckley, V. Pres. Benj. Graham (44 Pine St., New York), Treas. Frederic P. Allen, Sec. Chas. A. Williams, Supt. Wm. Rosborough, Ch. Engr. Geo. W. Howard, Elecn. Alfred Green. General office, 267 State St.

BUFFALO, N. Y.

MUNICIPAL STATISTICS AND INFORMATION.

Location.—Buffalo is situated in the western part of New York State, at the confluence of the Niagara River with Lake Erie. It is the county seat of Erie County.

Suburbs.—The city of Tonawanda is eleven miles north of Buffalo, and is connected with the latter by street railway lines.

Population.—The population in 1880 was 155,134, and in 1890, 255,664, an increase of 65 per cent. The population of Tonawanda in 1880 was 3,864, and in 1890, 7,145, an increase of 85 per cent. The total present population of the city and suburbs is approximately 275,000.

Railroad and Steamship Connections.—The New York Central R. R., the West Shore R. R., the Lake Shore & Michigan Southern R. R., the New York, Chicago & St. Louis R. R., the Buffalo, Rochester & Pittsburgh R. R., the Western New York & Pennsylvania R. R., the Lehigh Valley R. R., and the Michigan Central R. R. terminate at Buffalo, and make it one of the important railroad centers of the country. The Grand Trunk R. R. reaches Niagara Falls, and furnishes another outlet to the North and West. The city is also connected with all ports on the Great Lakes by regular lines of freight and passenger steamers.

Manufacturing and Commercial Interests.—A capital of about $70,000,000 is employed in the various manufacturing industries of the city, the principal productions being manufactured iron, steel, machinery, agricultural implements, carriages and wagons, tobacco, boots and shoes, furniture, glucose, vessels, cooperage, bricks, packed and dressed meats and other slaughter house products, malt liquors, lumber, clothing, leather, soap and candles, flour, patent medicines and compounds. Buffalo handles an immense amount of grain and flour, livestock, coal, lumber, iron and steel, its lake and railroad connections making it an important distributing point. About 50,000 hands are employed in the manufacturing industries, receiving in wages about $25,000,000 per annum, and the value of the manufactured product is about $100,000,000 per annum.

Banking Capital.—There are now (1894) 2 national banks with a combined capital and surplus of about $1,000,000; 17 state banks, with capital and surplus of about $8,000,000; 1 trust company, with capital and surplus of about $50,000; and 5 savings banks with surplus of about $5,000,000. The total banking capital is approximately $14,000,000, equivalent to about $53 per capita.

Assessed Valuation.—The assessed valuation of real estate is (1892) $183,254,870, the property being assessed at about 65 to 70 per cent. of its real value. The assessed valuation of the personal property (1892) was $13,829,910. The total valuation of real and personal property in 1893 was $208,665,620, equivalent to $820 per capita.

Municipal Debt.—The municipal debt of the city less sinking funds is (1894) $11,178,734, equivalent to $44 per capita.

Tax Rate.—The tax rate is (1893) $20.92 per $1,000.

STREET RAILWAY SYSTEM—Descriptive.

The street railway lines of Buffalo originate in the extremely small business district of the city, and thence branch out north and east over an unusually large residential area, triangular in shape and containing a large number of small homes. Main Street, the principal thoroughfare into which all the cars turn at various points, divides the city into two sections, locally called the East Side and the West Side. The arrangement of the lines which are now being extended in several directions, is such that the traffic is necessarily large, and will greatly increase under the stimulus of electric motive power now being introduced over the entire system. Until within the last two years the service has been inadequate to the needs of a rapidly growing city, and the facilities have been heavily taxed. With the development of the immense water power at Niagara Falls, and the consequent stimulus given to manufacturing industries in Western New York, it is believed that the growth of Buffalo within the next few years will be unprecedented. There are numerous and unusually beautiful parks in various parts of the city, and the pleasure travel in summer is an important source of revenue. The recent financial depression has had less effect on the prosperity of Buffalo and its street railway system than in many other places, as will be seen from the financial statement below. The street railway mileage is controlled by the Buffalo Railway Co., as follows:

	Owns.	Controls.
Buffalo Railway Co.	69.61	128.61
Crosstown Street Railway Co.	59.	
Total	128.61	128.61

STREET RAILWAY SYSTEM.—Present Companies.

Buffalo Railway Co.—Chartered, Nov. 22, 1890, for 999 years. Annual meeting third Tuesday in November. This is a consolidation of The Buffalo Street R. R. Co., The Buffalo East Side Street Ry. Co., and The West Side Street Ry. Co.

Capital Stock.—Common stock, authorized, $6,000,000; issued and outstanding (April, 1894), $5,370,500; par value $100 per share.

Funded Debt.—First consolidated mortgage bonds, authorized, $5,000,000, issued, $3,500,000, in escrow, $1,500,000 (see Note); coupon, but may be registered; dated Feb. 1, 1891, due 1931; denom. $1,000; int. 5 p. c., payable Feb. and Aug., at office of the company in Buffalo; trustee of mortgage, Solicitors' Loan & Trust Co. of Philadelphia.

Note.—The unissued consolidated mortgage bonds ($1,500,000) are reserved in the hands of the trustee to retire the following prior liens on the properties of constituent companies:

Buffalo Street R. R. Co. first mortgage bonds, authorized and issued, $150,000; due May 1, 1899; int. 7 p. c., payable May and Nov. Second mortgage bonds, authorized and issued $650,000; due July 1, 1905; int. 7 and 6 p. c., payable in Jan. and July.

Buffalo East Side Street Ry. Co. first mortgage bonds, authorized and issued, $300,000; due June 1, 1904; int. 7 p. c., payable in June and Dec. Second mortgage bonds, authorized, $300,000; issued, $293,500; due Sept. 1, 1912; int. 6 p. c., payable March and Sept.

Six real estate mortgages, 6 p. c., $106,500.

Seven purchase money mortgages, 6 p. c., $20,257.

Operation.—Consolidated report Buffalo Ry. Co., and Crosstown Street Ry. Co., for year ending Mar. 31,

	1893	1894
Receipts from passengers	$1,280,361	$1,480,661
" other sources	25,292	25,833
" total	1,305,653	1,506,494
Operating expenses	825,294	886,261
Earnings from operation	480,359	620,233
Deductions from earnings.		
Interest	320,598	356,460
Taxes	60,444	87,377
Surplus	99,317	176,396
Total surplus account	242,112	418,507
Per cent. O. E. to total receipts	64.46	59.85

Balance Sheet.—Buffalo Railway Co., dated Mar. 31, 1894.

Assets.		Liabilities.	
Cost of road	$8,607,354	Capital stock	$5,370,500
" equipment	2,533,669	Funded debt	5,020,257
Current assets	52,399	Bills payable	524,492
Other assets	355,000	Other liabilities	274,129
		Profit and loss (surplus)	359,044
Total	$11,548,422	Total	$11,548,422

Plant and Equipment.—Miles of main line owned 43.94, of second track 24.79, of sidings .89, total track owned 69.61. controlled and operated 128.61. Gauge, 4 ft. 8½ in.; 52 lb. to 93 lb. girder rail; 400 horses, 28 horse cars, 120 motor cars, 97 trail and open cars, Lake Erie engines, Gen. Elec. dynamos and motors.

Officers.—Pres. Henry M. Watson, V. Pres. & Gen. Man. H. H. Littell, Sec. & Treas. Jos. S. Baecher, Supt. F. O. Rusling. General office, 178 Main Street.

Crosstown Street Railway Co. of Buffalo,—(Operated by Buffalo Railway Co.) Chartered, February, 1, 1890. Annual meeting, third Tuesday in November. This road is not yet fully constructed.

Capital Stock.—Common stock, authorized, $3,000,000, issued and outstanding (Apr., 1894), $1,662,000, all in treasury of the Buffalo Ry. Co.

Funded Debt.—First mortgage bonds, authorized. $3,000,000 issued $1,662,000; coupon, but may be registered; dated May 1, 1892, due 1932; denom. $1,000; int. 5 p. c., payable May and Nov. at office of Metropolitan Trust Co. of New York, trustee of mortgage. These bonds are guaranteed by the Buffalo Ry. Co.

Operation.—Included in statement of Buffalo Ry. Co. (which see).

Balance Sheet.—Date Mar. 31, 1894.

Assets.		Liabilities.	
Cost of road	$3,052,969	Capital stock	$1,662,000
" equipment	278,628	Funded debt	1,662,000
Current assets	142,437	Bills payable	34,000
		Other liabilities	56,571
		Profit and loss (surplus)	59,463
Total	3,474,034	Total	3,474,034

Plant and Equipment.—Miles of main line owned , of second track , total track (electric), 59. Gauge, 4 ft. 8½ in.; 67 to 93 lb. girder rail; 90 motor cars; Gen. Elec. motors.

Officers.—Pres. & Gen. Man. H. H. Littell, Sec. & Treas. Jos. S. Baecher, Supt. F. O. Rusling General office, 178 Main St., with Buffalo Ry. Co.

THE STREET RAILWAY JOURNAL

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NEW ADVERTISEMENTS.

THE LUNKENHEIMER CO., of Cincinnati, mentions gate valves.

THE H. W. JOHNS MANUFACTURING CO., of New York, has a change.

THE TRENTON IRON CO., of Trenton, N. J., advertises its cable ropes.

THE E. T. BURROWES CO., of Portland, Me., mentions its car curtains.

C. J. FIELD, of New York, consulting electrical engineer, has a card.

THE COMPLETE ELECTRIC CONSTRUCTION CO., of New York, makes a change.

FIELD & BEATTIE, of New York, engravers and electrotypers, have a card.

THE SIEMENS HALSKE CO., of America, of Chicago, makes an extensive change.

THE WAKEFIELD ELECTRICAL ENGINEERING CO., of Philadelphia, Pa., has a card.

THE C. & G. COOPER & CO., of Mt. Vernon, O., advertises its engines this month.

SAMUEL LEWIS, of Brooklyn, N. Y., describes and illustrates his wood matting.

THE RAILWAY EQUIPMENT CO., of Chicago, specially mentions its track brooms.

A. B. WETMORE, of New York, mentions his business in lumber for car builders' use.

THE VENEER SEATING & CHURCH FURNITURE CO., of Brooklyn, advertises its business.

JULIUS MEYER, of New York, contractor and engineer for street railroads, has a card.

THE U. S. WIRE MAT CO., of Decatur, Ill., presents the merits of its wire matting.

THE R. A. CRAWFORD MANUFACTURING CO., of Pittsburgh, Pa., takes a page this month.

THE NORTH WESTERN LAND & COAL CO., of Boston, advertises a coal saving compound.

THE JACKSON & SHARP CO., of Wilmington, Del., builders of street railway cars, have a page.

THE BARNEY & SMITH CAR CO., of Dayton, O., advertises street railway cars of all descriptions.

THE LEWIS & FOWLER MANUFACTURING CO., of Brooklyn, N. Y., presents the claims of its patent stove box and street car heater, and its patent electric snow sweeper. It also devotes considerable space to the merits of its passenger register, and publishes a list of its patents thereon, with a warning against infringement thereof.

CONTENTS.

LIBRARY JAN 6 1894 U.S. PATENT OFFICE

Illustrated Articles.

Electric Railway Construction in Philadelphia..... 9
Power Station of the Lynn & Boston Railroad Co., at Salem, Mass..... 10
Exhibit of the J. A. Fay & Egan Co. at the World's Fair..... 12
Plant of the Worcester Traction Co..... 13
New Direct Connected Engine and Generator..... 14
A New Car and Truck..... 15
Curves and Turnouts for Electric Railways..... 26
Annual Report of the New York & Brooklyn Bridge Trustees..... 27
Starting the Cable Cars on Third Avenue, New York..... 38
The "Imperial" Steel Truck..... 47
New Glass Oil Cup for Dynamos and General Engine Bearings 48
Triple Expansion Engines in Central Stations..... 49
The Lodge & Davis Machine Tool Co.'s World's Fair Exhibit..... 50
A New Departure for a Long Established Company..... 50
Handsome Cars..... 51
The Pfingst Fender..... 51
The "Aluminum" Stationary Register..... 52
The Storey Electric Lathes and Motors..... 52
The Works of the J. W. Fowler Car Co..... 53
A Pressure Plate Switch..... 56
Electric and Cable Car Street Sprinkler..... 56
Death of William Richardson..... 57
The Requirements of Safety Appliances for Street Railways 58
The Works of the C. & C. Electric Co..... 58

Editorial.

"American Street Railway Investments:"—A Supplement..... 34
Valuable Financial Articles..... 34
Concrete Foundation for Street Railway Tracks..... 34
An Instructive and Interesting Report..... 35
The Past Year..... 35
The Measure of a Manager's Ability..... 35
A Broad and Liberal Policy..... 35

Correspondence.

Montreal Track Construction..... 37
A Letter from Mrs. Reckenzaun..... 37
The Fire at the Works of the New Castle Car Mfg. Co..... 37

Miscellaneous.

The Cost of Concrete Paving at Washington..... 13
Lithographed Car Tickets..... 14
The Medical Side of Street Railway Practice—Part III..... 16
Comments on English Track Construction..... 17
The Intrinsic Value of Street Railway Investments..... 18
Annual Report of the West End Street Railway Co..... 28
Trinidad Pitch..... 29
English Notes..... 30
Interesting Rail Tests..... 31
Notes on European Street Railway Practice..... 31
New Work of the Broadway Cable Co..... 33
A Comparison in Mileage and Cars for Two Years..... 33
Legal Pointers..... 36
Report of the Citizens' Traction Co., Pittsburgh, Pa..... 59
Retrospect of the Past Year's Business; Prospects for 1894... 61
Equipment Notes..... 68
New Publications..... 72
Personal..... 72
What is Short Lap Belting?..... 77
A New Departure for the Walker Manufacturing Co..... 79
Railway Statistics..... 80

Patents..... 73
Quotations of Street Railway Stocks..... 75
Financial..... 77
Street Railway Supply Directory..... xxxiii
Index to Advertisers..... v, vi

New Advertisements—Continued.

THE ERIE ENGINE CO., of Erie, Pa., gives some facts very flattering to its type of engines.

THE PITTSBURGH STEEL HOLLOW WARE CO., of Allegheny City, Pa., advertises again this month.

THE FIBERITE CO., of Mechanicville, N. Y., has a page devoted to its insulating appliances.

THE DORNER & DUTTON MANUFACTURING CO., of Cleveland, gives a view of its solid forged motor truck.

THE INTERNATIONAL REGISTER CO., of Chicago, illustrates its "Aluminum" and "Portable" fare registers.

THE LITHOGRAPH STREET CAR TICKET CO., of Cleveland, O., has a page illustrative of its specialty.

J. D. MURRAY, of New Brunswick, N. J., contractor and street railway builder, advertises his business.

THE FIELD ENGINEERING CO., of New York, again advertises the Lake Erie Engineering Co.'s engines.

ROBERT A. KEASBEY, of New York, continues to present good reasons for the use of magnesia covering.

THE LACLEDE CAR CO., of St. Louis, presents a cut of a car supplied to the Philadelphia Traction Co.

LOUIS PFINGST, of Boston, advertises his car fender, recently adopted by the Brooklyn City Railroad Co.

THE NEW CASTLE CAR MANUFACTURING CO., of New Castle, Pa., presents a page notice of its cars in this issue.

THE STEEL MOTOR CO., of Cleveland, this month gives a price list of a quantity of its electric railway supplies.

P. PRYIBIL, of New York, manufacturer of wood working machinery addresses a few arguments to car builders.

THE CALIFORNIA WIRE WORKS, of San Francisco, presents a half page notice of its business in cable ropes, etc.

BEVIN BROTHERS MANUFACTURING CO., of East Hampton, Conn., have an advertisement of their rotating gong.

THE EUPHRAT LIFE SAVING CAR FENDER CO., of New York, has a full page concerning its life protecting device.

THE BILLINGS & SPENCER CO., of Hartford, Conn., this month devotes a half page to its patent commutator bars.

WILLIAM SELLERS & CO., INCORPORATED, of Philadelphia, enumerate their appliances for the equipment of power houses.

THE GENERAL ELECTRIC CO., of Boston and New York, makes a change, as usual, giving additional testimony to the excellence of its apparatus.

THE STANWOOD MANUFACTURING CO., of Chicago, has two pages devoted to illustrations and a detailed description of the "Stanwood Steel Step."

THE FULTON TRUCK & FOUNDRY CO., of Cleveland and Mansfield, O., formerly the Fulton Foundry Co., has a notice of its single and double truck "Imperial."

TAYLOR, DEE & MACK, of Chicago, successors to Taylor, Goodhue & Ames, present the claims of the Burton electric heater, for which they are the selling agents.

THE J. W. FOWLER CAR CO., of Elizabethport, N. J., takes two extra pages in this issue, in which it gives a view of its extensive works, and also draws attention to two snow sweepers of its manufacture.

A directory of the American and State Street Railway Associations will be found on page 26.

A. S. LITTLEFIELD, President. A. H. ENGLUND, Sec'y and Manager.

THE INTERNATIONAL REGISTER CO.,

MANUFACTURERS OF

Stationary and Portable Fare Registers.



"THE ALUMINUM."

"THE ALUMINUM"

Stationary Register.

An Ideal Fare Register, embracing all the valuable improvements of a modern registering device. It has a 7½ inchs troke and is made with satin finished aluminum dials.

Our experience in the manufacture of portable registers has enabled us to produce in this device a mechanism, that for simplicity, accuracy and durability, will stand unequaled.

Sample Register will be sent on trial, free of charge.

—THE—

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INDEX TO ADVERTISERS.

Adams, W. L., & Co., Chicago, Ill..... 70
Allen Electric & Supply Co., Philadelphia, Pa..... 82
Allis, Edward P., Co., The, Milwaukee, Wis..... 52
Altoona Manufacturing Co., Altoona, Pa..... 49
American Car Co., St. Louis, Mo 114
American Electrical Works, Providence, R. I..... 81
American Rail Joint Co., Marion, Ind..... 90
Ames Iron Works, Oswego, N. Y..... 48
Anderson, A. & J. M., Boston, Mass..... 82

Babcock & Wilcox, New York..... 58
Baker, Wm. C., New York.....102
Baldwin Locomotive Works, Philadelphia, Pa.....103
Ball & Wood Co., The, New York. .....
Ball Engine Co., Erie, Pa..... 51
Barbour, Stockwell & Co., Cambridgeport, Mass..... 99
Barney & Smith Car Co., Dayton, O.....111
Bates Machine Co., Joliet, Ill..... 48
Belden, F. E., Mica Mining Co., Boston, Mass..... 41
Bemis Car Box Co., The, Springfield, Mass..... 78
Berlin Iron Bridge Co., East Berlin, Conn..... 79
Bevin Bros. Manufacturing Co., East Hampton, Conn.104
Bickford, J. H., Salem, Mass..... 80
Big Four Route..... 31
Billings & Spencer Co., Hartford, Conn..... 46
Briggs Carriage Company, Amesbury, Mass.....119
Brightman Stoker Co., Cleveland, O..... 55
Brill, J. G., Co., Philadelphia, Pa.....124, 125
Brooklyn Railway Supply Co., Stamford, Conn..... 45
Brown Electric Co., Boston, Mass..... 26
Brownell Car Co., St. Louis, Mo.....110, 111
Buckeye Engine Co., Salem, O..... 52
Burrowes, E. T., Co., The, Portland, Me..... 31
Burton Electric Co., Richmond, Va.....XXXVIII

California Wire Works, San Francisco, Cal..... 84
Cambria Iron Co., Philadelphia, Pa..... 71
Carleton & Kissam, Boston, New York, etc.....118
Central Electric Heating Co., New York.....VIII
Chapman Valve Mfg. Co., Indian Orchard, Mass..... 25
Chester Steel Castings Co., Philadelphia, Pa..... 71
Chicago, Milwaukee & St. Paul Railroad..... 46
Clark Brothers, Belmont, N. Y..... 54
Clarke, F. H., Springfield, O.....101
Colburn, Ralph D., Holliston, Mass..... 28
Complete Electric Construction Co., New York....26, 27
Consolidated Car Heating Co., Albany, N. Y.....102
Conway, M. W., Brooklyn, N. Y..... 71
Cooper, C. & G., & Co, Mt. Vernon, O..... 49
Correspondence School of Technology, Cleveland, O.. 25
Cradock, George, & Co., Wakefield, England..... 86
Craig, Wm. P., East Orange, N. J..... 71
Crawford, R. A, Manufacturing Co., Pittsburgh, Pa... 30
Curtis Electric Mfg. Co., Jersey City, N. J. XXX
Cutter Electrical & Mfg. Co., Philadelphia, Pa..... 29

Davis, I. B., & Son, Hartford, Conn..... 59
Davis, W. S., & Sons, Concord, N. H..... VII
Davis Car Shade Co., Portland, Me..... VII
Day, Josiah F., New York..... 29
Delaware Hard Fibre Co., Wilmington, Del..... VII
Devoe, F. W., & Co., New York.....XXXVII
DeWitt, E. F., & Co., Lansingburgh, N. Y.....104
Dick, Kerr & Co., London, Eng..... 64
Dickson Manufacturing Co., Scranton, Pa..... 88
Dixon, Joseph, Crucible Co., Jersey City, N. J..... 28
Dorner & Dutton Manufacturing Co., Cleveland, O.27,115

Eastern Electric Cable Co., Boston, Mass..... 27
Eddy Electric Manufacturing Co., Windsor, Conn.....XLI
Electric Railway Equipment Co., Cincinnati, O..... 70
Electric Storage Battery Co., The, Philadelphia, Pa. .. 41
Ellis Car Co., Amesbury, Mass.....117
Eppley, Francis M., New York..... 44
Euphrat Life Saving Car Fender Co., New York..... 33

Falls Rivet & Machine Co., Cuyahoga Falls, O..... 99
Fiberite Co., The, Mechanicville, N. Y..... 39
Field & Beattie, New York..... 28
Field, C. J., New York..... 35
Field Electric Car Life Guard Co., Boston, Mass.....100
Field Engineering Co., New York..... 35
Fishkill Landing Mach. Co., Fishkill-on-Hudson, N. Y. 25
Fitzgerald-Van Dorn Co., The, Lincoln, Neb..... 47
Fleming, W. R., & Co., New York..... 57
Floyd, James R., & Sons, New York..... 66
Fowler, Geo. L., New York..... 71
Fowler, J. W., Car Co., Elizabethport, N. J..78A, 78B, 122
Frost Veneer Seating Co., New York..... 44
Fuel Economizer Co., The, Matteawan, N. Y..... 58
Fulton Truck & Foundry Co., Cleveland, O.....XLII

General Electric Co., Boston and New York....XLIII, XLIV
General Incandescent Arc Light Co., New York..... XIV
Genett Air Brake Co., New York and Chicago, Ill....123
Globe Iron Works, New York..... 73
Goubert Manufacturing Co., The, New York..... 56
Grant, J. A., & Co., Boston, Mass..... 50
Green, H. N., New York..... 45
Groetzinger, A., & Sons, Allegheny Pa.....104

Habirshaw Wire, Yonkers, N. Y.....XXXIV
Hallowell, Eli B., & Co., Philadelphia, Pa..... VII
Hampson, Edw. P., & Co..... V
Harrington, Edwin, Son & Co., Incorporated, Philadelphia, Pa..... 57
Harrington, Robinson & Co., Boston, Mass 28
Harrisburg Foundry & Machine Co., Harrisburg, Pa.. 57
Hathaway, Alfred G., Cleveland, O..... 87
Hazard Manufacturing Co., Wilkesbarre, Pa..... 84
Heine Safety Boiler Co., St. Louis, Mo..... 56
Higgins, Edward E., New York..... 79
Hoffmann & Billings Mfg. Co., Milwaukee, Wis..... 47
Hooven, Owens & Rentschler Co., Hamilton, O..... 51
Hoppes Manufacturing Co., The, Springfield, O..... 56
Hunt, C. W., Co., New York.....106
Hutchinson, A. J., New York..... 71

Ide, A. L., & Son, Springfield, Ill..... 42
International Register Co., The, Chicago, Ill..... II

Jackson & Sharp Co., Wilmington, Del.....XXXII
Jarvis Engineering Co., Boston, Mass.....47, 69
Johns, H. W., Manufacturing Co. New York..... 81
Johnson Co., Johnstown, Pa..... 63
Jones' Sons, J. M., West Troy, N. Y.....121
Jonson Engineering & Foundry Co., New York..... 60

Keasbey, Robert A., New York.....101
Keithley, H. R., Chicago, Ill.....100
Kuhlman, G. C., Co., Cleveland, O.....105

"L. P. & D." Transmitter Co., Montpelier, Vt..... VII
Laclede Car Co., St. Louis, Mo.....108, 109
Lake Erie Engineering Co., Buffalo, N. Y..... 35

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Lake, J. H. & D., Co., Massillon. O..... 66
Lamokin Car Works, Philadelphia and Chester, Pa...104
Lane & Bodley Co., The, Cincinnati, O..... 47
Lewis & Fowler Girder Rail Co., The, Brooklyn, N. Y. 62
Lewis & Fowler Mfg Co., Brooklyn, N. Y. 61, 91, 92, 93, 94, 120
Lewis, Samuel, Brooklyn, N. Y XXXVIII
Link-Belt Engineering Co., Nicetown, Pa..... 44
Lithograph Street Car Ticket Co., The, Cleveland, O. 34
Lobdell Car Wheel Co., Wilmington, Del.....VII
Lunkenheimer Co., Cincinnati, O..... 71

McCarthy, F. E., & Co., Boston, Mass..... 28
McClure, Chas. L., New York..... VI
McEwen, J. H., Mfg. Co., Ridgway, Pa..... 53
McGuire Manufacturing Co., Chicago, Ill..... 77
McIntosh, Seymour & Co., Auburn, N. Y..... 50
McKinney, William M., New York..... 79
Mailloux, C. O., New York..... 70
Meaker Manufacturing Co., Chicago, Ill..... 97
Mertes, A., Manufacturing Co., Allegheny, Pa..... 25
Meyer, Julius, New York..... 31
Millers Falls Co., New York.....XIV
Moore, Alfred F., Philadelphia, Pa..... 46
Morse, C. D., Car Mfg. Co., Millbury, Mass.....107
Morse, Williams & Co., Philadelphia, Pa..... 42
Mowatt's Detective Service, Cleveland, O..... 28
Mundt & Sons, New York..... 41
Munson, Charles, Belting Co., Chicago, Ill..... 45
Murphy, T. J., & Co., New York..... X
Murray, J. D., New Brunswick, N. J..... 31

National Railroad Detective Agency, Newark N. J... 26
Neftel, O'Connor & Co., Incorporated, New York... 26
New Castle Car Manufacturing Co., New Castle, Pa.. 38
New Haven Car Register Co., New Haven, Conn..... 89
New Process Raw Hide Co., The, Syracuse, N. Y..... 83
New York Electrical Works, New York..... 83
New York Equipment Co., New York..... 25
New York Insulated Wire Co., New York.....101
Newburyport Car M'f'g. Co., Newburyport, Mass.....104
North Western Land & Coal Co., Boston, Mass..... 40
Nuttall, R. D., Co., Allegheny, Pa..... 81

Okonite Co. (Ltd.), The, New York.....XXIX
Otis Brothers & Co., New York..... 90
Otto Gas Engine Works, Philadelphia, Pa..... 55

Parker, J. W., & Co., Philadelphia, Pa.....XXVIII
Payne, B. W., & Sons, Elmira, N. Y..... 53
Peckham Motor Truck & Wheel Co., Kingston, N.Y..75, 76
Pennsylvania Iron Works Co., Philadelphia, Pa..... 65
Pepper & Register, Philadelphia, Pa..... 69
Pfingst, Louis, Boston, Mass..... 32
Philadelphia Engineering Works (Ltd.), Phila., Pa.... 41
Phoenix Iron Works, Cleveland, O..... 57
Phosphor Bronze Smelting Co., Philadelphia, Pa..... 41
Pierce & Miller Engineering Co., New York..... 50
Pitt, Wm. R., Composite Iron Works, New York..... 45
Pittsburgh Steel Hollow Ware Co., Allegheny City, Pa. 43
Porter, H. K., & Co., Pittsburgh, Pa.....103
Pressure Plate Switch Co., The, Brooklyn, N. Y .. XXXIX
Pryibil, P., New York..... 42
Pullman's Palace Car Co., Chicago, Ill.....116

Railway Equipment Co., Chicago, Ill..... 80
Railway Register Manufacturing Co., New York..... 95
Ralston & Henry, Philadelphia, Pa..... 28
Reed & McKibbin, New York..... 69
Reliable Detective Agency, The, New York..... 26
Reliable Manufacturing Co., The, Boston, Mass.....102
Reliance Gauge Co., Cleveland, O..... 80
Robins Life Guard & Mfg. Co., Philadelphia, Pa.....101
Robinson Electric Truck & Supply Co., Boston, Mass. 74
Roebling's, John A., Sons Co., Trenton, N. J..... 87
Rosenbaum, Wm. A., New York.....XXXV

Safety Car Heating & Lighting Co., New York.....100
St. Louis Car Co., St. Louis, Mo. 89, 112, 113
St. Louis Register Co., St. Louis, Mo..... 96
Scarritt Furniture Co., St. Louis, Mo.....107
Schaffer, J. T., Manufacturing Co., Rochester, N. Y.. 71
Scott, Charles, Spring Co., Philadelphia, Pa..... 67
Sellers, William, & Co., Incorp., Philadelphia, Pa..... 56
Shawmut Fuse Wire Co., Boston, Mass..... 45
Sheppard Manufacturing Co., Louisville, Ky..... 72
Shook, Anderson Manufacturing Co., Pittsburgh, Pa.. 54
Shriver, T., & Co., New York..... 57
Shultz Belting Co., St. Louis, Mo..... 44
Siemens & Halske Electric Co., of America, Chicago, Ill. 29
Simplex Electrical Co, Boston, Mass..... 27
Sjoberg, J. P., & Co., New York.....103
Smith, Edward & Co., New York.....XXXIII
Smith, Josephine D., New York..... 68
Smith, Thos. & Wm., Newcastle-on-Tyne, England.... 85
Société Anonyme Industrielle des Establissements Arbel, Rive-de-Gier (Loire), France.....XLI
Southwark Foundry & Machine Co., Philadelphia, Pa. 52
Standard Index & Register Co., New York..... 98
Standard Paint Co., New York..... 44
Standard Railway Supply Co., Chicago, Ill II
Stanwood Manufacturing Co., Chicago, Ill.....36, 37
Steam Gauge & Lantern Co., Syracuse, N. Y..... 69
Stearns Manufacturing Co., Erie, Pa..... 53
Steel Motor Co., Cleveland, O..... 83
Steel Rail Supply Co., New York..... 25
Stephenson, John, Co., Limited, New York.....126
Sterling Supply Co., New York XXXI
Stirling Co., The, Chicago, Ill..... 59
Sturtevant, B. F., & Co, Boston, Mass..... 55

Taylor, Dee & Mack, Chicago, Ill.....XXXVIII
Taylor Electric Truck Co., Troy, N. Y..... 74
Time Transfer Printer Mfg. Co., Pittsburgh, Pa..... 90
Trimble, Jas. A., New York.....103, 106
Trenton Iron Co, Trenton, N. J..... 84
Tupper, W. W., & Co., New York..... 42

U. S. Steam & St. Ry. Adver'g. Co., Boston, N.Y., etc..118
U. S. Wire Mat Co., Decatur, Ill..... 45
United Columbian Electric Co., The, New York..... 82

Valentine & Co., New York..... 25
Van Nuis, C. S., New York..... IX
Veneer Seating & Church Furniture Co., Brooklyn, N. Y. 27
Vose Spring Co., The, New York..... 66
Vulcanized Fibre Co., New York..... 71

Waddell-Entz Co., New York..... IV
Wakefield Electrical Engineering Co., Phila., Pa..... 31
Wales Manufacturing Co, Syracuse, N. Y..... 90
Walker Manufacturing Co., Cleveland, O..... 72
Walworth Manufacturing Co., Boston, Mass.....XXXVI
Washburn & Moen Manufacturing Co., Worcester, Mass 85
Watson & Stillman, New York..... 71
Western Electric Heating Co., Chicago, Ill.....VIII
Western New York & Pennsylvania Railroad Co..... 46
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa..... XL
Weston Electrical Instrument Co., Newark, N. J..... 25
Wetherill, Robert, & Co., Chester, Pa..... 53
Wetmore, A. B., New York.....XXXIX
Wharton, Wm., Jr., & Co. Philadelphia, Pa..... 67
Wheeler Reflector Co., Boston, Mass 26
White Manufacturing Co., The, New York..... 73
White, J. G., & Co., New York..... 79
Whitney, A., & Sons, Philadelphia, Pa..... 88
Williams, J. H., & Co., Brooklyn, N. Y.....XXXIX
Wilmot & Hobbs, New York, and Bridgeport, Conn... 80
Woodbridge & Turner Engineering Co., New York... 28
Woodman, Joel H., Hoboken, N. J.....103
Woodman, The R., M'f'g & Supply Co., Boston, Mass. 29
Wrought Iron Bridge Co., Canton, O..... 80

Young Lock Nut Co., New York..... 32

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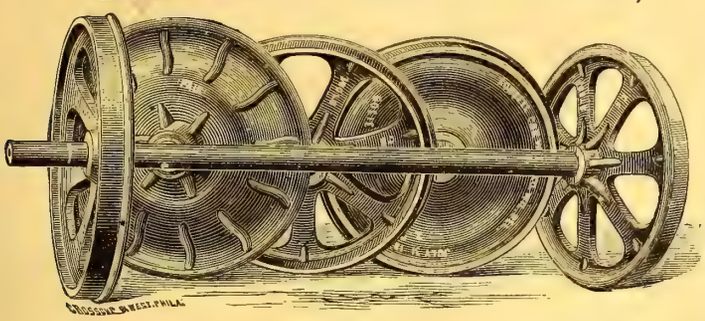
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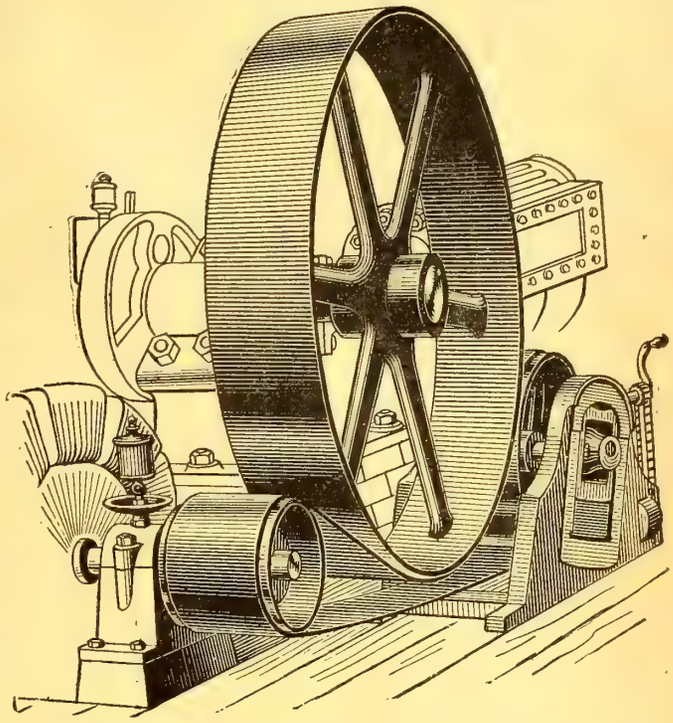
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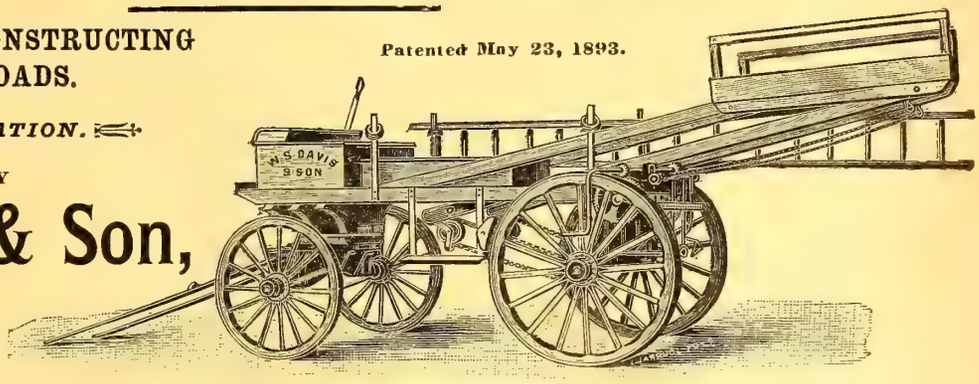
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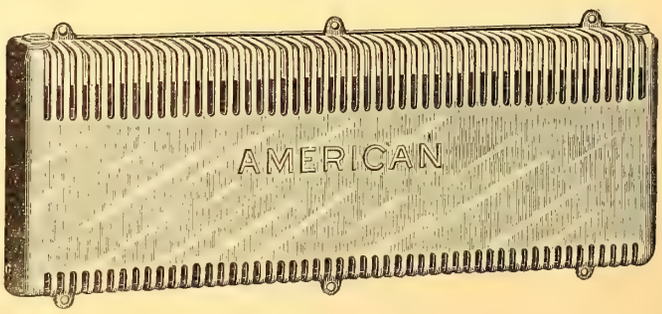
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Officials of Street Railways are earnestly requested to observe whether their roads are properly represented in this directory, and if no to send us the facts to make every item correct. For use in the February issue, directory matter must reach us by January 13.

ABBREVIATIONS.—m, miles; g, gauge; lb r, pounds rail to the yard; c-b r, center-bearing rail; s-b r, side-bearing rail; c, cars; m. c. motor cars; t. c. trail cars; g. c. grip cars; h, horses; mu, mules.

Officers' addresses are the same postoffice as the company unless otherwise specified.

The figures of mileage mean entire length of single track, counting one mile of double track as two of single, and counting switches as additional length.

Elec. after name of a road means that the road is operated wholly or partly by electric power. Capital means capital issued unless otherwise expressly stated.

A

ABERDEEN, WASH.—Wheless Underground Electric Co. 4 m c. Edison system. 10 2

ADRIAN, MICH.—Adrian City Electric Belt Ry Co. Elec. 2.8 m, 4-8½ g, 38 lb. T r, 4 c. of which 3 are m. c. and 1 t. c. Detroit system. Pres. J. H. Blain V. Pres. W. A. Jackson, Sec. C. Barker, Treas. M. E. Chittenden. Office, 25 S. Main st. Capital $50,000. Bonds, $36,500. 5 2

AKRON, O.—Akron St. R. R. Co. 12 m elec. 4-8½ g, 52 lb girder r, 35 c, of which 25 are m. c. and 10 are t. c. Edison system. Pres. J. F. Seiberling, V. Pres I. M. Miller, Sec. & Treas. F. A. Seiberling. Capital, $300,000. 10 2

ALAMEDA, CAL.—Alameda, Oakland & Piedmont Electric R. R. Co. 5 m, 4-8½ g, 8 m c. T-H system. Ingler & Atkinson cars. Ball engines. Pres. W. M. Rank, V. Pres. F. H. Meyers, Sec. O. H. Bass. Capital, $500,000. n 5 3

ALBANY, GA.—Artesian City R. R. Co. 3¼ m, 4-8½ g, 30 lb T r, 2 c, 4 mu. Pres. & Gen. Man. J. M Tift, Sec. & Treas. W. E. Mitchell. Capital, $20,000 authorized, $100,000. 9 3

ALBANY, N. Y.—The Albany Ry. Elec. 30 m, 4-8½ g, 60-65 lb girder r, 42 m. c. T-H and Westinghouse systems. Gilbert cars. McIntosh, Seymour & Co. engines. Pres. Rob't C. Pruyn, V. Pres. Anthony N. Brady, Sec. James McCredie, Treas. & Gen. Man. John W. McNamara, Asst. Gen. Man. E. S. Fassett. Capital $1,500,000. Bonds $1,000,000. Office, Albany Co. Bank building. 6 3

ALBANY, ORE.—Albany St. Ry. Co. Steam. 3 m, 3-6 g, 25, 35 lb T r, 4 motor c, 3 h Pres. L. Flinn V. Pres. S. E. Young, Sec. C. G. Burkhart, Treas. E. F. Sox, Supt. & Gen. Man. W. Goltra. Capital, $12,000; authorized $16,000. 11 2

ALEXANDRIA, VA.—Washington, Alexandria & Mt. Vernon Electric Ry. Co. Elec. 9 m, 4-8½ g 50, 70 lb girder and T r, 6 m c. T-H system. Pres G. E. Abbott, V. Pres. T. A. Reed, Sec. H. K. Whipple, Treas. D. C. Leeds, Supt. W. H. Cooper. Capital, $500,000. 9 2

ALHAMBRA, CAL.—Alhambra & Pasadena St. Ry. Co. 3½ m, 3-6 g, 16 lb. T r, 3 c, 4 h. 4 mu. Pres. A. C. Weeks, V. Pres. G. B. Adams, Sec. T. E. Stuart, Man. F. Williams. Capital, $12,000. 2 2

ALLEGHENY, PA.—Nunnery Hill Inclined Plane Ry. Co. Elec. 1,100 ft. 5 g, 60 lb. T r, 2 c, using wire rope and drum. St. Louis cars. Hardwick Erie Co. engines. Pres. & Treas. Oliver P. Scaife, Sec. A. Kennedy, Supt. C. D. Heist. Capital, $60,000. Office cor. Fairmount & Federal sts. 8 3

Federal St. & Pleasant Valley Ry. Co. Elec. 25 m, 4-8½ g, 50, 52, 66 lb girder and tram r, 75 m c. Edison and Westinghouse systems. Brill and Pullman cars. Buckeye and Westinghouse engines. Pres. & Gen. Man. D. F. Henry, Sec. Wm. H. Graham, Treas. R. F. Ramsey, Gen. Supt. W. M. Ramsey. Capital $1,400,000. Bonds $1,250,000. Office 125 Taggart St. 6 3

Troy Hill Inclined Plane & Bridge Co. 370 ft. 6 g, 60 lb T r, 2 c. Pres. Jas. D. Callery, Sec. C. S. Wight Treas. Wm. V. Callery, Gen. Man. J. J. Saint. Capital, $200,000. Office, 448 Liberty Ave. 2 3

ALLENTOWN, PA.—Allentown & Bethlehem Rapid Transit Co. Elec. 17 m, 4-8½ g, 45, 48, 70 lb T & girder r, 57 c, of which 28 are m. c. and 29 t. c. T-H system. Pres. G. H. Campbell, Sec. & Treas. A. A Glasier, Supt. A. H. Hayward. Capital, $700,000 Office, Car House, Madison St. near Gordon. 11 2

ALLIANCE, O.—Alliance St. Ry. Co. Elec. 2½ m 4-8 g, 42, 56 lb tram and girder r, 4 m c. T-H and Short systems. Brill and Laclede cars. Phœnix Iron Works engines. Pres. & Treas. W. W. Hazzard, Sec. & Gen. Man. W. H. Whitacre. Capital stock 85,000; authorized $100,000. Office 11 South Arch Ave. 5 3

ALTON, ILL.—Alton Improvement Association. 3½ m steam, 4-8½ g, 30 & 40 lb steel T r, 2 Baldwin m. c. Pres. Chas. W. Milnor, Sec. & Treas. H. R Phinney. Office, 305 W. 2d St. Capital $25.000. 8 3

Alton & Upper Alton Horse R. R. & Carrying Co 3 m, 4-8½ g, 40, 66 lb steel T & flat r, 7 c, of which 5 are box and 2 open, 24 h. Pres. C. W. Milnor, Sec Treas. & Supt. H. R. Phinney. Capital, $42,200; authorized, $100,000. Office, 305 W. 2d st. 5 3

ALTOONA, PA.—City Pass. Ry. Co. of Altoona Pa. Elec. 8 m, 5-3 g, 48½-70 lb. girder r, 25 c, of which 19 are m c and 6 t c. T-H and Westinghouse systems. Brill and Lamokin cars. Altoona Mfg. Co. engines. Pres. J. Lloyd, Sec. & Treas. C. A. Buch, Supt. W. P. Hewitt. Capital $180,000; Bonds $50,000. Office, Chestnut av. below First st. 8 3

Altoona & Logan Valley Ry. Co. Elec. 7¾ m, 4-8½ g, 60-65 lb channel and T r, 18 c, of which 9 are m. c. and 9 t. c. Edison sytem, Pres. S. C. Baker, V. Pres J. Loudon, Sec. & Treas. D. G. Thompson. Capital authorized, $150,000. 3 3

AMERICUS, GA.—Americus St. Ry. Co. Elec 5¼ m, 4-8½ g; 35 lb T r, 6 m c. T-H system. Owners T-H Co. Capital $50,000. Bonds $50,000. 8 3

AMES, IA.—Ames & College Ry. Co. 2¼ m. Steam 4-8½ g, 30 lb. T r, 2 c, 2 steam motors. Pres. J. L. Stevens, V. Pres. D. S. Fairchild, Sec. M. K. Smith Treas. B. J. Sheldon. Capital $20,000; authorized $25,000. 5 3

AMESBURY, MASS.— (See Haverhill, Mass and Newburyport, Mass.)

AMSTERDAM, N. Y.—Amsterdam St. Ry. Co Elec. 4 m. 4-8½ g, 48½ lb. girder r., 13 c, of which 6 are m. c. and 7 t. c, 5 h. Edison system. Pres. J H. McClement, V. Pres. F. J. Sprague, Sec. & Treas T. D. Mosscrop, Gen. Man. J. R. Snell, Counsel J. S Wise. Capital, $250,000. Bonds, $150,000, Office of Pres. and V. Pres. 42 and 44 Broad St., N. Y. City Office of Supt. 102 E. Main St., Amsterdam. 8 2

ANACONDA, MONT.—Electric Ry., Light & Power Co. 5.2 m, 4-8½, g, 35 & 50 lb. T r, 4 motors, 10 c, of which 4 are m. c. and 6 t. c. T-H system. Pres. M. Daly, Sec., Treas. and Gen. Man. D. F. Hallahan. 3 2

ANACOSTIA, D. C.—Anacostia & Potomac River Ry. Co. 15.3 m, 4-8½ g, 62 lb. girder r, 46 c, 200 h Pres. & Supt. H. A. Griswold, Sec. & Tres. J. B Pitcher. Capital $100,000. Bonds $300,000. Office, Anacostia, D. C. 8 3

ANDERSON, IND.—Anderson Electric St. Ry Co. 8½ m, 4-8½ g, 40, 50, 60 lb T r, 18 c, of which 10 are m c and 8 t c. Westinghouse, Edison & T-H systems. St. Louis cars. Allis engines. Pres., Treas. & Gen. Man. C. L. Henry, V. Pres. J. F. Wild, Sec. L. M. Cox, Supt. L. Cox. Capital, $150,000; authorized, $200,000. Bonds, $100,000. Office, Room 2 P. O. Block. 8 3

ANN ARBOR, MICH.—The Ann Arbor St. Ry Co. Elec. 5¾ m, 4-8½ g, 45, 48½, 66 lb girder r, 7 c, of which 6 are m. c. and 1 t. c. Edison system. Brill cars. Taylor engine. Pres. H. P. Glover, Sec. & Gen. Man. H. T. Morton, Treas. C. E. Hiscock. Capital, $93,100; authorized, $93,000. Bonds, $60,000. 8 3

Ann Arbor & Ypsilanti St. Ry. Co. Dummy. 9 m 4-8½ g, 40 lb T r, 11 c, of which 5 are pass. c & 6 gravel c; 2 steam motors. Porter and Baldwin engines. Pres. & Gen. Man. J. E. Beal, V. Pres. H. P. Glover, Sec. J. T. Jacobs, Treas. D. L. Quirk, Supt. W. Parker. Capital $100,000. Bonds $60,000. 8 3

ANNISTON, ALA.—Anniston City St. Ry. Co. 6 m, 35 lb T r, 9 box c, 35 h. Pres. J. W. Bigsby, Sec., Treas. and Gen. Man. O. E. Edwards. 9 1

Oxford Lake Line Ry. Co. Elec 14 m, 4-8½ g, 40 lb T r, 8 c, of which 6 are m c and 2 t c. T-H system. Stephenson cars. Pres. H. W. Sexton, Sec., Treas., Gen. Man. & Supt. F. M. Hight. Capital, $51,000; authorized, $175,000. Office 915 Wilmer St. 6 3

ANOKA, MINN.—Anoka St. Ry. Co. 3 m, 4-8½ g, 26 lb T r, 3 c, 13 h. Pres. R. Mahany, Sec. J. Mahany Treas. R. Mahany, Jr., Gen. Man. W. W. Mahany Capital, $15,000. 1 3

APPLETON, WIS.—Appleton Edison Electric Co 3.5 m. 4-8½ g, 33, 60 lb tram and girder r, 9 c, of which 5 are m. c. and 4 t. c. Edison system. Pres. & Treas. A. Le Smith, V. Pres. J. H. Van Nortwick, Sec. C. A. Beveridge, Supt. F. G. King. Office College Ave. 11 2

ASBURY PARK, N. J.—Seashore Elec. Ry. Co. 12 m, 4-8½ g, 45 lb flat & girder r, 23 m. c. T-H & Wightman systems. Hamilton-Corliss engines. Pres. & Treas. J. S. Shaeffer. Supt. A. S. Hickley. Capital, $200,000; authorized, $500,000. 8 3

ASHEVILLE, N. C.—Asheville St. Ry. Co. Elec 6½ m, 4-8½ g, 30 & 40 lb c. b. & T r, 14 c of which 12 are m. c. and 2 t. c. T-H and Edison systems. Gilbert cars. Armington & Sims engines. Receiver, L. Maddux, Pres. & Gen. Man. J. G. Martin, V. Pres. W. T. Penniman, Sec. & Treas. B. M. Jones, Supt. J. P. Arthur. Capital, $100,000; authorized $250.000. Bonds, $300,000. 2 3

Ashville & Craggy Mountain Ry. Co. Steam 2½ m, 4-8½ g, 40 lb T r, 2 c. Brill cars. Baldwin engines. Pres. & Gen. Man. W. B. Gwyn. Sec. & Treas. W. W. West. Capital $24,700; authorized $500,000. 1 3

Ashville Loan, Construction & Improvement Co. Elec. 1 m, 4-8½ g, 40, 45 lb T & girder r, 2 m c. T-H system. Pres. & Gen Man. G. S. Powell, Sec. M. J. Bender, Treas. W. W. Bonnel. Capital, $296,000; authorized. $300,000. Bonds, $20,000. 1 3

West Asheville & Sulphur Springs Ry. Co. Elec. 6 m, 4-8½ g, 40 lb T & girder r, 4 m c. T-H system. Ellis and Stephenson cars. Pres. E. G. Carrier, Sec. & Supt. J. D. Carrier. Capital. $50,000; authorized $260,000. Bonds, $35,000. 1 3

ASHLAND, KY.—Ashland & Catlettsburg St Ry. Co. 6 m, 4-8½ g, 45 & 50 lb Johnson girder & T r, 7 c, of which 4 are m. c. and 3 are t. c. Pres. & Man. W. L. Ringo, Sec. & Treas. John Russell, Jr Capital, $20,000, authorized, $200,000. 8 3

ASHLAND, PA.—Schuylkill Traction Co. (Leases Mahanoy, Shenandoah, Girardville & Ashland St. Ry.) Elec. 22 m, 4-8½ g, 40, 50, 60 lb T r, 30 c, of which 20 are m c & 10 t c. T-H & Westinghouse systems. Pres. J. F. Bailey, V. Pres. J. H. Cofrode, Sec. & Treas. C. E. Winters, Supt. B. E. Jones. Office, 265 Centre st. 5 3

ASHLAND, WIS.—Ashland Lighting & St. Ry. Co. Elec. 10 m, 4-8½ g, 60 lb T r, 16 c, of which 8 are m c and 8 t c. T-H system. Stephenson cars. Ide engines. Pres. G. W. Harrison, Sec. & Treas. G. F. Merrill, Gen. Man. & Supt. C. Bayliss. Capital $75,000; authorized $100,000. 5 3

AJAX SWITCHES AND LIGHTNING ARRESTERS, C. S. Van Nuis, 136 LIBERTY ST., NEW YORK.

ASHTABULA, O.—Ashtabula City Ry. Co.—4 m 4-8½ g, 40 lb T r, 9 c, 60 h. Prop'r. J. N. Stewart Sec. & Treas. S. C. Stewart, Man. H. H. Stewart. Officers and office at Cleveland, O. 1 3

Ashtabula Rapid Transit Co. Elec. 4½ m, 4-8½ g. 47 & 70 lb Johnson girder r, 9 c, of which 5 are m. c. and 4 t. c. T-H system. Pres. F. B. Wagner, V. Pres. R. A. Brown. Sec. & Supt. T. Fricker, Treas. E. W. Savage. Capital $150,000. 8 2

ASPEN, COLO.—Aspen City Ry. Co. 2 m, 4-8½ g, 16 lb T r, 2 open c, 3 h, 2 mu. Pres. H. A. Tabor, Sec. M. K. Page, Gen. Man. T. J. Flynn. 5 2

ASTORIA, ORE.—Astoria St. Ry. Co. Elec. 3 m, 3-6 g, 30 lb T r, 8 c, of which 4 are m c and 4 t c. T-H system. Brownell cars. Pres. J. W. Conn, V. Pres. W. A. Sherman, Sec. & Supt. F. W. Newell, Treas. F. R. Stokes. Capital, $45.000; authorized, $200,000. 7 2

ATCHISON, KAN.—Atchison St. Ry. Co. 8½ m, 4-8½ g, 20-50 lb tram & T r, 26 c, 39 h, 32 mu. Laclede cars. Pres. & Treas. W. L. Challis, V. Pres. P. Challis, Sec. W. L. Baiby, Gen. Man. & Supt. G. T. Ada. Capital $150,000; authorized $300,000. 5 3

ATHENS, GA.—Athens Ry. Co. Elec. 6 m, 4-8½ g 40 lb T 6 m, c. Detroit and T-H systems. Pres. E. G. Harris, Sec. Treas. & Gen. Man, J. T. Voss, Supt. W. E. Voss. Capital $10.000. 11 2

ATLANTA, GA.—Atlanta Consolidated St. Ry. Co Lines operated, Peachtree st, and North Atlanta, Peachtree st. and Ponce de Leon, Marietta st.—Decatur st., Whitehall st. and West End, Capitol Ave. —North Ave., Wheat st. and Ponce de Leon. Broad st., West End, West View Cemetery and Fulton County St. R. R. 75 m, of which 3 are horse 8 steam and 64 elec. 4-8½ g, 45, 52 & 63 lb girder & T r, 133 c, of which 40 are h c. 87 m c and 6 t c, 20 h 17 mu. T-H system. Brill, Pullman and Stephenson cars. Cooper-Corliss engines. Pres. J. Hurt, V. Pres. H. E. W. Palmer, Sec. T. K. Glemm, Treas. R. J. Lowry, Gen. Supt. H. N. Hurt. Capital, 2,000,000. Bonds, $2,000,000. 8 3

Atlanta Traction Co. Elec. 18¾ m, 4-8½ g. 40 lb T r, 8 m c. Detroit and Edison systems. Pres. T. B. Felder, V. Pres. E. T. Shubrick, Sec. & Treas. J. B. Zachary, Supt. F. H. Talbot. Capital $150,000. 7 3

Atlanta, West End & McPherson Barracks St. Ry. Co. 13 m c. Edison system. 7 2

Collins Park & Belt R. R. Co. Elec. 15 m, 4-8½ g, 56 lb T r, 9 m c. Short system. Brill cars. Allis engines. Receiver & Man. J. W. Darr. P. O. Box 541. 8 3

ATLANTIC CITY, N. J.—Atlantic City Electric Ry. (Operated by Pennsylvania R. R. Co.) 17 m, 4-8½ g, 60 lb T & girder r, 54 c, of which 30 are m c. and 24 t c. Edison and Westinghouse systems. Brill cars. Pres. J. S. Roberts, Gen. Foreman, W. K. McAlister. 8 3

ATTLEBORO, MASS.—Attleboro, N. Attleboro & Wrentham St. Ry. Elec. 6½ m 4-8½ g, 40 lb. T r 17 c, of which 9 are m. c. and 8 are t. c. T-H system. Pres. P. Nerney, Treas. C. T. Guild, Supt M. A. Carter. Capital, $60,000, bonds $50,000. 8 2

AUBURN, N. Y.—Auburn City Ry. Co. Elec. 5½ m, 4-8½ g, 45-47 lb girder & T r, 14 c, of which 11 are m c and 3 t. c. 5 h. T-H system. Jones and Stephenson cars. McIntosh & Seymour engines. Pres. C. E. Eddy, V. Pres. G. Underwood, Sec. & Supt. A. H. Underwood, Treas. J. E. Storke. Capital $50,000, authorized $150,000. Bonds $200,000. 8 3

AUGUSTA, GA.—Augusta Ry. Co. Elec. 25 m, 4-8½ g, 35, 54 lb T & girder r, 46 c, of which 35 are m. c. and 11 t. c. Edison and T-H systems. Brill and Stephenson cars. Corliss engines. Pres. D. B. Dyer, V. Pres. R. R. Conklin. Sec. C. B. Reavis, Supt. T. A. Roberts. Capital, $300,000. Bonds, $400,000. Office, Jarvis-Conklin building. 8 3

AUGUSTA, ME.—Augusta, Hallowell & Gardiner R. R. Co. Elec. 8 m, 4-8½ g, 40 & 55 lb. T & Johnson r 13 c, of which 9 are m, c. and 4 t. c. T-H., Edison & Detroit systems. Pres. & Treas. G. E. Macomber, Sec. H. G. Staples, Supt. W. G. Meloon. Capital, $120,000; authorized, $150,000. Bonds, $150,000. Office Hallowell, Me. 5 3

AURORA, ILL.—Aurora St. Ry. Co. Elec. 18 m 4-8½ g, 67 lb. T and 57 lb girder r, 21 m c. T-H and Detroit systems. Briggs and Gilbert cars. Pres. & Treas. R. B. Dodson, V. Pres. H. C. Tinker, Sec. A. T. Simendinger, Gen. Man. D. A. Belden. Capital, $300,000. Bonds, $303,000. 5 3

AUSTIN, TEX.—Austin Rapid Transit Ry. Co. Elec. 15 m, 4-8½ g, 40 lb girder & T r, 20 c, of which 12 are m. c. and 8 t. c. T-H system. Pres. F. H. Watriss V. Pres. I. H. Evans. Sec. & Supt. J. K. Urie. Capital $200,000. 8 3

B

BABYLON, N. Y.—Babylon Street Ry. Co. .53 o, 4-9 g, 60 lb T r, 4 c, of which 3 are box and 1 is open, 3 h. Pres. W. F. Norton, Sec. Jos. F. Sammis Treas. John R. Reid, Supt. David S. S. Sammis Capital $25,000. 11 2

BAKER CITY, ORE.—Baker City St. Ry. & Motor Co., 2½ m, 3-5½ g, 20 lb. T r, 2 4-wheel box c. 6 h Pres., Gen. Man. & Supt. C. L. Palmer, Sec. M. D Abbott, Treas. L. W. Place. Capital, $50,000. 6 2

BALTIMORE, MD.—Baltimore & Curtis Bay St. R. R. Co. Elec. 10 m, 5 m c, Edison system. 7 2

Baltimore City Pass. Ry. Co. 49 m, of which 27 are horse and 22 cable, 5-4½ g, 75 lb r, 287 c, of which 163 are h c, 62 g c and 62 t c. Brill cars (cable). Allis engines. Pres. & Supt. Oden Bowie, Sec. S. L. Bridge, Treas. A. B. Clark. Gen. Man. A. N. Connett. Capital $1,000,000; authorized $2,000,000. Bonds, $2,000,000. Office cor. Calvert & Baltimore sts. Horse lines changing to electricity. 8 3

Baltimore Traction Co. Elec. (Includes N. Baltimore Pass. Ry. and Baltimore & Powhatan Ry.) 66 m, of which 32 are horse. 15 cable and 19 elec, 5-4½ g, 66, 78, 89 lb girder r, 225 c, of which 100 are h c, 60 g c, 30 m c and 35 t c, 831 h. Westinghouse system. Brownell and Lewis & Fowler cars. Corliss, McIntosh & Seymour and Westinghouse engines. Pres. T. E. Hambleton, V. Pres. J. S. Hagerty, Sec. N. H. Johnson. Treas. F. S. Hambleton, Gen. Man. Wm. A. House, Jr., Ch. Engr. F. H. Hambleton, Office, Druid Hill Ave. Extension, Clifton. 6 3

Central Ry. Co. Elec. 13 m, 5-4½ g, 80 lb tram r, 40 c, of which 30 are m c and 10 t c. T-H system. Brill and Stephenson cars. McIntosh & Seymour engines. Pres. G. Blakistone, Sec. N. James, Treas. N. H. Bell, Supt. J. Hopps. Capital, $350,000; authorized $3,000,000. Bonds $700,000. Office 503 E. Preston st. 5 3

City & Suburban Ry. Co. Elec. (Owns Highlandtown & Point Breeze Ry.) 45 m, 5-4½ g, 25, 45, 65 lb T and girder r, 117 c, 710 mu. Pres. N. Perin, V. Pres. G. C. Jenkins, Sec. L. Fender, Treas. E. J. D. Cross, Gen. Man. J. F. Heyward. Capital, $3,000,000. Bonds, $1,430,000; authorized 3,000,000. 5 3

Highlandtown & Point Breeze Ry. Co. Elec. (Owned by Baltimore Union Pass. Ry. Co.) 6 m, 5-4½ g, 45 lb tram & T r, 25 c, of which 20 are 4 wheel box & 6 4-wheel open, 100 h. 6 3

Lake Roland Elevated Ry. Co. Elec. 20½ m 5-4½ g, 66, 74 lb. T, Duplex & girder r, 32 m c. T-H and Edison systems. Lewis & Fowler and Pullman cars. Corliss engines. Pres. J. L. McLane, V. Pres. & Treas. R. R. Conklin, Sec. E. H. Bouton, Gen. Man. J. L. Smith, Supt. L. N. Frederick. Capital, $1,000,000. Bonds $1,000,000. Office. 22 N. Charles St. 5 3

BANGOR, ME.—Bangor St. Ry. (Owned and operated by Public Works Co.) Elec. 8½ m, 4-8½ g, 35 lb tram & T r; 25 c, of which 22 are m c and 3 t c. T-H system. Newburyport cars. Pres. F. M. Laughton, Sec. J. R. Mason, Treas. and Gen. Man. J. H. Cutler, Supt. Ry. Dept. J. G. Carroll, Chief Eng. J. G. Kimball. Capital, $200,000. Bonds, $200,000. 9 3

BATH, ME.—Bath St. Ry. Co. Elec. 4½ m, 4-8½ g. 50 lb. T r. 8 c, of which 6 are m c and 2 t c. Westinghouse system. Ball & Wood engines. Pres. A. H. Shaw, Sec. C, C. Low, Treas. F. H. Twitchell, Gen. Man. A. F. Gerald, Supt. W. H. Hayden. 11 3

BATTLE CREEK, MICH.—Battle Creek Electric Ry. Co. 8½ m, 4-8½ g, 42 lb r; 18 c, of which 8 are m c and 10 t c. Short system. St. Louis cars. Williams engines. Pres. E. C. Hinman, V. Pres. H. H. C. Miller, Sec. & Gen. Man. A. K. McRae, Treas. C. H. Harbert. Capital, $100,000. Bonds, $110,000. Office, 15 & 17 Annex Building. 6 3

BAY CITY, MICH.—Bay Cities Consolidated Ry. Co. (Covering Bay City and West Bay City.) 24 m, of which 6 are horse and 18 elec., 4-8½ g, 45, 60 lb tram and T r. 57 c, of which 10 are h c, 32 m c and 15 t c, 50 h. Edison and Westinghouse systems. Brill and Stephenson cars. Corliss engines. Pres. W. B. McKinley, V. Pres. R. S. Hunter, Gen. Man. S. L. Nelson. Capital $1,000,000. Bonds $500,000. 5 3

BAY RIDGE, MD.—Arundel on the Bay R. R. (Operated by Chesapeake & Columbia Investment Co.) Steam 2 m, 4-8½ g. 30 lb T r, 4 c, 1 engine. Pres. T. W. Smith, V. Pres. W. P. C. Hazen, Sec. T. D. Keleher, Treas. N. H. Shea, Gen. Man. D. D. Stone, Supt. L. Cavanaugh. Capital, $100,000. Office, 806 F St., N. W., Washington, D. C. 8 3

BEATRICE, NEB.—Beatrice Rapid Transit & Power Co. Elec. 6 m, 4-8½ g, 38, 52 lb girder & T r, 8 c, of which 4 are m c and 4 t c. Short system Receiver M. C. Steele, Pres. N. N. Brumback, V. Pres. C. L. Schell, Sec. L. E. Spencer, Treas. S. K. Davis, Supt. G. M. Johnston. Capital $250,000. Office Cor Court & 8th Sts. 11 2

BEAUMONT, TEX.—Beaumont St. Ry. Co. 2½ m, 4-8½ g. 30 lb T r, 3 c, 8 mu. Pres. G. W. Carroll V, Pres. W. R. Caswell, Sec., Treas. & Gen. Man. J H. Rachford. Capital, $15,000; authorized $100,000 2 3

BEAVER FALLS, PA.—Beaver Valley Traction Co. (Includes Central Electric St. R. R. Co. and College & Grand View Co.) Elec. 9 m, 5-2 g, 45, 56, 72 lb. girder & T r, 15 c, of which 12 are m c and 3 t c, T-H system. Brill cars. Buckeye engines. Pres. J. M. Buchanan, V. Pres. T. P. Simpson, Sec. & Gen. Man. H. P. Brown, Treas. S. P. Stone. Capital, $300,000. Bonds, $150,000. 8 3

College & Grand View Electric R. R. Co. (Extension of Beaver Valley Traction Co.) 7 m, 4-8½ g, 56 lb girder r, 2 m c, Westinghouse system. Pres. C. O. Mallon, Sec. A. R. Leyda, Treas. J. B. Sherwood. Capital, $15,000. 7 3

BELLAIRE, O.—Bellaire St. R.R. Co. 2½ m, 4-8½ g, 20 lb r, 5 c, 20 h. Pres. & Gen. Man. J. Felix, Treas. J. C. Beard, Supt. F. Rodewig. 2 3

BENSON, NEB.—Benson & Halcyon Heights Ry. Co. Elec. 2 m, 4-8½ g, 20 lb T r, 2 m c. Westinghouse system. Pres. W. H. Crary, Supt. E. H. Cone 8 3

BEREA, O.—Cleveland & Berea St. Ry. Co. 4½ m 4-8½ g, 40 lb tram & T r, 2 4-wheel box c, 3 h. Pres C. W. D. Miller, V. Pres. O. S. Pomeroy, Sec. & Treas A. H. Pomeroy, Supt. A. W. Bishop. Capital, $60,000 authorized, $150,000. Bonds, $15,000. 1 3

BERKLEY, VA.—The Berkley St. Ry. Co. 2 m, 4-8½ g, 20 & 42 lb c. b., & T. r, 7 c, 12 h, 8 mu. Jones and Stephenson cars. Pres. T. H. Synon, Sec. Treas. & Gen. Man. W. Tillotson, Capital, $8,750; authorized $75,000. Bonds $8,500. 5 3

BESSEMER, ALA.—Bessemer & Birmingham R. R. Co. 13½ m, 4-8½ g, 40 lb T. r, 15 c. of which 10 are 8 wheel box & 5 8-wheel open, 4 frgt. c, 5 steam motors. Pres. T. T. Hillman, V. Pres. & Gen. Man. R. Jemison, Sec. J. A. Stratton, Supt. J. B. McClary Capital $250,000. Owned by Birmingham Ry. & Elec. Co. 8 3

BIDDEFORD, ME.—Biddeford & Saco R. R. Elec 6 m, 4-8½ g, 35 lb T r, 18 c, of which 4 are 4-wheel box 7 m c and 7 t c. T-H system. Jones cars. Westinghouse engines. Pres. E. H. Banks, Sec. & Treas. Chas. H. Prescott. Capital, $40,000. Bonds, $90,000. Office, 154 Main st. 8 3

BINGHAMTON, N. Y.—Binghamton R. R. Co. Elec. 22.12 m, of which 1 is horse and 21.12 elec, 4-8½ g, 35. 40, 48 lb T r, 35 c, of which 25 are m c and 10 t c, 17 h.. Edison and T-H systems. Ball & Wood engines. Pres. G. T. Rogers, V. Pres. J. Evans, Sec. C. O Root, Treas. J. B. Rogers, Gen. Man. & Supt. J. P. E. Clark. Capital, $268,650; authorized $500.000. Bonds, $220,000. Office, Power Station. 8 3

Court St. & East End R. R. 3.38 m, 4-8½ g, 35 & 45 lb flat & T r, 9 c, of which 5 are box and 4 open, 26 h Pres. Chas. M. Stone, V. Pres., Sec. & Treas. Wm G. Phelps, Supt. Miles Leonard. Office, Phelps Bank Bldg. Capital stock, $35,000. 1 3

West Side St. Ry. Co. 1½ m, 4-8½ g, 35 lb. T r 2 4-wheel box c. Pres. C. M. Stone, Sec. & Treas. W G. Phelps. Office, Phelps Block. Capital, $25,000. Leased to Court st. & East End R. R. 1 3

BIRMINGHAM, ALA.—Birmingham Ry. & Electric Co. 58 m, of which 43 are steam, and 15 elec 4 8½ g, 40-58 lb T & Johnson girder r, 104 c, of which 32 are h. c. 36 steam, 24 m. c. and 12 t. c, 50 h. T-H system. Pres. T. T. Hillman, V. Pres. & Gen. Man. R. Jemison, Sec. & Treas. Jas. A. Stratton, Supt. J. B. McClary. Capital, $1,900,000; authorized, $3,000,000; Bonds, $927,000. Office, 303 20th St. 8 3

Birmingham & Forest City Dummy St. R. R.. 4 m, 4-8½ g, 38 lb. r., 2 dummies, 2 coaches. Pres. & Man. E. Eastman. 9

Highland Ave. & Belt R. R. Co. 29 m, 4-8½ g, 40 lb T r and 14 pass. c, 9 engines. Pres. F. M. Billing Treas. & Gen. Man. J. London, Supt. F. T. Bradford, Aud'r L. F. Worl. Gen. Frt. Agt. J. E. Scott. Capital $1,000.000. Office, 9 N. 20th St. 9 2

BIRMINGHAM, CONN.—Derby Street Ry. Co Elec. 4 m, 4-8½ g, 45 lb girder and flat r; 11 c, of which 6 are m c and 5 t c. T-H system. Pres. H Holton Wood, V. Pres. Chas. F. Bliss, Sec. Geo. O Schneller, Treas. Chas. E. Clark. Supt. B. W. Porter Capital stock $50,000; authorized $200,000, Bonds $5,000 8 3

BLOOMFIELD, N. J.—Newark & Bloomfield R R. (See Newark, N. J.)

BLOOMINGTON, ILL.—The Bloomington City Ry. Co. Elec. 11 m, 4-8½ g, 45, 47 lb T & tram r, 25 c, of which 15 are m. c. and 10 t. c. Westinghouse and Short systems. St. Louis cars. Buckeye engines. Pres. John J. Patterson, V. Pres, Sec., Treas. & Gen. Man. W. H. Patterson. Capital, $600,000. Bonds, $209,000. 8

BLOUNTSVILLE, ALA.—Blountsville & Bangor Dummy Line Co. 12½ m. Pres. A. E. Fields, V. Pres. W. M. Cole, Sec. J. L. Montgomery, Treas. W. M Fennell, Gen. Man. C. Ternen, Supt. J. A. B. Lovett. 1 3

BOISE CITY, IDAHO.—Boise City Rapid Transit Co. Elec. 3 m, 4-8½ g, 35 lb T r, 2 m c. Edison system. Brill cars. Pres. G. Ainslee, V. Pres. D. Arnold, Sec. G. E. Gray, Treas. & Gen. Man. G. D. Ellis. Capital $56,000; authorized $200,000. Office Main St. 9 3

Electrical Slate and Marble, Contracts Taken for Switchboards, Including Iron Frames, Drilling and Placing in Position. T. J. MURPHY & CO., 136 Liberty St., New York.

BOONE, IA.—Boone Electric St. Ry. Light & Power Co. 5½ m, 4-8¾ g, 52 lb T r, 8 m c. Westinghouse system. Pres. L. W. Reynolds, V. Pres. D. F. Goodykoontz, Sec. S. T. Stanfield, Treas. C. E. Rice, Gen. Man. J. Reynolds, Supt. J. F. Reynolds. Capital, $200,000. Bonds, $125,000. 5 3

BOSTON, MASS.—Boston & Chelsea R. R. Co. (Leased to West End St. Ry. Co. operated by Lynn & Boston Ry. Co.) 4.154 m, 4-8½ g, 48-56 lb girder r Pres. W. G. Wheilden, Treas. & Clerk, John H. Studley, Jr. Office, 81 Milk st. Capital $121,000. 5 3

Boston & Revere Electric St. Ry. Co. 4-30 m, 4-8¾ g, 56 lb T r, 16 c, of which 6 are 4-wheel open m.c. and 10 are 4-wheel open t.c. T-H system. Pres. & Man. Washington G. Benedict, Sec. & Treas. Elery I. Garfield, Capital $50,000. 11 2

East Middlesex St. R. R. Co. (Controlled by North Shore Traction Co.) Elec. 18.31 m, of which 12.31 are horse and 6 elec, 4-8¾ g, 42, 70 lb r, 48 c, of which 39 are h c and 9 m c, 185 h. T-H system. Pres. A. F. Breed, Sec. L. F. Arnold, Treas. D. H. Sweetser, Supt. J. E. Sewell. Capital, $300,000. Bonds, $225,000. Office, 35 Congress st. 5 3

Lynn & Boston R. R. Co. (Includes Essex, Naumkeag & Lynn Belt Line Rys., Controlled by North Shore Traction Co.) Elec. 108¾ m, 4-8½ g, 35, 45, 50, 70 lb tram, girder & T r, 381 c, of which 319 are h c, 48 m c and 14 t c, 1,195 h. T-H system. Pres. Amos F. Breed, V. Pres. & Clerk, E. Francis Oliver, Treas. C. Williams, Gen. Man. Elwin C. Foster, Auditor, A. S. Palfray. Capital, $700,000; authorized $1,000,000. Bonds, $7,000,000. Office, 333 Union st., Boston. 11 2

Malden & Melrose R. R. Co. (Operated by West End St. Ry. Co.) 8 m, 4-8½ g, 35 & 52 lb Street r Pres. Chas. E. Powers, Sec. J. H. Studley, Jr. Capital $200,000. Office, 81 Milk st. 5 3

North Shore Traction Co. (Controls Lynn & Boston Ry. Co.) Capital, $6,000,000. Bonds, $2,445,000.

Somerville Horse R. R. Co. (Operated by the West End St. Ry. Co.) 5.4 m, 4-8¾ g, 56 lb r Boston pattern. Pres. Josiah Q. Bennett, Somerville, Treas & Clerk, J. H. Studley, Jr. Office, 81 Milk st. Capital, $153,000. 6 3

West End St. Ry. Co. (includes Boston & Chelsea, Malden & Melrose, Somerville), 255 m, of which 115 are horse and 140 are elec., 4-8¾ g, 50 to 100 lb. tram & girder r, 2254 c, of which 1226 are h c, 1028 m c. 3754 h. T-H system. Pres. S. Little, V. Pres. P. Cummings, Treas. J. H. Goodspeed, Gen. Man. C. S. Sergeant, Auditor, H. L. Wilson, Pur. Agt. Henry F. Woods, Chief Eng. Elec. Dept. F. S. Pearson Capital, $15,485,000; authorized $16,400,000. Bonds, $3,250,000. Office, 81 Milk St. 5 3

Winnisimmet R. R. Co. Elec. 2.0153 m, 4-8½ g, 70 lb girder r, T-H system. Pres T. P. Proctor, Boston, Mass., Treas. & Clerk, E. Francis Oliver, Boston. Capital, $50,000; authorized, $75,000. Office 32 Pemberton St. Leased to Lynn & Boston Co. 5 3

BOWLING GREEN, KY.—Park City Ry. Co. Pres. H. E. Jenkins, V. Pres. J. E. DuBose. 12 2

BRADFORD, PA.—Bradford & Kendall Ry. Co 1¾ m, 4-8¾ g, 35 lb T & flat r, 2 c, 5 h. Pres. & Gen Man. W. S. Wales, Sec. & Supt. M. F. King, Treas G. S. Wales. Capital, $12,000. 9 2

BRADDOCK, PA.—Braddock & Turtle Creek St Ry. Co. Elec. 3.7 m, 5-2½ g, 40, 48½ lb T & Johnson girder r, 6 m c, Westinghouse & T-H systems Pres. J. D. Callery, Sec. J. C. Reilly, Treas. J. W Taylor. Capital $62,000. Bonds $50,000. 7 2

Braddock Electric Ry. Co. 3¾ m, 5-2½ g, 48½ lb Johnson girder r, 5 m. c. Short system. Pres. A. L Sailor, V. Pres. J. P. McKelvey, Sec., Treas. & Man. C. F. Ellis. Capital, $80,000; authorized, $100,000. Bonds, $40,000. Office, Bell Ave. 5 3

BRANTFORD, CAN.—Brantford St. Ry. Co. 5 m, 3-6 g, 25 lb r, 7 4-wheel box c, 22 h. Pres. D. A. Flack, V. Pres. R. A. Pringle, Sec., Treas. & Man Chas. H. Flack. Capital $40,000. h 3 1

BRIDGEPORT, CONN.—Bridgeport Horse R. R Co. (Controlled by Bridgeport Traction Co.)

Bridgeport Traction Co. (Controls Bridgeport Ry., Bridgeport Horse R. R. and East End Ry. companies.) 22 m, 4-8½ g, 30, 45, 56 lb T, c b & s b r, 84 c, 436 h. Brill, Jones and Stephenson cars. Pres. & Gen. Man. N. H. Heft, V. Pres. E. S. Ward, Sec. T. L. Watson, Treas. W. Scheerer. Capital $2,000,000. Bonds authorized $780,000. 8 3

The East End Ry. Co. (Controlled by Bridgeport Traction Co.) 6 m, 4-8¾ g, 35 & 45 lb T r, 27 c, of which 15 are 2-h. and 12 1-h, 200 h. Pres. N. H. Heft, Treas. W, H. Scheerer, Supt. T. B. Lashar. Capital $42,550; authorized, $100,000. Bonds, $12,000. 5 3

BRIDGEPORT, O.—Bellaire, Bridgeport & Martin's Ferry St. R. R. Co. 11½ m, 5-2 g, 63, 83 lb girder r, 13 m c 3 h. T-H system. New Castle cars. Buckeye engines. Pres. J. K. Jolly, V. Pres. P. D. Nicols, Sec. R. T. Howell. Treas. A. R. Leyda, Supt. J. G. Ourey. Capital, $250,000. Bonds, $150,000. 9 3

BRISTOL, TENN.—Bristol St. Car Co. (Owned by Bristol Belt Line Ry. Co.)

Bristol Belt Line Ry. Co. Elec. 7 m, 4-8¾ g, 35 lb T r, 7 c, of which 5 are m c and 2 t c. Short & Edison system. Pres. J. L. Stadelman, Sec. & Gen. Man W. A. Stadelman, Treas. Aaron Ward Morris. Capital, $250,000. Bonds, $75,000. 12 2

BROCKTON, MASS.—Brockton St. Ry. Co. (Includes East Side, Brockton & Holbrook and Whitman Rys). Elec. 31.635 m, 4-8½ g, 35 40 & 45 lb flat and T r; 75 c, of which 49 are m c and 26 are t c. T-H system. Pres. G. H. Campbell, Treas. A. A. Glasier, Gen. Man. H. B. Rogers. Capital, $250,000. Bonds, $300,000. Office, 203 Main st. 5 3

BROOKLYN, N. Y.—Atlantic Avenue R. R. Co. of Brooklyn. (Controlled by Brooklyn Traction Co.) Elec. 42 m, 4-8½ g, 50-60 lb c b and flat r, 383 c, 1,562 h. Westinghouse system. Pres. B. Norton, Sec. W. J. Richardson, Treas. N. H. Frost. Supt. H. R. Newkirk. Supt. of Const'n J. R. Beetem, Elec. Engr. F. Stillman, Jr., Supt. of Line Const'n E. B. Gunn, Pur. Agt. W. M. Tobias. Capital, $9,000,000. Bonds $3,000,000. Executive office, Franklin Trust Co. Building, Montague St.; Supt's office, cor. Atlantic & Third aves. 6 3

Broadway R. R. Co. of Brooklyn. 23.042 m, 4-8½ g 60 lb double groove r, 203 c, 733 h. Pres. S. Spencer, V. Pres. & Gen. Man. G. W. Maslin, Sec. W. S. Townsend, Treas. R. D. Lankford, Supt. H. Myerholz Capital, $525,000. Bonds, $350,000. Office, 21 Broadway, E. D. 8 3

Brooklyn City R. R. Co. Elec, 184 m, of which 156 are horse, 8 steam and 20 elec, 4-8½ g, 50, 60 & 65 lb s b, c-b & girder r (all steel), 1,603 c, of which 1,507 are horse, 76 elec. m c, 20 are t c, 29 steam motors, 5,587 h. Pres. D. F. Lewis, V. Pres. E. D. White, Sec. & Treas. W. A. H. Bogardus, Asst. Sec. & Treas. Thos. P. Swin, Supt. J. C. Cameron. Capital authorized and issued $6,000,000. Bonds, $3,925,000. Offices cor. Montague & Clinton Sts. 9 2

Brooklyn City & Newtown R. R. Co. Elec. 21¼ m, 4-8¾ g, 58-96 lb girder r, 256 c of which 108 are m c and 148 t c 24 h. Westinghouse system. Brill, Jones and Stephenson cars. Westinghouse, Church, Kerr & Co. engines. Pres. John N. Partridge, V. Pres. L. Fitzgerald, Sec. & Treas. Duncan, B. Cannon, Supt. John L. Heins. Capital, $1,000,000; authorized $2,000,000. Bonds, $1,775,000. General office, 120 Broadway. Executive office, cor. DeKalb & Central aves. 11 3

Broadway Ferry & Metropolitan Ave. R. R. Co. 11 m, 4-8½ g, 47-52 lb c. b. and tram r, 55 c, 124 h. Pres G.W. Maslin, Sec. E. M. Robinson, Treas. R. D. Lankford, Supt. H. Myerholz. Capital, $100.000. Bonds, $155,000. Office, 21 Broadway. 8 3

Brooklyn Heights R. R. Co. Cable. 1.1 m, 4-8½ g 60 lb girder r, 8 c. Pres. D. F. Lewis, V. Pres. J. E Searles, Jr., Sec. E. Johnson, Treas. G. S. Studwell. Supt. A. Rogers. Capital, $200,000. Bonds, $250,000 Office, 40 State st. 4 2

Coney Island & Bklyn R.R. Co. Elec. 22 m, of which 16 are horse & 6 elec., 45 & 60 lb r, 4-8½ g, 115 c, of which 40 are box, 61 open and 14 m. c., 300 h, T-H and Edison systems. Pres. H. W. Slocum, Sec. & Treas. E. F. Drayton Supt. D. W. Sullivan. Office, cor. Smith & Huntington sts. Capital, $500,000. 4 2

Franklin Ave. R. R. Branch of Brooklyn City & Newtown R. R. Co. Elec. 9 m, 4-8½ g, 98 lb girder r, 72 c, of which 40 are 4-wheel box and 32 are 4-wheel open. Westinghouse system. 8 3

Jamaica & Brooklyn R. R. Co. (See Jamaica, N. Y)

Prospect Park & Flatbush R. R. Co. 3 m, 4-8½ g, 34 lb r, 4 box c, 10 h. Pres. H. W. Slocum, Sec. & Treas H. W. Slocum, Jr., Supt. D. W. Sullivan. Office, 45 Broadway. Capital $50,000. 4 2

Van Brunt St. & Erie Basin R.R. Co. 2½ m, 4-8½ g, 45 lb s b r, 19 c, 41 h. Pres. Michael Murphy, Sec. & Treas. Wyllys Terry, Supt. T. J. Carey. Capital authorized and issued, $150,000. Bonds, $25,000. Offices, 264 Van Brunt st. 9 2

BROWNSTOWN, IND.—Brownstown & Ewing St. R, R. Co. 2 m, 5-4 g, T r, 1 c, 4 h, 2 mu. Pres. & Supt. F. Falk, V. Pres. & Sec. W. L. Bryatt, Treas. G. H. Hines Capital, $3,500; authorized, $5,000. 5 3

BRUNSWICK, GA.—Brunswick St. R. R. Co. 9 m, 4-8½ g, 48½ lb T and girder r, 15 c, 50 mu, 1½ m on St. Simon's Island, with 2 steamboats connecting lines. Stephenson cars. Owners. A. J. Crovatt, J. E. Dubignon, A. H. Lane, W. O. Allison, Gen. Man. W. E. Recknagel. Office, Newcastle st. Capital, $200,000. 6 3

BUFFALO, ILL.—See Mechanicsburg, Ill.

BUFFALO, N. Y.—Buffalo Railway Co. (Operates Crosstown Ry.) Elec. 120.53 m, of which 24 are horse and 96 elec., 4-8½ g, 62 lb girder r, 345 c, of which 118 are h c, 127 m c and 100 t c, 762 h. T-H system. Pres. Henry M. Watson, V. Pres. & Gen. Man. H. H. Littell, Sec. & Treas. Joseph S. Baecher, Supt. ——— Capital, $5,370,500; authorized, $6,000,000. Bonds, $6,320,000. Office, 346 Main st., Buffalo. 8 3

Buffalo, Bellevue & Lancaster Ry. Co. 5 m c. T-H system. 12 2

Buffalo & Tonawanda Electric Ry. Co. 6 m, 4-8½ g, 45 lb T & girder r, 8 c, of which 3 are m c and 5 t c T-H & Edison systems. Pres. E. H. Butler, V. Pres M. Nellany, Sec. & Treas. C. M. Howard, Supt. W. J Voorhees. Capital, $125,000; authorized $250,000. 9 2

Buffalo, Kenmore & Tonawanda Electric R. R. Co. 5-66 m, 4-8½ g, 60, 75 lb T & girder r, 4 m. c. T-H system. Brill cars. Noye Engines. Pres. D. F. Callahan, V. Pres. N. E. Mack, Sec. G. H. Frost, Treas. J. L. Donovan, Supt. H. E. Heller. Capital $50,000. 8 3

Buffalo, North Main St. & Tonawanda R. R. Co Elec. 5¾ m, 4-8½ g, 65-90 T r, 6 c, of which 3 are m c and 3 t c. Pres. L. F. W. Arend, V. Pres. A. T Fancher, Sec. E. Rutherford, Treas. C. C. Mead Capital $60,000. Office 44 Niagara st. 5 3

Crosstown St. Ry. Co. (Operated by Buffalo Ry. Co.) Elec. 52 m, 4-8½ g, 67 lb girder r, 60 m c. T-H system. Pres. & Gen. Man. H. H. Littell, Sec. & Treas. J. S. Baecher, Supt. A. J. Porter. Capital, $1,500,000. Bonds, $1,500,000. 8 3

BURLINGTON, IA.—Burlington Electric Ry. Co. 11 m, 4-8½ g, 40 lb T r, 45 c, of which 20 are h c, 15 m c and 7 t c. Westinghouse system. Pres. W F. Putnam, V. Pres., Treas. & Supt. F. G. Jones, Sec G. McInnes. Capital, $650,000. Bonds, $300,000. 7 1

BURLINGTON, VT.—Winooski & Burlington St. Ry. Co. 6.38 m, of which 1.50 are horse and 4.88 Elec. 4-8½ g, 50 lb T r, 17 c, of which 8 are m c and 9 h c and t c, 24 h. Gen. Elec. system. Gilbert cars. Pres. Elias Lyman, V Pres. J. A. Powers, Sec. & Treas W. F. Hendee, Supt. T. B. Jones. Capital, $135,000; authorized, $200,000. Bonds, $100,000. Office, 186 College st. 8 3

BUTTE, MONT.—Butte Consolidated Ry. Co. 15 m, of which 1½ are cable, 2 steam and 13½ elec, 4-8½ g, 40 and 50 lb T r, 24 c, of which 5 are steam, 4 g c, 10 m c and 5 t c. Edison system. Pres. W. Bennett, Sec. & Gen. Man. J. R. Wharton, Treas. W. A. Clark. Capital, $500,000. Office, Main & Park sts. 9 3

C

CAIRO, ILL.—The Delta Electric Co. 4 m, 4-8½ g 45 lb T r, 6 c, of which 4 are m c and 2 t c. Detroit system. St. Louis cars. Russell engines. Pres. W. Kluge, V. Pres. A. Miller, Sec. & Gen. Man. H. Schulze, Treas, H Hasenjaeger. Capital, $150,000. Bonds, $50,000. Office 1010 Washington av. 8 3

CALERA, ALA.—So. Calera Land & Imp't Co. 2 m, 4-8 ½ g, 40 lb steel r, 1 dummy engine. Capital, $150,000. Office, Calera. b

CAMDEN, N. J.—Camden & Atlantic R. R. Co Elec. 6½ m, 4-9 g, 60 lb. r, 18 motor & 19 trail c Pres. G. B. Roberts, V. Pres. Wm. J. Sewell, Sec. J R. McClure, Treas. W. Taylor, Supt. A. O. Dayton Office 233 S. 4th st., Phila. 7 1

Camden, Gloucester & Woodbury Ry. Co. Elec. 15 m, 5 g, 80 lb. girder r, 42 c, of which 12 are m c and 30 t c. Westinghouse system. Lamokin cars. Westinghouse engines. Pres. J. Willard Morgan, Sec. T. P. Curley, Treas. W. J. Tompson, Engr. J. J. de Kinder, Supt. H. M. Royal. Capital, $600,000. Bonds, $250,000. 9 3

Camden Horse R. R. Co. Elec. 28¼ m, of which 11½ are horse and 16¾ elec. 5 g., 47, 52, 63½, 80 lb s-b Duplex and girder r, 74 c, of which 28 are h c, 26 m c and 18 t c, 150 h. Edison, T-H and Westinghouse systems. Brill, Lewis & Fowler and Stephenson cars. Westinghouse and Ball engines. Pres. Wm. S. Scull, V. Pres. B. C. Reeve, Sec. Morris W. Hall, Treas. G. G. Browning, Supt. S. J. Fenner. Capital, $250,000. Bonds, $150,000. Office, 307 Market st. 8 3

CANANDAIGUA, N. Y.—Canandaigua St. R. R Co. 2¾ m, 4-8½ g, 36 lb Johnson girder r, 6 c, of which 4 are box and 2 are open, 12 h. 12 mu. Pres. A. S. Cooley, V. Pres. I. B. Smith, Sec. Chas. F. Milliken, Treas. & Supt. Chas. C. Sackett. Capital, $30,000. Bonds $20,000. 9 1

CANTON, O.—Canton St. Ry. Co. Elec, 6¾ m 4 g, 40 & 50 girder & T r, 38 c, of which 24 are m. c and 14 t. c. Edison system. Pres. & Treas. W. A Lynch, V Pres. R. A. Miller, Sec. A. J. Underhill, Supt. T. R. Catlin. Capital $300,000. Office, 275 W. Tuscarawas st. 9 2

Lakeside St. R. R. Co. Elec. 2½ m, 4 g, 40 lb T r, 12 c, of which 6 are m. c. and 6 t. c. Summer line. Officers, same as above. 9 2

CAPE MAY, N. J.—Cape May & Schellenger's Landing R. R. Co. 3 m, 5-2 g, 45 lb r, 4 1-h 4 2-h c, 50 h. Pres. L. H. Cone, Sec., Treas. & Gen. Man. J. H. Edmunds. 7 1

Cape May, Delaware Bay & Sewell's Point Electric Ry. Co. 6¾ m, 4-8½ g, 45 lb T r, 16 c. of which 10 are m c and 6 t c. Westinghouse system. Brill and Lamokin cars, Ball engines. Pres. G. G. Browning, Sec. & Gen Man. J. J. Burleigh, Treas. B. C. Reeves, Supt J. H. Edmunds. Capital, $150,000. Bonds, $150,000. Office, Camden. 8 3

CARBONDALE, PA.—Carbondale Traction Co Elec. 7 m, 5-2 g, 45, 52 lb T & girder r, 6 m c. T-H system. Pres. J. W. Aitken, Treas. M. F. Tompson, Gen. Man. W. F. Sadler, Jr., Supt. H. M. Kalbuch. Capital, $150,000. Bonds, $150,000. 4 3

CARTERVILLE, MO.—Southwest Missouri Electric Ry. Co. (See Webb City.)

CARTHAGE, MO.—Carthage Horse Ry. Co. 4½ m, 3-6 g, 16-30 lb T r, 5c, of which 4 are box and 1 open, 2h, 18 mu. Pres. J. Guinney, Sec. J. W. Halliburton, Gen. Man. & Supt. E. A. Sexton. Capital $30,000. Bonds $10,000. Office, 19 S. Grant st. 5 3

CEDAR RAPIDS, IA.—Cedar Rapids & Marion Ry. Elec. 14 m, 4-8½ g, 45, 58 lb T & girder r, 25c, of which 18 are m c and 7 t c. T-H system. American and St. Louis cars. Allis engines. Pres. P. E. Hall, V. Pres. W. D. Douglas, Sec. J. S. Ely, Treas. C. H. Clark, Supt. F. L. Diserens. 5 3

CENTERVILLE, IA.—Centerville St. Ry. 1.6 m 3-8 g, 20 lb. T r, 2 4-wheel box c, 14 mu. Robinson & Hitt cars. Pres. J. R. Wooden, Sec. & Treas. C. R. Wooden. Capital $12,000; authorized, $25,000. 5 3

CENTRALIA, ILL.—Centralia & Central City St. Ry. Co. 3¼ m, 4-8½ g, 25 lb T r, 8 c, 14 mu. Pres. S. N. Pierce, V. Pres. J. Grush, Sec. G. P. Duncan, Treas. A. Dunker, Supt H. M. Johnson. Capital, $7,950; authorized, $10,000. 8 3

CHAMPAIGN, ILL.—Urbana & Champaign St Ry.Co. (Lessee of Champaign Rapid Transit.) Elec. 9 m, 4-8½ g, 40-48 lb T r, 12 c. of which 6 are m. c. and 6 t c. Westinghouse system. Pres.,Treas. & Gen. Man. B. F Harris, Jr., Gen. Supt. H. J. Pepper. Capital, $150,000. Bonds, $50,000. 11 2

Champaign Rapid Transit Co. Leased to Urbana & Champaign St. Ry. Co. Elec. 3 m, 4-8½ g 50 lb. T r, 3 m. c. Westinghouse system. Capital, $50,000. 11 2

CHARLESTON, S. C.—Charleston City Ry. Co. 13 m, 4-8½ g, 38 & 42 lb c. b. r, 39 c, of which 28 are box, & 11 open 144 h. Pres. Jno. S. Riggs, Sec. & Treas. Frank F. Whilden, Supt. John Mohlenhoff. Office, 4 Broad st. 11 2

Enterprise R. R. Co. 13½ m, 5 g, 30 & 40 lb c b & T r 35 c, 87 h, 16 mu. Brill and Jones cars. Pres. and Gen. Man. T. W. Passallaigue, Sec. & Treas. P. J. Balaguer. Capital, $250,000; authorized, $500,000. Bonds, $50,000. Office, Cor. Shepard and Meeting Sts. 8 3

Middle Street Sullivan Island Ry. Co. 2¼ m, 4-8¼ g, 20 & 30 lb T r, 7 c, 14 mu. Pres. B. Callaghan, Sec & Treas. Frank F. Whilden, Supt. B. Buckley Capital $15,000. Office 4 Broad st. 1 3

CHARLESTON, W. VA.—Charleston St. Ry. Co 4 m, 4-8½ g, 35 lb. s. b. r, 6 open c, 7 h, 12 mu. Sec E. W. Bridge, Treas. & Gen. Man. J. D. Campbell Supt. W. B. Carder. Capital, $50,000. Bonds, $10,000 Office, 215 Kanawha st. 3 2

CHARLOTTE, N. C.—Charlotte St. Ry. Co. Elec 5 m, 4-8½ g, 40-45 lb T & girder r, 9 c, of which 6 are m c and 3 t c. Edison system. Brill cars. Armington & Sims engines. Pres. & Treas. E. D. Latta, Gen. Supt. A. J. Baird Auditor, F. A. Savin. Capital, $60,000. Bonds $100,000 5 3

CHARLOTTESVILLE, VA.—Charlottesville & University St. Ry. Co. 1¾ m, 4-8½ g, 16 lb T r, 6 c, 2 h, 13 mu. Lewis & Fowler cars. Pres., Treas. & Gen. Man. R. P. Valentine, Sec. Geo. Perkins, Supt. H. D. Porter. Capital, $10,000; authorized, $100,000. Bonds, $22,000. 8 3

CHATTANOOGA, TENN.—Chattanooga & North Side St. Ry. Co. Elec. 6 m, 4-8½ g, 56 lb. girder & T r 9m. c. T-H system. Stephenson cars. Armington & Sims engines. Pres. & Gen. Man. S. R. Read, V. Pres. N. E. Barker, Sec. & Treas. W. H. Hart. Capital, $40,000. Bonds, $60,000. 8 3

Chattanooga Coal, Iron, Land & Ry. Co. 3 m. 3 m c. Edison system. 7 2

Chattanooga Electric Ry. Co. 40 m, 4-8½ g, 40, 63 lb T & girder r, 36 c, of which 32 are m c and 4 t c T-H, Detroit & Edison systems. Brill and Stephenson cars. Armington & Sims and Taylor engines. Pres., Sec. & Treas. S. W. Divine, V. Pres. E. Watkins, Supt. C. P. Young. Capital, $1,500,000; authorized, $1,500,000. Bonds, $1,200,000. 5 3

Chattanooga Union Ry. Co. dummy line, 44 m 4-8½ g, 56 lb. r, 59 c, of which 17 are pass. c. and 42 freight c. Gilbert and Chattanooga Car & Foundry Co. cars. Baldwin and Rhode Island engines. Pres. H. S. Chamberlain, Sec. & Treas. O. L. Hurlbut, Supt. J. R. Shaler. Capital, $1,000,000. 5 3

North Chattanooga St. Car Co. Elec. 3 m, 4-8½ g, 56 lb T r. 3 m c. Edison system. Stephenson cars. Pres. T. D. Young, Sec. H. C. Beck, Treas. J. Orr, Gen Man, T. J. Nicholl, Supt. W. T. Teas. 1 3

CHESTER, PA.—Chester St. Ry. Co. (Leased to Union Ry. Co.) 7½ m, 5-2¼ g, 47 lb r, 18 c, 80 h. Pres. S. A. Dyer, V. Pres. R. Peters, Jr., Sec. J. G. Dyer, Treas. J. F. Black, Supt. John McFayden. Capital $100,000, fully paid up. Office, 1,300 Edgmont av. 6 2

Chester, Darby & Philadelphia St. Ry. Co. Elec, 8 m, 4-8½ g, 20 m c. Pres. G. C. Hetzel, Consulting Engr. W. E. Clemens, Wakefield Mass. 5 3

Union Ry. Co. Elec. 25 m, 5-2½ g, 62½ lb. girder r, 35 m c. Short and Westinghouse systems. Brill and Lamokin cars. Wetherill engines. Pres. S. A. Dyer, Sec. & Treas. J. G. Dyer, Supt. J. MacFayden. Capital, $100,000. 5 3

CHEYENNE, WYO.—Cheyenne St. R. R. Co. 5 m, 3-6 g, 22 lb T r, 11 c, 20 h. Pres. F. E. Warren V. Pres. N. R. Davis, Sec. J. C. Baird, Gen. Man. & Supt. T. A. Kent. 5 3

CHICAGO, ILL.—Chicago City Ry. Co. 159.74 m, of which 98.21 are horse, 34 97 cable and 26.56 elec. 4-8½ g, 78, 83 lb girder r, 1,739 c, of which 1,355 are h c and t c, 62 m c and 322 g c, 2,618 h. Pres. Geo. H. Wheeler, 1st V. Pres. J. C. King, 2d V. Pres. E. M. Phelps, Sec. F. R. Greene, Treas. T. C. Pennington, Track Master C. E. Hall, Supt. M. K. Bowen Capital, $9,000,000. Bonds $4,619,500. Office, 2,020 State St. 5 3

Calumet Electric St. Ry. Co. Elec. 44 m, 4-8½ g, 78 80 lb girder r, 101 c, of which 50 are m c and 51 t c. T-H & Detroit systems. American, Pullman and St. Louis cars. Ball and Armington & Sims engines. Pres. W.V. Jacobs, V. Pres. J. C. Evans, Sec. & Treas A. J. Whipple, Gen. Supt. F. O. Rusling. Capital, $500,000. Office, cor. 94th and Drexel Ave. 9 3

Chicago General St. Ry. Co. (includes West & South Towns St. Ry. Co). Elec. 11½ m, 4-8½ g, 80 lb girder r, 5 m c. Sperry system. Pullman cars. Siemens & Halske engines. Pres. L. E. McGann, V. Pres. C. L. Bonney, Sec. & Treas. L. C. Bonney. Capital $500,000; authorized $3,000,000. Bonds $200,000. Office 971 W. 22d St. 8 3

Chicago Pass. Ry. Co. 27 m, 4-8½ g, 52 & 60 lb r, 113 c, 480 h. Pres. & Gen. Man. J. B. Parsons, Sec. & Treas. Geo. L. Webb. Leased to West Chicago St R. R. Co. Office, 89 W. Washington St. 5 3

Cicero & Proviso St. Ry. Elec. 27 m, 4-8½ g, 60 lb Johnson girder r, 54 c, of which 43 are m c and 11 t c. Edison system. Pres. D. J Kennedy, V. Pres. T. A. Snow, Sec. F. E. Ballard, Treas. D. J. Kennedy, Gen. Man. Geo. Butters, Supt. J. T. Hughes. Capital stock, $1,000,000. Bonds, $600,000. Office, Oak Park. 1 3

North Chicago St. R. R. Co. 83 m, of which 66 are horse and 17 are cable, 4-8½ g, 66½ lb girder r, 641 c, of which 116 are g c and 525 horse and t c, 1,300 h Pres. Chas. T. Yerkes, 1st V. Pres. W. F. Furbeck, 2d V. Pres. & Supt. J. M. Roach, Sec. & Treas. Wm. D Meeker, Gen Man. Fred L. Threedy, Asst. Supt. E. W. Sherman. Capital, $5,000,000. Office, 444 N. Clark st. 11 2

South Chicago City Ry. Co. Elec. 30 m, 4-8½ g 78 lb girder r, 86 c, of which 46 are m c and 40 t c Edison and Westinghouse systems. Brownell, Pullman and St. Louis cars. Allis engines. Pres. D. F. Cameron, V. Pres. D. M. Cummings, Sec. & Treas. O. S. Gaither, Supt. R. D. Rowe. Capital, $100,000. Office, 208 1st Nat. Bank building, Chicago. 7 3

West Chicago St. R. R. Co. (includes Chicago Pass. Ry.) 185 m, of which 151 are horse and 34 cable, 4-8½ g, 43-90 lb flat & girder r, 1,900 c, of which 1,475 are h c and 425 t c and g c, 4,500 h. Pres. Chas. T. Yerkes, V. Pres. & Gen. Man. John B. Parsons. Sec. & Treas. R. C. Crawford. Supt. C. F. Nagel. Capital, $12,000,000. Office of Pres. & Supt. 89 W. Washington st. 9 3

CHILLICOTHE, ILL.— People's Street Ry. Co 3½ m, 4-8½ g, 16, 20, 25 lb T r, 6 c, 12 mu. Lessees & Gen. Mans. Kinloch & Ryon. Capital, $8,000. 8 3

CHILLICOTHE, O.—Chillicothe Electric Ry. & Lighting Co. 4¼ m, 4-8½ g, 60 lb T r, 13 c, of which 8 are m c and 5 t c. T-H and Edison systems. Pres. M. Cahil, Treas. William Poland, Receiver & Gen. Man. A. H. Reutinger. Capital $100,000. Bonds, $100,000. 8 3

CINCINNATI, O.—Cincinnati Inclined Plane Ry Co. Elec. 16 m. 1920 ft. of which are cable and 16 m elec, 5-2½ g, 56, 58¾, 63 lb. girder r, 38 c, of which 36 are m. c. and 2 incline cable, 5 h. Edison system. Pres. H. H. Littell, V.Pres. St. John Boyle, Sec. J. M. Doherty, Gen. Man. H. P. Bradford. Capital, $725,000; authorized, $1,000,000. Bonds, $500,000. 9 3

Cincinnati St. Ry. Co. Elec., cable and horse. 139½ m, 8 m cable, 37 electric, 5-2 g, 42-52 lb tram and Johnson r, 300 c of which 91 are m c, 36 grip, 72 trail. T-H system. 1,200 to 1,500 h. Pres. & Gen. Man. John Kilgour, Sec. & Auditor Jas. A. Collins, Treas. R. A. Dunlap, Gen. Supt. Jno. Harris, Pur. Agt. A. G. Starr, Elec. Engr. B. L. Kilgour. Office, 2d floor Apollo bldg. 5 3

Mt. Adams & Eden Park Inclined Ry. Elec. 25 m of which 8 are cable and 17 elec, 5-2½ g, 52-100 lb r 160 c, of which 32 are g c, 50 m c and 78 t c. T-H system. Brill, Laciede, Pullman and Stephenson cars. Pres. John Kilgour, Sec. & Treas. James A. Collins, Pur. Agt. & Auditor, A. G. Starr, Supt. John C. Weaver. Office, 5th & Walnut, sts. 3 0

Mt. Auburn Cable Ry. Co. 8½ m, cable, 5-2 g, 56 lb girder r, 42 c, of which 21 are g c. & 21 tc. Pres Henry Martin, V. Pres. R. Wurlitzer, Sec. and Treas A. Hill Supt. G. Levins. Capital $300,000; authorized, $600,000. Bonds, $370,000. Office, Highland ave. & Saunders st. 8 3

Pendleton, Mt. Lookout & E. Walnut Hill Ry. Co Elec. and Dummy. 1¾ m, 5.2 g, 40 lb T r, 6 c., of which 2 are dummy, 2 m. c. and 2 t. c. Pres. C. H Kilgour, Sec. A. H. Meier. Capital authorized $150,000. Office Station C. 8 3

Price Hill Inclined Planes, 2 planes, each 800 ft 5-6 g, 60 & 85 lb T r, 2 c on each plane. Pres. M. W Oliver, Gen. Man. Rees E. McDuffie, Sec. & Treas Geo. T. McDuffie. Capital, $400,000. Office, Price Hill 5 3

So. Covington & Cincinnati. (See Covington, Ky.)

CITY ISLAND, N. Y.—Pelham Park R. R. Co 3½ m, 3-6 g, 30-57 lb T and s b r, 8 c, of which 6 are 4-wheel box and 2 4-wheel open, 15 h. Pres. W. R. Lamberton V. Pres. H. D. Cary, Sec. & Treas. E. N Anable, Supt. F. Underhill, Capital $50,000. Office, City Island, N. Y. 1 3

CLARKSVILLE, TENN.—Clarksville St. Ry Co. 4.2 m, 4-8 g, 18 lb T r, 6 c, 32 mu. Pres. W. M Daniel, Sec., W. T. Dortch, Supt. J. Black. Capital $16,500. Bonds, $11,000. Office, Farmers & Merchants' Nat. Bank. 2 2

CLEVELAND, O.—Cleveland City Ry. Co. (Includes Woodland Ave. & West Side R. R., Superior St., Payne & Lexington Ave. and St. Clair st. lines.) 72 m, of which 19 are cable and 53 elec. 82-98 lb. girder r, 346 c. of which 47 are g. c. 140 m. c. and 159 t c. Westinghouse and Short systems. Brill and Jones cars. Globe engines. Pres. M. A. Hanna, V. Pres. F. De H. Robison, Sec. & Pur. Agt. J. B. Hanna, Gen. Supt. George G. Mulhern. Capital, $7,000,000. Bonds $2,000,000. Office, Western Reserve Bldg. 8 3

Cleveland Electric Ry. Co. 120 m, 4-8½ g, 62-98 lb girder r, 482 c, of which 240 are m c and 242 t c. General Electric and Steel Motor systems. Brill and Jones cars. Allis engines. Pres. H. A. Everett, V. Pres. H. E. Andrews, Sec. R. A. Harman, Asst. Sec. L. E. Beilstein, Treas. J. Parmelee, Elecn. & Pur. Agt. C. W. Wason, Supt. J. J. Stanley. Capital $12,000,000. 5 3

East Cleveland, Euclid & Wickliffe St. Ry. Co. Elec. 3 m, 4-8½ g, 52 lb girder r, 4 c of which 2 are m c and 2 t c. Edison system. Pres. A. Everett, Sec. & Treas. H. A. Everett, Supt. E. Duty. Capital $25,000. 11 2

Lake View & East Cleveland St. Ry. Co. Elec. 12.68 m, 4-8½ g, 52 lb girder r, 8 c, of which 4 are m c and 4 t c. Edison system. Pres. A. Everett, Sec. & Treas H. A Everett, Supt. E. Duty, Capital $25,000. Office 2,500 Euclid ave. 11 2

CLEVELAND, TENN.—Cleveland St Ry. Co. 2 m, 4-9 g, 32 lb. T r, 2 4-wheel box c, 4 mu. Pres. L D. Campbell, Sec. & Treas. L. L. Harle, Supt. J. T Johnston. Capital $4,000. 6 2

CLINTON, IA.—Lyons & Clinton Horse R. R. Co. (See Lyons.)

State Electric Co. 14 m, of which 2 are horse and 12 elec. 4-8½ g, 45, 54 lb girder & T r, 20 c, of which 2 are h c 12 m c and 6 t c, 6 h, 4 mu. T-H and Westinghouse systems. Pullman cars. Ideal engines. Pres. E. C. Walsh, V. Pres. D. Langan, Sec. C. C. Coan, Treas. A. L. Stone, Gen. Man. J. P. Calman, Supt. W. H. Calnan. Capital, $500,000. 9 3

CLINTON, MASS.—Clinton St. Ry. Co. Elec. 2½ m, 4-8½ g, 58 lb T r, 2 m c. Pres. H. Parker, V. Pres. H. A. Wallis, Sec. W. R. Dane. Treas. A. J. Witherall, Auditor, B. F. Wallace. Capital $30,000. 9 3

CLINTON, MO.—Clinton St. Ry. Co. 3 m, 4 g Z T & crescent r, 5 c, 8 mu. Pres. A. P. Frowein, V. Pres. J. T. Ruffin, Sec. & Treas. H. P. Faris, Supt. G. C. Haysler. Capital, $12,000. 8 3

COLORADO SPRINGS, COLO.—Colorado Springs Rapid Transit Ry. Co. Elec 28 m, 4-8½ g, 30 lb T r, 42 c, of which 25 are m. c and 17 t. c. Edison system. Pullman and Woeber cars. Frick-Corliss and Reynolds engines. Pres. F. L. Martin, V. Pres. E. J. Eaton, Sec. & Treas. A. L. Lawton, Gen. Man. & Auditor, A. A. McGovney, Supt. D. L. Macaffree. Capital, $500,000. Bonds, $350,000. 8 3

COLUMBIA, PA.—Columbia & Ironville St. Ry. Pass. Co. Elec. 5½ m, 5 2½ g, 56 lb girder r, 6 m c. Westinghouse system. Brill cars. Pres. W. B. Given, Sec & Gen. Man. F. S. Given, Treas. J. Janson. Capital, 100,000. 5 3

Columbia & Donegal Ry. Co. Elec. 7 m, 5-2½ g, 56 lb T & girder r, 4 m c. Westinghouse system. Lamokin cars. Westinghouse engines. Pres. W. B. Given, Sec. & Gen. Man. F. S. Given, Treas. H. L. Haldeman. Capital, $75,000. 9 3

COLUMBIA, S. C.—Columbia Electric St. Ry. Light & Power Co. Elec. 21 m, 4-8½ g, 48 lb T r, 6 m c. Short system. Pres. & Gen. Man. J. Q. Marshall, V. Pres. W. A. Clark, Sec. W. G. Childs, Supt. A. Wallace. Capital, $50,000. Office, 85 Gervais st. Changing to elec. 6 3

COLUMBUS, GA.—Columbus R. R. Co. 17 m, of which 5 are horse and 12 steam, 4-8½ & 4-9 g, 25 & 40 lb T r, 27 c, of which 9 are dummy and 18 h. c, 10 h 50 mu Pres. J. F. Flournoy, Sec. & Treas. Cliff B. Grimes, Supt. J. H. Henderson. Capital, $25,000 Bonds $100,000. 8 3

North Highlands R. R. Co. Elec. 3¼ m, 4-8½ g, 45 lb T r, 6 c, of which 3 are m c. and 3 t c. T-H system. Brill and Ellis cars. Armington & Sims engines. Pres. & Gen. Man. S. A Carter, V. Pres. E. J. Rankin, Sec. & Treas, R. Browne, Supt. F. E. Knapp. Capital $31,000; authorized, $200,000. Office, Front St. 8 3

COLUMBUS, IND.—Crump's St. Ry. 7 m, of which ½ m is horse and 6½ elec, 4-8½ g, 30 lb T r, 9 c of which 1 is h c, 4 m c and 4 t c. American Car Co. and Brownell cars. Ide engines. John S. Crump, proprietor; Man. R. F. Gottschalk, Supt. J. W. Crump, Jr. 5 3

COLUMBUS, MISS.—Columbus St. Ry. & Power Co. Dummy. 2 m, 4-½ g, 40 lb T r, 2 c. Pres E. Cahn, Sec. & Gen. Man. C. E. Rodenburg, Treas. R T. Williams. Capital, $25,000. 9 2

COLUMBUS, O.—Columbus St. Ry. Co. (Operates Glenwood & Greenlawn St. Ry.) Elec. 50 m, 5-2 g, 52-95 lb T & girder r, 140 c, of which 112 are m c and 28 t c. T-H system. Brill and Brownell cars. Buckeye and McIntosh & Seymour engines. Pres. E. E. Denniston, V. Pres. & Gen. Man. E. K. Stewart, Sec. J. A. Williams, Gen. Supt. W. F. Kelly. Capital, $3,000,000. Office 12 N. High St. 8 3

Glenwood & Greenlawn St. Ry. Co. (Operated by Columbus St. Ry. Co.) Elec. 5 m, 5-2 g, 5-2 g, 45 lb girder & T r, 14 c, of which 8 are m. c. and 6 t. c. Edison and Westinghouse systems. 8 3

CONCORD, N. C.—Concord Ry. Co. Steam. 2.65 m, 48½ g, 40 lb T r, 3 c. Pres. W. M. Smith, V. Pres. N. F. York, Sec. J. B. Shui, Treas. D. B. Caltrane, Capital $15,000; authorized $100,000. 2 3

CONCORD, N. H.—Concord St, Ry. Co. Elec 10 m. 3 g, 35, 45 & 50 lb T r, 20 c, of which 13 are m c and 7 t. c. T-H. system. Pres. J. H. Albin, Sec. N. E. Martin, Treas. E. C. Hoague, Supt. H. E. Chamberlin, Elecn. D. W. White. Capital, $100,000; authorized $150,000. Office, Main st. 6 3

CONEY ISLAND, N. Y.—Sea View R. R. Co Elevated. 2¼ m, 4-8½ g, 50 lb T r, 7 c, 7 steam motors Brill and Feigel cars. Baldwin engines. Pres. F. A. Schroeder, Sec., Gen. Man. & Supt. Wm. Finley, Treas. I. M. Bon. Capital, $191,000; authorized $250,000. Office Flatbush, N. Y. 8 3

CONNELLSVILLE, PA.—Connellsville, New Haven & Leisenring St. Ry. Co. Elec. 4¾m. 5 2½g 52 lb. girder r 5 m. c. Edison & Westinghouse systems. Brill cars. Taylor engines. Pres J. D. Frisbee, Sec. J. K. Ewing, Jr., Treas. E. T. Norton, Supt. J. L. Gans. Capital, $50,000; authorized, $100,000. Bonds, $30,000. 6 3

CORPUS CHRISTI, TEX.—Corpus Christi Improvement Co. Dummy. 6½ m, 4-8½ g, 30 lb T r 4 c, 2 steam motors. Pres. E. H. Ropes, V. Pres J. M. Ropes, Sec. W. B. Newkirk, Treas. & Supt H. Keller. Capital, $100,000. 2 3

Gussett St. Ry. 4 m, 4-8½ g. 25-30 lb T r, 6 c, 16 mu. Proprietor, N. Gussett. Capital $25,000. 9 1

CORSICANA, TEX.—Corsicana St. Ry. Co. 4½ m, 4-8½ g, 16 lb T r, 6 c, 28 mu. Pres. & Gen. Man B. G. McKie, V. Pres. J. E. Whiteside, Sec. & Treas W. J. McKie. Capital, $50,000. 5 3

CORTLAND, N.Y.—Cortland & Homer Horse R. R. Co. 4.1 m, 4-8½ g, 25-30 lb flat & T r, 8 c, of which 4 are box and 8 open, 25 h. Pres. C. H. Garrison, V. Pres. S. E. Welch, Sec., Treas., Gen. Man. & Supt. L. D. Garrison. Capital, $40,000. Office, 19 Main St. 8 3

CORVALLIS, ORE.—The Corvallis St. Ry. Co. 2 m, 3-6 g, 30 lb. steel T r, 2 box c, 5 h. Pres. & Gen Man. M. W. Wilkins, Sec. M. O. Wilkins, Treas. M. G. Wilkins. Capital. $50,000; authorized. $60,000. Bonds, $10,000. 2 3

COTTAGE CITY, MASS.—Cottage City St. Ry Co. 5 m, 4-8½ g, 40 lb T r, 10 c. Briggs and Ellis cars. Pres. W. C. Van Derlip, V. Pres., Sec. & Gen. Man. W. A. Boland, Supt. H. S. Kemp. Capital, $15,000; authorized, $25,000. Office of Gen. Man. 610 Exchange Bldg, Boston. 9 3

COTTONWOOD FALLS, KAN.—Consolidated St. Ry. Co. 2 m, 3-6 g, 36 T lb steel T r, 2 4-wheel box c, 5 h, 3 mu. Pres. W. Adare, Sec. E. W. Tanner, Treas. J. M. Little, Supt. W. L. Holsinger. Capital $10,000. 2 3

COUNCIL BLUFFS, IA.—Omaha & Council Bluffs Ry. & Bridge Co. Elec. High steel bridge spans the Missouri river. 20 m, 4-8½ g, 40, 45 & 56 lb girder & T r. 56 c, of which 36 are m c & 20 t c. T-H & Edison systems. Pres. John T. Stewart, V. Pres. G. C. Barton. Sec. Geo. F. Wright, Treas. J. H. Millard, Supt. A. K. Stone. 5 3

COUNCIL GROVE, KAN.—Council Grove St. Ry Co. 1½ m, 3-6 g, 20 lb T r, 2 c, 4 mu. Pres. W. H White, Sec. & Treas. H. W. Gildermeister, Treas. & Gen. Man. A. J. Marks, Morris Co. Capital, $6,000. 7 1

COVINGTON, GA.—Covington & Oxford St. R. R Co. 6 m, 4-8½ g, 25 lb. T r, 6 c, 8 mu. Pres. I. W. Brown Sec. & Treas. J. G. Lester, Gen. Man. & Supt. R. O Usher. Capital, $16,000, authorized $20,000. 5 3

COVINGTON, KY.—South Covington & Cincinnati St. Ry. Co. Elec. 35 m, of which 10 are horse and 25 elec. 5-2½ g, 65, 80 lb T & girder r. 120 c, of which 34 are h. c. and 86 m. c. 120 h, 150 m. Westinghouse, Short & T-H systems. Brownell, Jones and Stephenson cars. Cleveland Ship Bldg Co. and Lane & Bodley engines. Pres. J. J. Shipherd, V. Pres. S. Bigstaff, Sec. & Treas. G. M. Abbott, Supt. T. M. Jenkins. Capital, $500,000; Bonds $500,000. Office, 402 Scott st. 6 3

CUMBERLAND, MD.—Cumberland Electric Ry Co. 6 m, 4-8½ g, 54 lb girder r; 13 c, of which 8 are m c and 5 t c. Edison system. Pres. G. D. Landwehr, V. Pres. G. L. Wellington, V. Pres. L. Lowndes, Sec. & Treas. J. H. Holzshu, Supt. W. Milnor Roberts, Jr. Capital $70,000; authorized $100,000. Bonds $30,000. Office North Centre St 5 3

CUYAHOGA FALLS, O.—Akron & Cuyahoga Falls Rapid Transit Co. Elec. 8 m, 4-8½ g, 52, 66 lb T r, 11 m. c. Gen. Elec. system. Capital, $300,000. Address, R. J. Randolph, Cuyahoga Falls. 6 3

D

DALLAS, TEX.—Dallas Consolidated Traction Ry. Co. Elec. 26 3-16 of which 16 1-16 are horse and 10 2-16 elec, 4-8½ g, 30-40 lb. girder & T r, 82 c, of which 67 are h. c. and 15 m. c, 3 h. 200 mu. T-H & Edison systems. Laclede, St. Louis and Stephenson cars. Receiver, S. P. Cochran, Gen. Man. for Receiver K. Kurtz. Capital, $1,000,000. Office, 135 Main St. 5 3

Dallas & Oak Cliff Ry. Co. Steam. 11 m, 4-8½ g, 35 & 65 lb T r, 4 m, 15 c. Pres. & Man. T. L. Marsalis, V. Pres. J. T. Elliott, Sec. & Treas. E. L. Snodgrass. Capital $460,000. Room 5 Knepply Bldg. 11 2

Dallas Rapid Transit Ry. Co. Elec. 13 m, 4-8½ g, 35 & 45 lb steel T r, 14 m. c. Edison system. Receiver, C. F. Freeman, Supt. Geo. D. Hartson. Capital, $200,000. Office, 303 North Texas Bank B'ld'g. 6 3

North Dallas Circuit Ry. Co. Elec. 4 m, 4-8½ g 40 lb T r, 4 m c. T-H system, St. Louis cars. Pres. J. C. Schneider, V. Pres. & Gen. Man. Royal A. Ferris, Sec. E. T. Moore, Treas. N. A. McMillin. Capital, $100,000. Bonds, $100,000. 2 3

Queen City Ry. Co. Elec. 5.17 m, 4-8½ g, 45 lb T r, 12 m c. T-H system. American cars. Pres. & Gen. Man. A. W. Childress, V. Pres. J. S. Armstrong, Sec. & Treas C. L. Wakefield, Asst. Supt. R. S. Wakefield. 9 3

DANBURY, CONN.—Danbury & Bethel Horse Ry. Co. 6½ m, 4-8½ g, 25 lb T, s. and c. b. r, 20 c, of which 13 are 4-wheel box and 7 4-wheel open, 130 h Pres. S. C. Holly, V. Pres. S. H. Wagner, Sec. & Treas J. B. McGeorge, Gen. Supt. G. H. Klinzing. Office 23 South st. Capital, $100,000. 1 3

DANVILLE, ILL.—Danville Gas, Elec. Light & St. Ry. Co. 8 m, 4-8½ g, 50 lb. T r, 21 c, of which 11 are m. c. and 10 t. c. T-H system. St. Louis cars. Ide engines. Pres. F. W. Penwell, V. Pres. A. C. Daniel, Sec & Treas. W. P. Cannon, Supt. M. Connor. Capital, $250,000. 6 3

DANVILLE, VA.—Danville St. Car Co. Elec 2.06 m, 4-8½ g, 38 lb girder r, 5 m. c. T-H system. Lamokin cars. Taylor engines. Pres. P. R. Jones, V. Pres. L. C. Berkeley Jr., Sec. & Treas. H. S. Lanier Gen Man. & Supt. N. W. Berkeley, Jr. Capital, $50,000 authorized $300,000. Office, 320 Craighead st. 1 3

DAVENPORT, IA.—Davenport & Rock Island Ry. Co. Elec. 55 m, of which 4 are horse and 51 elec. 4-8½ g, 52 lb girder r, 110 c, of which 8 are h c, 60 m c and 42 t c. T-H system. St. Louis Cars. Pres. D. H. Louderbach, V. Pres., Sec. & Treas. J. F. Lardner, Supt. H. Schnitger. Capital, $750.000; authorized, $1,500,000. Bonds $600,000. Office, 2d & Rock Island sts Davenport, Ia. 8 3

DAYTON, KY.—Cincinnati, Newport & Covington St. Ry. Co., Dayton Division (See Covington, Ky.)

DAYTON, O.—Dayton St. R. R. Co. 8½ m, 4-8½ g, 44, 70 lb girder r, 28 c, 98 h, 50 mu. Pres. C. J Ferneding, V. Pres. G. W. Rogers, Sec. Wm. H Simms, Treas. 4th Nat. Bank, Supt. A. W. Anderson Capital $300,0000. Office, W. 3d st. 11 2

City St. Ry. Co. (Controls all lines in city.) Pres. D B. Coffin, V. Pres. C. B. Clegg, Sec. W. H. Sims. 6 3

Dayton & Soldiers' Home Electric R. R. Co. Extension of west end of Fifth st. R. R. 4 m, 4-8½ g, 45 lb Johnson r, 4 c, of which 2 are m c & 2 t c. Edison system. Pres. D. B. Corwin, V. Pres. A. A. Thomas Sec. & Treas. J. C. Pierce, Supt. T. E. Howell. Capital, $100,000. 2 3

Fifth St. R. R. Co. 10 m, 4-8½ g, 48 & 52 lb tram & girder r, 30 c, 115 h. Pres. D. B. Corwin, V. Pres Sec. & Treas. J. C. Peirce, Supt. & Pur. Agt. T. E Howell. Capital $400,000. Office, West End. 2 3

Home Avenue R. R. Co. Steam 3 m, 4-8½ g, 40 lb T r, 6 c, 3 motors. Barney, Smith & Co. cars. Porter engines. Pres. J. Applegate, V. Pres. W. P. Callahan, Sec. & Treas. C. W. Dustin, Gen Man. & Supt. W. F. Stark. Capital, $100,000. Office, N. Ma n St. 8 3

Oakwood St. Ry. Co. 8 m, 4-8½ g, 60, 72 lb girder r, 18 box c, 80 h. Pres. Charles B. Clegg, V. Pres. A L. Stout, Sec. V. Winters, Treas. 4th Nat. Bank, Gen Man. H. P. Clegg, Supt. William Jones. Capital $300,000. Office, cor. Brown & Fairground av. 5 3

Wayne & Fifth St. R. R. Co. 6½ m, 4-8½ g, 38, 65 70 lb Johnson r, 13 c, 75 h. Pres. Geo. W. Shaw, V. Pres. & Gen. Man. Ezra Bimm, Sec. & Treas. Eugene Wuichet, Supt. N. Routzahn. Capital $100,000. Office 29 Wayne av. 8 3

White Line St. R. R. Co. Elec. 11½ m, 4-8½ g 42 lb steel girder r, 34 c, of which 22 are m c and 12 t c T-H system. Pres. J. A. McMahon, V. Pres. A. G Clark, Sec. J. E. Lowes, Treas. M. A. Nipgen, Supt & Pur. Agt. W. Beach. Capital, $300,000. 5 3

DEADWOOD, SO. DAK.—Deadwood St. Ry Co. 2 m. 3 g, 30 lb flat r, 3 c, 4 h. Pres. J. Swift V. Pres. W. H. Swift, Sec., Treas. & Gen. Man. A. W Coe. Capital authorized, $20,000 1 3

DECATUR, ALA.—Decatur St. Ry. Co. 4 m, 4-8½ g, 20 lb. T r, 5 c, 32 mu. Pres. W. W. Hedges, V. Pres A. C. Hartshorn, Sec. & Gen. Man. A. Bibb. Capital $100,000. 11 2

DECATUR, ILL.—City Electric Ry Co. 13 m elec., 4-8½ g, 40, 42, 48 lb T & girder r, 24 c, of which 18 are m c and 6 t c. T-H and Westinghouse systems Pres. D. S. Shellabarger, Sec. & Treas. W. L. Shellabarger, Gen. Man. W. L. Ferguson. Capital $300,000. Bonds $175,000. 11 2

Decatur Electric Ry. Co. 4 m elec., 4-8½ g, 40 lb Johnson girder and T r, 9 m. c., of which 4 are open and 5 box. Detroit system. Pres. J. R. Mills, Sec. W H. Star, Gen. Man. J. W. Alexander. Capital, $100,000. Plant purchased by City Electric Ry Co. 12 1

DEERFIELD, N. Y.—Deerfield & Utica R. R. Co 2 m, 4-8½ g, 42 lb s b r, 3 box c, 8 h. Pres. & Gen Man. Frederick G. Weaver, Deerfield; Sec. & Treas A. T. Goodwin, Utica. Capital $12,000. 6 2

DEFIANCE, O.—The Defiance Light & Power Co. Elec. 3½ m, 60 lb T r. 6 c, of which 3 are m c and 3 t c. Westinghouse system. Brownell and Pullman cars. Russell engines. Pres. S. L. Nelson, V. Pres. W. B. McKinley. Sec. & Treas. F. E. Smith, Gen. Man. H. J. Smith. Capital stock, $100,000. Bonds, $100,000. 8 3

DELAWARE, O.—Delaware Electric St. Ry. Co. 5½ m, 4-8½ g, 45 lb girder r, 7 m c. Westinghouse system. Brill cars. Pres. J. K. Newcomer, V. Pres. J. D. Van Deman, Sec. L. L. Hudson, Treas. V. T. Hills, Supt. F. P. Welch. Capital, $60,000. 5 3

DENISON, TEX.—Denison Rapid Transit Ry. Co. 6½ m. 4-8½ g, 35 lb T r, 6 c, 2 dummies. Pres. & Man. B. J. Derby, Sec. C. F. Rose, Treas. S. Star. Owned and operated by the Denison Land & Improvement Co. 4 1

Denison Street & Belt Line Ry. Co. 13 m, of which 5½ are horse and 7½ steam, 4-8½ g, 16, 35 lb. T r, 17 c of which 11 are h. c. and 6 steam, 2 engines, 42 mu. Baldwin engines. Pres. F. C. Churchill, V. Pres. A. H. Coffin, Sec. A. Zintgraf, Treas. E. H. Hanna, Gen. Man. B. J. Derby. Capital, $150,000. Bonds, $75,600. 1 3

DENNISON, O.—The United Electric Co. 2 m, 4-8½ g, 45 lb girder r, 3 m c. T-H system. Lamokin cars. Russell and Westinghouse engines. Pres. T. H. Wilson, Sec. E. E. Elvin, Treas. W. H. Smith, Gen. Man. R. F. Gardner. Capital $28,000; authorized $100,000. Office Grant St. 8 3

DENVER, COL.—Colfax Electric Ry. Co 10¼ m 3-6 g, 30 lb T r, 32 c, of which 12 are m. c. and 20 t. c Edison system. Pres. D. Fletcher, V. Pres. Sec. & Gen. Man. S. M. Perry, Treas. T. S. Hayden, Supt. F. A. Perry. Capital, $150,000. Office, 1738 Curtis st. 8 3

Denver & Westminster Ry. Co. Elec. 18 m, 4-8½ g. Pres. H. J. Mayham, V. Pres. R. W. Woodbury, Sec. J. Downing, Engr. F. H. Whiting. Capital, $1,000,000. Office, 1643 Curtis St. 2 3

Denver City Cable Ry. Co. 35 m, of which 5 are horse and 30 cable, 3-6 g, 60, 75 lb girder & T r, 177 c, of which 5 are h c, 62 g c, and 110 t c, 20 h. Laclede and Woeber cars. Wright engines. Pres. Geo. H. Holt, Sec. & Treas. G. D. L'Hullier, Gen. Man. G. E. Randolph, Supt. V. Spangberg. Capital, $3,000,000. Bonds, $3,300,000. Office, 18th & Lawrence Sts. 1 3

MICA All Sizes and Qualities for Electrical Purposes. Eugene Munsell & Co., 218 Water St., New York. W. H. SILLS, 86 Lake St., Chicago, Ill. **"MICANITE"** PERFECT INSULATOR.

Denver, Lakewood & Golden R. R. Co. Elec. and Steam. 20 m, of which 15 are steam and 5 elec, 4-8½ g, 60, 76 lb T r, 12 c, of which 4 are m c, 4 t c and 4 steam c. T-H system. Woeber cars. Sioux City engines. Pres. C. C. Welch, V. Pres. W. F. R. Mills, Sec. J. Q. Adams, Treas. W. A. H. Loveland, Supt. T. E. Mitten. Capital, $1,000,000. Bonds, $250,000. Offices, 1427 Arapahoe St. 8 3

Denver Tramway Co. (Includes Denver Cable Denver & Berkeley Park, So. Denver Cable, University Park and Metropolitan.) Elec. 96.75 m, 3-6 g, 48 T r, 266 c, of which 42 are g c, 138 m c and 86 t c. lb T-H, Westinghouse and Edison systems. Brill, St. Louis and Woeber cars. Hamilton-Corliss and Wetherill engines. Pres. Rodney Curtis, V. Pres. Jno. J. Riethman, Sec. Wm. G. Evans, Treas. F. A. Keener, Gen. Supt. C. K. Durbin. Capital, $4,000,000. Bonds $3,100,000. Gen. Offices, Broadway and Colfax and Railroad Bldg. 5 3

Thirty-fourth Ave. Ry. 1¼ m, 3-6 g, 25 lb T r, 1 c, 6 h. Owner, J. Cook, Jr., P. O. Box 528. 8 3

West End St. Ry. Co. Elec. 10¼ m, 4-8½ g, 50 lb r, 17 m c. Edison system. Laclede and Woeber cars. Armington & Sims engines. Pres. J. Wilbour, V. Pres. & Gen. Man. D. F. Longstreet, Sec. E. M. Dexter, Supt. & Pur. Agt. S. R. Wright. Capital, $500,000. Bonds, $300,000. Office Prospect Ave. 8 3

DEPTFORD, TENN.—Deptford & South Pittsburg St. Ry. Co. Dummy. 2½ m, 4-8½ g, 40 lb T r 3 c, 8 mu. Pres. L. W. Barringer, V. Pres. J. G. Kelly, Sec. Treas. & Gen. Man. J. Bright. Capital, $12,000. Office, Deptford. 8 3

DES MOINES, IA.—Des Moines City Ry. Co. Elec. 35 m, 4-8½ g, 45, 50, 62 lb girder & T r, 46 m. c. T-H system. Lane & Bodley engines. Pres. J. S. Polk, V. Pres. G. M. Hippee, Sec. G. H. Huttonlocher, Treas. E. H. Hunter, Gen. Man. Geo. B. Hippee. Capital $1,000,000; authorized, $3,000,000. Bonds, $900,000. Office, 201 5th St. 5 3

DETROIT, MICH.—Fort Wayne & Belle Isle Ry Co. Elec. 23½ m, 4-8½ g, 48-90 s b girder & grooved r, 86 c, of which 29 are m. c. and 57 t. c. Gen. Elec. system. Brill cars. Allis engines. Pres. E. H. Butler, Sec. N. W. Goodwin, Treas. E. S. Heineman, Supt. G. S. Hazard. Capital $250,000. Bonds $226,000. Office, Room 12 Kanten Bldg. 8 3

Detroit Citizens' St. Ry. Co. (Includes Grand River St. Ry. and Hamtramck & Grosse Point Ry.) Elec. 67 m. of which 37 are horse and 30 elec, 4-8½ g, 45, 66, 78 lb tram and girder r, 245 c, of which 174 are h c, 59 m c and 12 t c, 1,830 h. T-H, Detroit and Westinghouse systems. Brownell, Jones, Lewis & Fowler, Pullman and Stephenson cars. Westinghouse, Church, Kerr & Co. engines. Pres. D. M. Ferry, V. Pres. W. C. Colburn, Sec. J. R. Stirling, Treas. G. H. Russel, Gen. Man. J. D. Hawks, Supt. J. H. Fry. Office 12 Woodward Ave. 9 3

Detroit, Rouge River & Dearborn St. Ry. Co. Elec 1½ m, 4-8½ g, 56 lb. T r, 1 m c. Edison system. Pres. E. J. Owen, V. Pres. J. R. McLoughlin, Sec. S. Hendrie, Treas. R. J. McLoughlin. Office, Moffat Building. 9 3

Highland Park Ry. Co. Elec. 4 m, 4-8½ g, 30 & 42 lb T r, 8 c, of which 4 are 4-wheel box & 4 4-wheel open, & 4 m. c. Detroit system. Pres. & Treas. Frank E. Snow, Sec. F. Woodruff, Supt. H. Lewis. Capital, $50,000. Office, 904 Hammond Building. 1 3

DOVER, N. H.—Union St. Ry. Co. Elec. 14 m 4-8½ g, 40 lb T r, 19 c, of which 10 are m c and 9 t c T-H system. Pres. H. Haley, V. Pres. & Treas. H. W Burgett, Sec. R. W. Burwell, Supt. J. Houston Capital $150,000. Leased by Consolidated Light & Power Co. 12 2

DUBLIN, TEX.—Dublin St. R. R. Co. 5 m, (1½ in operation), 4 g, 20 lb T r, 3 c, 20 mu. Pres. H. A Smith, V. Pres. R. H. McCain, Sec. & Gen. Man. J. E. Chapman, Treas. A. A. Chapman. Capital stock $10,000. 8 3

DU BOIS, PA.—Du Bois Traction Passenger Ry. Co. Elec. 2¼ m, 4-8½ g, 50 lb. girder r, 3 m. c. Wightman and Edison systems. Brill cars. McEwen engines. Pres. M. D. Wayman, V. Pres. A. C. Bailey, Sec. Gen. Man. & Supt. C. E. Bostwick, Treas G. E. Grier. Capital, $30,000; authorized, $85,000. Bonds, $30,000. 1 3

DU QUOIN, ILL.—Du Quoin St. R. R. Co. 3 m 4-8½ g, 57 lb. T r, 3 c, 3 h. Pres. & Gen. Man. P. D. Miffien, V. Pres. C. Horn, Sec. D. White, Treas. P. N. Pope. Capital, $5,375. 1 3

DUBUQUE, IA.—Dubuque St. R. R. Elec. 15 m 4-8½ g, 52 lb girder r, 25 c, of which 15 are m. c. and 10 t. c. Edison generators and Detroit motors. Brill cars. Sioux City engines. Pres. & Gen. Man. J. A. Rhomberg, Sec. C. H. Meyer, Treas. & Supt. J. H. Rhomberg. Capital $375,000; authorized $500,000. Bonds $250,000. 9 3

Dubuque Electric Ry., Light & Power Co. 10 m. 4-8½ g, 50 lb. Johnson girder r, 16 c, of which 12 are m c. and 4 t c. Edison system. Receiver, H. Poole, Pres. R. W. Stewart, V. Pres. T. O. Swiney, Sec. & Treas. A. F. Cutter, Supt. W. T. Griffith. Capital, $500,000. 1 3

Eighth St. & West Dubuque St. Ry. Co. Elec. 2½ m, 4-8½ g, 52 lb girder r, 6 c, of which 4 are m c and 2 t c. Edison system. Northern Car Co. cars. Fairbanks, Morse & Co. engines. Pres. L. H. Bigelow, V. Pres. E. P. Griswold, Treas. W. H. Doane, Supt. H. J. Dressel. Capital, $100,000. Office, foot of 8th st. 5 3

DULUTH, MINN.—Duluth St. Ry. Co. Elec 40 m, of which 1.13 are cable and 38.87 elec, 4-8½ g 45, 60 lb girder & T, r, 51 c, of which 47 are m. c. and 4 t. c. T-H and Short systems. Pres. L. Mendenhall, V. Pres. G. G. Hartley, Sec. & Treas. T. W. Hoopes, Gen. Man. & Supt. Capital, $300,000; authorized, $1,500,000. Bonds, $88,000. Office, 16 3d av, West Duluth. 11 2

Lakeside Ry. Co. Elec. 4 m. 4-8½ g, 45 lb T r, Pres. D. G. Cash, Sec., Treas. & Man. W. C. Sargent Capital, $100,000. Operated by Duluth St. Ry. Co 8 2

Minnesota Point St. Ry. 3¾ m, 3-6 g, 28 lb T r, 8 c 16 h. Pres. J. J. Hibbard, V. Pres. R. P. Edson, Sec., Gen. Man. & Supt. W. Warner, Treas. B. Silberstein, Capital $60,000; authorized $100,000 9 3

Motor Line Improvement Co. Elec. 6 m, 4-8½ g 45 lb T r, 4 m c. T-H system. Laclede cars. Pres. G. G. Hartley, V. Pres. J. D. Stryker, Sec. T. W. Hoopes, Treas. A. R. Macfarlane, Gen. Mans. Mendenhall & Hoopes. Capital, $150,000; authorized $600,000. Bonds, $200,000. Office 12 3d Ave. W. 8 3

DURANGO, COLO.—Durango Ry. & Realty Co., Elec. 2 m, 3 g, 30 lb T r, 2 c, 16 h. Westinghouse system. Woeber cars. Ide engines. Pres. C. M. Williams, V. Pres. T. C. Graden, Sec. W. S. Pickerill, Treas. & Supt. H. J. Arnold. Capital, $250,000. 9 3

DURHAM, N. C.—Durham St. Ry. Co. 2 m, 4-8½ g, 16 lb T r, 4 box c, 4 mu. Pres. J. S. Carr, V. Pres A. B. Anderson, Sec. R. H. Wright. 8 3

E

EAST LIVERPOOL, O.—East Liverpool & Wellsville R. R. Co. Elec. 8½ m, 4-8½ g, 56 lb T and 81 lb girder r, 20 m. c. Short and Westinghouse systems. Brill and Stephenson cars. Pres. & Gen. Man. A. L. Johnson, Sec. & Treas. C. H. J. Davis, Supt. R. L. Andrews. 8 3

EAST WAREHAM, MASS.—East Wareham Onset Bay & Point Independence St. Ry. Co. 2.779 m 4-8½ g, 25 & 35 lb. T r, 14 c, 15 h. Pres. T. B. Griffith, Sec. B. F. Gibbs, Treas. & Supt. I. B. Eldridge. Capital, $20,600; authorized, $26,000. 1 3

EASTON, PA.—Easton Transit Co. Elec. 10 m, of which 3 are horse and 7 elec, 5-2½ g, 68 lb girder r, 20 c, of which 10 are h c and 10 m c, 26 h. Westinghouse system. Brill cars. Pres. W. A. Wilbur, Sec. & Treas. A. D. Childsey, Gen Man. & Supt. W. M. Williams. Capital, $150,000; authorized $500,000. Office, 60 Centre sq. 1 3

Easton & Bangor Electric Ry. Co. 16 m, 5-2½ g, 48 lb r. Pres. J. M. Young, Sec. & Treas. D. W. Nevin. Capital, $100,000. 9 3

Pennsylvania Motor Co. 2½ m, elec. 5-2½ g, 36-56 lb flat & T r, 8 m c. Wightman system. Pres. H. E. Hand, Sec., Treas. & Gen. Man. D. W. Nevin, Supt. L. Richter. Capital, $120,000. Bonds, $60,000 1 3

EAU CLAIRE, WIS.—Eau Claire St. Ry. Lt. & Power Co. 8 m, elec, 4-8½ g, 35, 42 & 45 lb c & s b r 13 c, of which 8 are m c and 5 t c. Edison and Detroit Elec. Works systems. Pres. W. Lewis, V. Pres & Gen. Man A. F. Gerald, Treas. W. G. Maxcy, Capital, $100,000. 6 3

EL PASO DE ROBLES, CAL.—El Paso de Robles St. Ry. 5 m, 3 g, 16 lb T r, 2 box c, 6 h Proprietor, George R. Adams. Cost, $10,000. Office Adams Block, cor Spring & 12th sts. 9 3

EL PASO, TEX.—El Paso & Juarez Ave. St. Ry. Co. 6½ m, 4-8½ g, 30 lb. T r, 14 c, 30 mu. Pres. Z. T. White, Supt. A. Lamour. 9 3

San Antonio & Magoffin St. Ry. Co. 4 m, 4-8½ g, 30 lb T r, 6 c, 5 mu. Pres. J. Magoffin, Supt. A. Lamour. 9 3

ELGIN, ILL.—Elgin City Ry. Elec. 13 m, 4-8½ g 40 & 45 lb T & girder r, 22 c, of which 13 are m c and 9 t c. Edison system. Pres. W. Grote, V. Pres. J. B Lane, Sec. & Treas. A. B. Church, Gen. Man. C Wuestenfeld. Capital, $250,000. 1 3

ELIZABETH, N. J.—Elizabeth St. Ry. Co. 3½ m, 4-8½ g, 38 & 52 lb Johnson girder r, 13 box c, 45 h. Pres. F. L. Heidritter, Sec. & Treas. E. C. Woodruff, Supt. J. C. Husbands. Capital $50,000. Office, East Jersey and Front sts. 1 3

ELKHART, IND.—Elkhart Electric & Ry. Co. Elec. 7 m, 4-8½ g, 35 lb T & tram r, 11 c, of which 7 are m c & 4 t c. Detroit system. Pres. L. Warfield, V. Pres. J. McNaughton, Sec. J. W. Ellis, Treas. T. Muir, Supt. C. T. Goodrich. Capital, $99,000; authorized, $100,000. Bonds, $65,000. 9 2

ELMIRA, N. Y.—Elmira & Horseheads Ry. Co. Elec. 15.7 m, of which .7 is horse and 15 elec. 4-8½ g, 45-78 lb. T & girder r, 49 c, of which 18 are h. c. 17 m. c, and 14 t. c, 14 h. Edison, T-H and Westinghouse systems. Stephenson cars. McIntosh & Seymour engines. Pres. R. Leland, Sec. E. Spencer, Treas. & Gen. Man. C. H. Baldwin. Capital, $400,000. Bonds, $400,000. 8 3

West Side R. R. Co. Elec. 7½ m, 4-8½ g, 70 lb girder r, 22 c, of which 19 are m c and 3 t c. T-H system. Brill and Stephenson cars. Bates-Corliss engines. Pres. C. M. Tompkins, V. Pres. A. E. Ockley, Sec. & Treas. H. H. Hallock, Gen. Man. & Supt. W. W. Cole Capital, $100,000. Office, 123 Baldwin st. 8 3

EMPORIA, KAN.—Emporia City Ry. Co. 3½ m, 3-6 g, 20 lb r, 8 c, 24 h. Pres. Van R. Holmes, Treas. A. F. Crowe, Sec. & Man. J. D. Holden. 11 2

ENSLEY, ALA.—Ensley Ry. Co. (Consolidated with Birmingham Ry. & Elec. Co.)

ERIE, PA.—Erie City Passenger Ry. Elec. (Operated by Erie Elec. Motor Co.)

Erie Elec. Motor Co. 25 m, 4-8½ g, 52 lb Johnson girder r, 87 c, of which 71 are m. c, 6 transfer c and 10 t. c. Edison system. Pres. J. S. Casement, V Pres. J. C. Brady, Sec. & Treas. J. L. Sternberg, Gen Man. H. F. Wilbur. Capital, $700,000. Bonds, $35000. Office 202 State st. 5 3

ESSEX, MASS.—(See Salem, Mass.)

EUREKA, CAL.—Eureka St. R.R. Co. 4½ m, 4-8½ g, 14 & 36 lb T & flat r, 6 box c, 13 h, 7 mu. Holt and N. B. & M. Ry. cars. Pres. & Gen. Man. R. M. Fernald, Supt. J. A. Clark. Capital $60,000. 9 3

EUREKA SPRINGS, ARK.—Eureka Springs Elec. Lt. & St. Ry. Co. 2½ m, 4-8½ g, 35 lb T r, 5 c, 17 mu. St. Louis cars. Pres., Sec. & Gen. Man. J. D. Jordan, V. Pres. C. F. Ellis, Treas. T. N. Cloflin, Supt. W. J. Wallace. Capital $17,000; authorized, $20,000. Bonds $3,700. 8 3

EVANSVILLE, IND.—Evansville St. Ry. Co Elec. 23 m, 4-8½ g, 60 lb T & girder r, 84 c, of which 28 are m c and 56 t c. Westinghouse system. Pres J. J. Shipherd, V. Pres. G. H. Stockwell, Sec. H. D Moran, Treas. S. Krutz, Supt. T. J. Gist. Capital $200,000; authorized, $300,000. Bonds, $1,000,000. Office, 102 Main St. 11 2

EVERETT, WASH.—Everett Ry. & Electric Co. 7.42 m, 4-8½ g, 40 lb girder r, 5 m c. Westinghouse system. American cars. Ball engines. Pres. S. Duryee, V. Pres. G. Colby, Sec. H. A. Schenck, Treas. & Gen. Man. A. R. Whitney, Jr., Supt. H. C. Wybro. Capital, $200,000. 9 3

F

FAIRHAVEN, WASH.—Fairhaven & New Whatcom Ry. Co. Elec. 18½ m, 4-8½ g, 40, 56 lb T r, 16 m c. T-H system. Brill cars. Ide engines. Pres. H. Eldridge, V. Pres., Gen. Man. & Supt. E. Cosgrove, Sec J. A. Kerr, Treas. C. C. Fisher. Capital, 500,000; authorized, $600,000. 6 3

FALL RIVER, MASS.—Globe St. Ry. Co. Elec. 24 m, 4-8½ g, 45, 48½, 75 lb girder & s b r, 88 c, of which 72 are m c and 16 t c. T-H system. Feigel, Jones, Newburyport and Stephenson cars. McIntosh & Seymour engines. Pres. Frank S. Stevens, Sec. M. G. B. Swift, Treas. R. S. Goff, Supt. John H. Bowker. Capital, 650,000. Office, 182 N. Main st. 8 3

FINDLAY, O.—Findlay St. Ry. Co. (Operated by Northern Ohio & Lake Erie Ry., Lt. & Power Co.) Elec. 12½ m, of which 4 are horse and 8½ elec., 4-8½ g, 35 & 60 lb T r, 22 c, of which 7 are h c, 10 m c, and 5 t c, 4 h, 32 mu. Westinghouse system. Laclede cars. Buckeye engines. Pres. G. B. Kerper, V. Pres. J. N. Kinney, Sec. J. Strader, Treas. C. D. Kinney, Supt. Chas. Smith. Capital $100,000; authorized $200,000. Bonds $100,000. Office N. Main St. 5 3

Northern Ohio & Lake Erie Ry., Lt. & Pow. Co. (Operates Findlay St. Ry. and Tiffin Elec. Ry.)

FISHKILL-ON-HUDSON, N. Y.—Citizens' St R. R. Co. Elec. 3½ m, 4-8½ g, 45, 54 lb T & girder r, 12 c. T-H system. Pres. J. T. Smith, V. Pres. H. G. Wolcott, Sec. S. K. Phillips, Treas. W. H. Southard, Supt. W. E. Havens. Capital $75,000. 8 3

FITCHBURG, MASS.—Fitchburg & Leominster St. Ry. Co. Elec. 11.129 m, of which 4.44 are horse and 6.689 elec., 4-8½ g, 58 lb T r, 28 c, of which 17 are h c and 11 m c, 60 h. Westinghouse system. Brill, Jones & Newburyport cars. Pres. H. A. Willis, V. Pres. H. I. Wallace, Sec. C. F. Baker, Treas. B. F. Wallis, Gen. Man. & Pur. Agt. W. W. Sargent. Capital $135,000; authorized $250,000. Bonds $30,000. 5 3

FLUSHING, N. Y.—Flushing & College Point St. Ry. Co. Elec. 4 m, 4-8½ g, 47 lb s. b. r, 9 c, of which 5 are m c and 4 t c. Westingeouse system. Jones and Stephenson cars. N. Y. Safety Power engines. Pres. Joseph Dykes, V. Pres. E. P. Stratton, Sec. D. Master, Treas. J. Hepburn, Supt. W. G. Rock. Capital $60,000. 6 3

FOND DU LAC, WIS.—Fond du Lac St. Ry. Co Elec. 5 m, 4-8½ g, 35 lb T & tram r, 8 c, of which 6 are m c and 2 t c. Westinghouse system. Pullman cars. Ball engines. Pres. & Gen. Man. W. G. De Celle, Treas. W. H. Cole, Asst. Gen. Man. G. A. Voorhees, Supt. L. Marion. Capital, $125,000. 8 3

FORT MADISON, IA.—Fort Madison St. Ry. Co. 4 m, 4-8½ g, 20 & 40 lb T & tram r, 8 c, 5 h 28 mu. Pres. & Gen. Man. D. A. Morrison, V. Pres. R S. Johnson, Sec. H. Jones, Treas. J. C. Brewster, Supt. F. H. Weber. Capital, $100,000. Office, Santa Fe Ave. 8 3

FORT MEADE, FLA.—Fort Meade St. Ry. Co. 2¼ m, 3 g, 25 lb T r, 3 c, 2 mu. Pres. F. N. Varn, V-Pres. A. H. Adams, Sec. F. B. Hadless, Treas. J. G Carter, Gen. Man. Max Reif. Capital $6,000. 6 2

FORT SCOTT, KAN.—Fort Scott Rapid Transit Co. Elec. 8½ m, of which 1½ are horse & 7 elec. 4 g, 35 lb T r, 16 c, of which 8 are h c and 8 m c. Edison system. Operated by Davenport & Fort Scott Investment Co. Pres. H. H. Anderson, Sec. F. H. Griggs, Supt. W. D. Mitchell. Capital, $250,000; authorized $500,000. Bonds $100,000. Office Katzung & Malin Block. 5 3

FORT SMITH, ARK.—Fort Smith St. Ry. Co. 8½ m, 3-6 g, 38 & 45 lb girder r, 22 c, 2 h, 60 mu. Pres Gen. Man. & Supt. Sam'l McLoud, V. Pres. Benj. T Duval, Sec. & Treas. Geo. T. Sparks. Capital, $150,000. Bonds, $35,000. Office, Cor. Third & A sts. 9 3

FORT WAYNE, IND.—C. L. Centlivre St. Ry. Co 2 m, 4-8½ g, 18 lb. T r, 6 c, of which 2 are 4 wheel box and 4 4-wheel open, 24 h. Pres. L. A. Centlivre V. Pres. & Sec. C. F. Centlivre. Treas. J. B. Reuss, Gen. Man. Le Meyers. Capital, $30,000. d 3 2

Fort Wayne Electric Ry. 18½ m, 4-8½ g, 40, 60 lb T & tram r, 67 c, of which 57 are m c and 10 t c, S h. Own system. Jones cars. Pres. J. H. Bass, V. Pres. & Treas. M. S. Robison, Jr., Sec. J. M. Barrett, Supt. L. D. McNutt. 8 3

Lakeside electric Ry. 1 m, 52 lb s b Duplex & T r. Gen. Elec, system. Gen. Man. J. D. McDonald. 8 3

FORT WORTH, TEX.—North Side St. R. R. Co. Elec. 14 m, of which 1¼ are horse and 12½ elec, 4 g, 30 lb T & girder r, 19 c of which 15 are m c and 4 t c. T-H system. Brownell cars. Hamilton engines. Receiver, H. Harding. Gen. Man. G. B. Hendricks, Supt, T. H. Wilson. Capital, $200,000. Bonds, 150,000. Office, 409½ Main St. 8 3

Fort Worth & Arlington Heights St. Ry. Co. Elec. 6½ m, 4 g, 35 lb T r, 5m. c. Edison system Pres. H. W. Tallant, V. Pres. A. W. Chamberlin Sec. & Treas. W. C. Winthrop, Supt. S. Horn. Capital, $300,000. 9 3

City Ry. Co. Elec. 16 m, 4 g, 30, 35 lb T r, 16 c, of which 14 are m c and 2 t c. Detroit system. Pullman cars. Ide engines. Pres. L. Worfield, V. Pres. & Sec. J. C. Terrall, Jr., Treas. J. C. Harrison, Supt. W. P. Quigg. Capital stock, $400,000. 8 3

Lampasas St. Ry. Co. 3 m, 4-8½ g, 35 lb. T r, 4 c, 16 h. Pres. R. E. Maddox, Sec. & Treas. W. H. Little Gen. Man. E. P. Maddox. Office, Lampasas. d 7 1

Polytechnic St. Ry. Co. 2½ m, 4 g, 20 lb T r, 2 c, 10 mu. Pres. W. D. Hall, V. Pres. R. Vickery, Sec. M. F. Lomer, Treas. G. E. Tandy. 4 2

FRAMINGHAM, MASS.—Framingham Union St. Ry. Co. 7.35 m, 4-8½ g, 30 & 35 lb. T & s. b. r, 17 c 40 h. Pres. Jas. R. Entwistle, Sec. I. B. Forbes, Treas. F. E. Gregory, Supt. J. J. Hennessy. Capital $60,000 & $50,000 bonds. Office, S. Framingham. 5 3

FRANKFORT, N. Y.—Frankfort & Ilion St. Ry. Co. 2½ m, 5 g, 25 lb T r, 5 c, of which 4 are box and 1 open. 6 h. Pres. J. H. Hoard, V. Pres. P. A Skiff, Sec. W. I. Piper, Treas. W. W. Crosby, Supt J. Myers. Capital, $20,000. Office, Frankfort. 6 3

FREDONIA, N. Y.—Dunkirk & Fredonia R. R. Co. Elec. 3½ m, 4-8½ g, 42-48 lb c. b. and girder r, 9 c, of which 3 are m c and 6 t c. Edison and Westinghouse systems. Pres. W. McKinstry, Sec, Treas & Man. M. M. Fenner. Capital, $73,450; authorized, $75,000. Bonds, $30,000; authorized, $40,000. 8 3

FREEPORT, ILL.—Freeport St. Ry. Co. 4 m, 4-8½ g, 30 lb. s. b. r, 6 4-wheel box c, 24 h. Pres. Jacob Krohn, V. Pres. F. C. Platt, Sec. W. G. Barnes, Treas & Gen Man. John B. Taylor. Capital, $45,000. 1 2

FREMONT, NEB.—City St. Ry. Co. 6½ m, 4-8½ g, 16-40 lb T r, 7 c, 24 h. Pres. F. Fowler, V. Pres. F. Meyer, Sec., Treas. & Gen. Man, E. N. Morse. Capital $45,000. 8 3

FREMONT, O.—Fremont St. Ry. Co. 1½ m 4-8½ g, 40 lb flat r, 2 4-wheel box c, 8 h. Pres. F. N. Carter, 29 Euclid ave., Cleveland, O., Treas. T. M Irvine, Cleveland, O., Supt. E. J. Carter. Capital $125,000. Office, 307 Croghan st. 8 3

FRESNO, CAL.—Fresno R. R. Co. 4½ m, 4-8½ g, 20 lb r. 7 c, 7 h. Pres. Dr. L. Leach, V. Pres. R. E. Hughes, Sec. N. I. Baldwin, Treas. L. Einstein. Capital, $200,000. 11 0

Fresno, Belmont & Yosemite R. R. Co. 4 m. 4-8½ g, 20 lb steel T r, 6 c, 12 h, 6 mu. Stockton cars. Pres. T. C. White, V. Pres. H. P. Hedges, Sec. J. P. Vincent, Gen. Man. C. L. Walter. Capital, $500,000. Leased to C. L. Walter. 9 3

FRYEBURG, ME.—Fryeburg Horse R. R. Co. 3 m, 4 8½ g, 16 lb steel T r, 5 c, 1 h. Pres. Freeman Hatch, Clerk, Gen. Man. & Supt. Seth W. Fife, Treas. John Locke. Capital $5,075, authorized $10,000. 8 3

FULTON, N. Y.—Fulton & Oswego Falls St. Ry. Co. 6,000 ft, 4-8½g, Gibbon's metallic stringer and r, 4 c, of which 3 are box and 1 open, 9 h. Pres Joseph Walker, Jr., V. Pres. N. N. Stranahan, Sec. & Treas. Charles Lyman, Supt. H. Hulett. Capital, $15,000. Office, 15 Broad st., New York. 1 3 1

G

GADSDEN, ALA. — Gadsden & Attalla Union Ry. Co. Dummy. 13½ m, of which 2 are horse and 11½ steam, 4-8½ g, 40 lb T r, 16 c, of which 2 are h c and 14 steam c, 6 motors, 2 h, 10 mu. Pres. J. M. Elliott, Jr., V. Pres. C. A. Lyerly, Sec., Treas., Gen. Man. & Supt. M. L. Foster. Capital, $200,000. Office 123 N. 4th st. 5 3

GAINESVILLE, GA.—Gainesville & Hall Co. St. R. R. Co. 5 m, 4-8½ g, 20 lb crescent r, 3 c, 3 h, 4 mu. Pres. Sec. & Treas. H. H. Dean, V. Pres. A. D. Candler. Capital, $15,000. Leased to G. P. Boone for three years from Oct. 1, 1891. Office, 10 Spring st. 2 3

GAINESVILLE, TEX.—Gainesville St. Ry. Co. 3½ m, 4-8½ g, 36 lb T r, 8 c, 16 mu. Pres. J. M. Lindsay Gen. Man. & Supt. G. W. Lindsay. Capital $40,000. Office, Fort Worth. 2 3

GALESBURG, ILL.—Galesburg Electric Motor & Power Co. 8 m, 4-8½ g, 50 lb T r, 22 c, of which 6 are h c, 8 m c and 8 t c. Westinghouse system. Pullman cars. Westinghous engines. Pres. W. Seacord, V. Pres. & Treas. R. Chappell, Sec. H. F. Arnold, Supt. H. F. Hawley. Capital $210,000. Bonds $111,000. Office 540 Main St. 8 3

GALLIPOLIS, O.—Gallipolis St. Ry. Co. Elec 3 m c, T-H system. 10 2

GALVESTON, TEX.—Galveston City R. R. Co Elec. 33 m, 4-8½ g, 40, 52 lb T r, 84 c, of which 26 are h c, 47 m c and 11 t c, 5 h, 54 mu. T-H and Westinghouse systems. Laclede and St. Louis cars. Buckeye and Cooper engines. Pres. & Gen. Man. Wm. H. Sinclair, Sec. & Treas. H. Kellner, Supt. W. H. Griffen. Capital, $318,673.50; authorized, $1,000,000. Bonds, $750,000. Office, I and Center Sts. 8 3

Gulf City St. Ry. & Real Estate Co. Elec. 11 m, of which 8 are horse & 3 elec. 4-8½g, 25-40 lb T r, 22 c, 32 mu. Pres. J. H. Burnett, Sec. P. S. Wren. Capital $100,000. Office, Ave. 1& 21st St. 8 3

South Galveston & Gulf Shore R. R. Co. Elec. 2½ m, 4-8½ g, 45 lb. T r. Pres. G. J. Gray, V. Pres. H C. Brown, Sec. H. E. Barden, Treas. L. Minor, Supt N. Dahl. Capital, $300,000. 10 2

GEORGETOWN, KY.—Georgetown St. Ry. Co 1¼ m, 4-8½ g, 20 lb T r, 2 c, 6 mu. Pres. S. M. Davis Sec. W. Z. Thomson, Treas. A. H. Sinclair. Capital $6,000. Leased to John Cole. 6 3

GETTYSBURG, PA.—Gettysburg Electric Ry. Co. 8 m, 4-8½ g, 56 lb T r, 6 c, of which 3 are m c and 3 t c. Brill cars. Pres. Gen. Man. & Supt. E. M. Hoffer, Sec. & Treas. G. P. Hoffer. 9 3

GIRARDVILLE, PA.—Mahanoy, Shenandoah Girardville & Ashland St. Ry. Co. (Leased to Schuylkill Traction Co.) Elec. 24 m, 20 m c. T-H and Westinghouse systems. Pres. W. F. Harrity, V. Pres. & Gen. Man. H. Wickham, Sec. & Treas. J. A. Graham. 9 3

GLENS FALLS, N. Y.—Glens Falls, Sandy Hill & Fort Edward St. R. R. Co. Elec. 8 m, 4-8½ g, 40 lb T r, 12 c, of which 8 are m c and 4 t c. Westinghouse system. Pres. J. M. Coolidge, V. Pres. L Allen, Sec. & Treas. B. B. Fowler, Supt. H. Crable Capital authorized $120,000. Bonds $100,000. 8 3

GLOUCESTER, MASS.—Gloucester St. Ry. Co. Elec. 8½ m, 4-8½ g, 40-60 lb T & Johnson r, 13 m c T-H and Detroit systems. Pres. W. B. Ferguson, V Pres. J. H. Cunningham, Sec. D. S. Presson, Treas. A. D. Bosson, Supt. A. R. Hallowell. Capital, $180,000. Bonds, $60,000. Office, Gloucester st. 1 3

GLOVERSVILLE, N. Y.—Cayadutta Electric R. R. Co. 17 m, 4-8½ g, 40, 80 lb girder & T r, 16 c of which 12 are m c and 4 t c. T-H., Westinghouse and Short systems. Brill and Gilbert cars. Russell & Co. Engines. Pres. J. Shanahan, V. Pres. A. J. Zimmer, Sec. H. Dudley, Treas. J. L. Hees, Gen. Man. T. C. Frenyear. Capital, $280,000; authorized, $350,000. Bonds, $212,000. Office 1 S. Main St. 1 3

Jonstown, Gloversville & Kingsboro Horse R. R. Co. Elec. 4½ m, 4-8½ g, 45 lb T & girder r, 12 c, of which 8 are m c and 4 t c, 22 h. Gilbert cars. Gloversville Fdy. & Mach. Co. engines. Pres. W. S. Northrop, V. Pres. H. W. Potter, Sec. F. Burton, Treas. W. D. West, Gen. Man. F. A. Caten. Capital $50,000. Bonds $50,000. 2 3

GRAND ISLAND, NEB.—Grand Island St. Ry. Co. 7 m, 4-6 g, 16 & 20 lb T r, 11 c, 52 h & mu. St. Louis cars. Pres. A. H. Baker, V. Pres. H. A, Koenig Sec. O. B. Thomson, Treas. W. A. Hagge, Gen. Man. & Supt. W. C. Lamon. Capital, $50,000. 2 3

GRAND JUNCTION, COL. — Grand Junction St. Car Co. 2 m, 3 g, 22 lb. T r, 2 4-wheel box c, 4 h. Pres. G. Wheeler, V. Pres. B. Cannon, Sec. & Treas. T. B. Crawford, Gen. Man. & Supt. B. K. Kennedy. Capital $25,000. h 3 1

GRAND RAPIDS, MICH.—Consolidated St. Ry Co. Elec. 44 m, 4-8½ g, 45, 66 & 78 lb girder r; 183 c, of which 138 are m c and 45 t c. Edison and Detroit systems. Hamilton and Wheelock engines. Pres. A. J. Bowne, V. Pres. & Gen. Man. J. R. Chapman, Sec. J. M. Hagar, Treas. J. Blair, Asst. Sec. & Asst. Treas. B. S. Hanchett, Jr., Supt. D. Campbell, Gen. Elec'n. S. Barnes. Capital $1,500,000; authorized $2,000,000. Bonds, $2,900,000. 8 3

GREAT FALLS, MONT.—Great Falls St. Ry Co. Elec. 10.8 m, 4-8½ g, 45 lb T & girder r, 11 c, of which 7 are m. c. and 4 t. c. T-H system. Water power. Pres. A. S. Bigelow, V. Pres. L. Lewesohn, Sec. & Treas. T. Nelson, Supt. W. D. Dickinson. Capital, $200,000. Bonds $120,000. 8 3

GREENBUSH, N. Y.—North & East Greenbush St. Ry. Co. 1.7 m, 4-8½ g, 6 c, 22 h. Pres. & Treas. A Bleecker Banks. Capital $50,000. Office, 473 Broadway, Albany. 3 2

GREEN CASTLE, IND.—Green Castle City St. Ry. Co. 2.60 m, 4-8½ g, 30 lb T r, 3 4-wheel open c, 10 mu. Pres. J. W. Weik, V. Pres. J. S. Dowling, Sec. & Supt. F. G. Gilmore, Treas. H. Meltzer, Gen Man. E. McClean. Capital $32,000; authorized $50,000. Office Crystal Palace cor. Vine and Walnut sts. 10 2

GREENSBURG, PA.—Greensburg & Hempfield Electric St. Ry. 2.4 m elec., 4 8½ g, 35 & 45 lb Johnson & T r, 3 m. c. Westinghouse system. Pres. R. S. Jamison Sec. J. E. Keenan, Treas. W. A. Huff, Gen. Man. F. Y. Clopper, Supt. R. C. Reamer. Capital $60,000, bonds $59,200. Office, Huff Building. 11 2

GREENVILLE, S. C.—St. Ry. Co. of the City of Greenville. 2½ m, 5 g, 16 lb crescent r, 6 c, 3 mu T. C. Gower & Son, proprs. Pres. T. C. Gower, Sec G. G. Wells, Supt. A. G. Gower. Capital $10,000. Office, 104 Washington st. 8 3

GREENVILLE, MISS.—Greenville St. Ry. Co. 6 m, 4-8½ g, 25-30 lb T r, 9 c, 15 mu. Pres. J. M Joyne, Sec. & Treas. J. E. Neggus, Gen. Man. J Gunn, Supt. J. H. Gonterman. Capital, $35,000 authorized, $100,000. 3 2

Suburban St. Ry. of Greenville. 2 m, 4-8½ g, T r 2 c, 4 mu. Pres. & Man. H. Wilczinski, V. Pres. N Wilczinski, Sec. & Treas. L. Wilczinski. Capital $25,000. 3 2

GRIFFIN, GA.—Griffin St. Ry. Co. 3 m, 4-8½ g, 35 lb steel r, 5 c, 13 mu. Brill and Laclede cars. Pres. & Gen. Man. J. G. Rhea, V. Pres. D. Giessner, Sec. & Treas. R. H. Drake, Supt. A. Gray. Capital, $20,000, authorized $50,000. 9 3

H

HALIFAX, N. S.—Nova Scotia Power Co. (Lim.) 7 m, 4-8½ g, 45-60 lb T r, 25 c, 100 h. Pres. John White, Sec. & Treas. H. Freeman, Supt. J. Adams. Office, 138 Hollis st. Halifax, N. S. Office of Supt. Richmond. 11 0

HAMILTON, O.—Hamilton & Lindenwald Electric Transit Co. 9 m, 4-8½ g, 40, 45 lb T and girder r, 23 c, of which 15 are m. c. and 8 t. c. Edison system. Stephenson cars. Hamilton engines. Pres. Thos. Millikin, V. Pres. C. Benninghofen, Sec. & Gen. Man. Ira S. Millikin, Treas. P. Benninghofen. Capital, $100,000. Bonds $100,000 5 3

HAMILTON, ONT.—Hamilton St. Ry. Co. Elec 15 m, 4-8½ g, 62, 69 lb girder r, 75 c. Westinghouse system. Pres. B. E. Charlton, V. Pres. E. Martin, Gen. Man. J. B. Griffith. Capital $205,000. Office 6 James St., South. 5 3

HAMPTON, VA.—Hampton & Old Point Ry. Co Elec. 14 m, 4-8½ g, 50-69 lb T & girder r, 20 c, of which 12 are m c, 1 freight and 2 flat c. Edison system. Pres. F. W. Darling, V. Pres. J. McMenamin Sec. & Treas. H. L. Schmelz, Elec'n J. B. Crankshaw Capital, $150,000. 8 2

HANNIBAL, MO.—Hannibal Ry. Co. Elec 2½ m 4-8½ g, 36,40 lb T & c b r, 5 c, of which 3 are m. c. and 2 t. c. T-H system. Pres. & Supt. M. Doyle Sec. & Treas. James O'Hern. Capital $25,000. Office 300 Market st. 1 3

General Incandescent Arc Light Co., S. BERGMAN, President. BEST RAILWAY LAMPS, 572 to 578 First Ave., NEW YORK.

HARRISBURG, PA.—Harrisburg City Passenger Ry. Co. (Leased to East Harrisburg Pass. Ry. Co.) Elec. 5½ m, 5-2½ g, 70 lb girder r. T-H system. Pres. H. A. Kelker, V. Pres. G. R. Fleming, Sec. A. Roberts, Treas. W. L. Gorgas. Capital $125,000. Office, 27 South 2d st. 9 3

Citizens' Passenger Ry. Co. Elec. 9 m, 5-2½ g, 75 lb girder r, 16 m. c. Baxter, Curtis and Westinghouse systems. Ide engines. Pres. B. F. Meyers, V. Pres. J. A. Dunkle, Sec. & Treas. A. W. Dunkle, Supt. F. H. Alleman. Capital, $200,000. 6 3

East Harrisburg Pass. Ry. Co. Elec. 15 m, 5-2½ g 52, 78, 92 lb girder and T r, 62 c, of which 47 are m c and 15 t. c. T-H system. Brill and Lamokin cars. Wetherill engines. Pres. John Q. Denney, V. Pres. T. G. Greenawalt, Sec. & Treas. W. J. Calder, Supt. F. B. Musser. Capital, $500,000. Office, S. Cameron st. 5 3

HARTFORD, CONN.—Hartford St. Ry. Co. Elec. 30 m, of which 20 are horse and 10 elec, 4-8½ g, 35-60 lb T, & girder r, 118 c, of which 108 are m c and 10 t c, 460 h. Westinghouse, Short and T-H systems. Pres. E. S. Goodrich, Sec. & Treas. Dan'l R. Howe. Capital, $200,000 Bonds, $400,000. Office, 346 Main st. 5 3

East Hartford & Glastonbury Horse R. R. Co. Elec 5 m, 4-8½ g, 50 lb T r, 4 m c. Short system. Pres D. R. Howe, V. Pres. I. Broadhead, Sec. G. D. Curtis Treas. E. M. White, Gen. Man. E. S. Goodrich. 11 2

HARVEY, ILL.—Harvey Transit Co. Elec. 3 m c, 4-8½ g, T r, 3 m c. Short system. Laclede cars. Ide engines. Pres. A. G. Spalding, V. Pres. A. C. Badger, Gen. Man. W. J. McCorkindale, Supt. H. E. Geyer. Capital $150,000. Bonds $150,000 9 3

HASTINGS, NEB.—Citizens' St. Ry. Co. 5½ m, 4-8½ g, 16 & 32 lb T & flat r, 6 box c, 8 h. Pres. Gen. Man. & Supt. R. A. Batty, Sec. Rose E. Shedd, Treas. J. Hornshaw. Capital $65,000; authorized, $100,000. 9 3

HAVERHILL, MASS.—(Haverhill & Groveland St. Ry. Owned by Lowell, Lawrence & Haverhill St. Ry. Co. See Lowell, Mass.)

Haverhill & Amesbury St. Ry. Co. Elec. 32 m, of which 8½ are horse, 5½ steam & 18 elec, 4-8½ g, 35 50, 70 lb T & girder r, 65 c, of which 20 are h c, 32 m c and 13 t c. T.H and Westinghouse systems. Briggs, Ellis and Newburyport cars. Pres. & Gen. Man. E. P. Shaw, Treas. A. C. Pond, Supt. W. Wentworth. Capital, $150,000; authorized. $250,000. Bonds, $300,000. 1 3

HAZLETON, PA.—Lehigh Traction Co. 10 m, 4-8½ g, 60 lb T r, 10 c, of which 6 are m c and 4 t c. Westinghouse system. Brill and Lamokin cars. Westinghouse engines. Pres. C. W. Kline, V. Pres. H. Dryfoos, Sec. E. S. Doud, Treas. N. C. Yost, Gen. Man. J. E. Giles. Capital, $1,000,000. Bonds, $250,-000. 9 3

HELENA, ARK.—Citizens' St. Ry. Co. 2½ m, 4-8½ g, 20 & 40 lb T & Johnson r, 7 c, of which 4 are 4-wheel box & 3 truck c, 12 mu. St. Louis cars. Pres. H. S. Hornor, V. Pres. D. T. Hargraves, Sec. & Gen Man. J. H. Thompson, Treas. S. H. Hornor. Capital $30,000. 5 3

HELENA, MONT.—Helena Electric Ry. Co. 9 m, 4-8½ g, 38-48 lb girder & T r, 16 c, of which 8 are m c and 8 t c. T-H & Westinghouse systems. Pullman and Stephenson cars. Corliss engines. Pres. C. K. Wells, V. Pres. H. M. Parchen, Sec. & Treas. H. L. Walker. Capital, 250,000. Office, Main St. & 6th Ave. 9 3

Helena Rapid Transit Co. Elec. 15 m, 4-8½ g, 35 45, 50 lb T & girder r 9 m c T-H system. Northern cars. Russell engines. Gen. Mans. W. H. Clark & Son, Supt. C. A. Cahill. Capital $500.000. Office 7 N. Jackson St. 8 3

Helena Rapid Transit R.R. Elec. 15 m, 4-8½ g, 35 45, 50 lb T & girder r, 9 m c. T-H. system. Russell engines. Pres. & Man. R. Lockey, V. Pres. P. Winne, Sec. J. T. Hoag. Capital, $500,000. Office, Lockey Bldg, 6th ave. 12 3

HENDERSON, KY.—Henderson St. Ry. Co. 6½ m, 4-8½ g, 20 lb steel T r, 12 c, 2 h, 44 mu. St. Louis cars. Pres. E. G. Sebree, Jr., Sec. & Treas. D. Bank, Jr., Gen. Man. & Supt. J. W. O'Brien. Authorized capital, $100,000. 9 3

HENDERSONVILLE, N. C.—Hendersonville St. Ry. Co. 3 m, 4-8½ g, 30 lb T r, 3 c, of which 1 is 4-wheel box and 2 4-wheel open, 1 h, 2 mu. Stephenson cars. Owner & Gen. Man. S. V. Pickens. Capital, $6,000. Office, 1 S. End Main st. 9 3

HOBOKEN, N. J.—North Hudson County Ry Co. (Includes Pavonia Horse R. R.) Elec. 44 m, of which 28 are horse, 2½ cable, 7½ steam and 6 elec, 4-6¾, 4-8½ g, 56, 67, 78 lb c. b. girder and T r, 209 c, of which 171 are h c, 17 g c and 21 m c, 930 h. T-H system. Brill, Gilbert and Stephenson cars. Ball, Baldwin, Campbell, Porter and Watts engines. Pres. S. B. Dod, V. Pres. H. J. Bonn, Sec. T. J. Mallory, Treas. J. F. W. Mangels, Gen. Man. H. W. Starr, Supt. Nicholas Goelz. Capital $1,000,000. Bonds, $3,000,000. Office, 21 Hudson Place. 2 3

HOLYOKE, MASS.—Holyoke St. Ry. Co. Elec 8 m, 4-8½ g, 56 lb. T r, 32 c. of which 20 are m c and 12 t c. T-H and Westinghouse systems. Pres. Levi Perkins, Treas. & Gen. Man. Wm. S. Loomis, Supt. G. Hunter. Capital $250,000. Office 23 Canal St. 8 3

HORNELLSVILLE, N. Y.—Hornellsville Electric Ry. Co. 4 m, 4-8½ g, 56 lb girder r, 10 c of which 5 are m c and 5 t c. Edison system. Pres. C. Adsit, V. Pres. F. D, Sherwood, Sec. D. M. Page, Treas. G. T. Rehn, Supt. G. K. Ridgway. Capital, $50,000; Bonds, $50,000. Office, 119 Main St. 9 3

Hornellsville & Canisteo Ry. Co. Elec. 5 m, 4-8½ g, 40 lb T r, 4 c, of which 3 are m c and 1 t c. Edison system. Brill cars. Pres. D. M. Page, V. Pres. F. D. Sherwood, Sec. C. Adsit, Treas. G. T. Rehn, Supt. G. K. Ridgway. Capital, $50,000. Bonds, $50,000. Office, 119 Main St. 9 3

HOT SPRINGS, ARK.—Hot Springs Electric St Ry. Co. 15.4 m, of which 2 are horse and 13.4 elec, 4-8½ g, 48 lb T r, 35 c, of which 10 are h c 10 m c and 15 t c. T-H system. American cars. Pres. S. W. Fordyce, Sec. C. E. Maurice, Treas., Man. & Pur. Agent C. G. Convers. Capital, $500,000. Office, 615 Park Ave. 9 3

Fountain & Suburban R. R. Co. Elec. 4½ m, 4 g 35 lb T r R. Murray, owner & manager, Williamson Block, Valley st., at Malvern Crossing. Capital $20,000. 8 2

HOT SPRINGS, S. DAK.—Hot Springs & Chautauqua R. R. Co. Elec. 1¼ m, 2 m. c. Short system 10 1

HOUSTON, TEX.—Houston City St. Ry. Co. (Operates Bayou City and Houston Heights Rys.) Elec. 35 m, 4-8½ g, 40, 45 lb T & flat r, 55 c, of which 45 are m c and 10 t c, Edison and T-H systems. Brill, Brownell, St Louis and Stephenson cars. Allis engines. Pres. C. S. Montgomery, V. Pres. & Gen. Man. H. F. MacGregor, Sec. & Tres. C. A. McKinney, Supt. F. Mundes. Capital, $1,000,-000. Office, 502-4 Travis st. 9 3

HUDSON, N. Y.—Hudson Elec. Ry. Co. 1¾ m elec, 4-8½ g, 35 lb T r. 5 m. c. T-H system. Pres. H Mc Gonegal, Vice-Pres. A. J. Rowles, Sec. E. J Hodge, Treas. S. D. Lake. Capital stock $50,000. 5 3

HUNTINGTON, L. I., N. Y.—Huntington R. R Co. 3 m, 4-8½ g, 30 lb. T r, 3 c, 10 h. Pres. E. D. Davidson, V. Pres. Temple Prime, Sec. Geo. M. Tileston Treas. D. Conklin, Gen. Man. I. Rogers. Capital $30,000. Bonds, $26,000. 9 3

HUNTINGTON, W. VA.—Consolidated Light & Ry. Co. Elec. 11 m, of which 4 are horse and 7 Elec. 4-8½ g, 42, 52 lb girder & T r, 13 c, of which 7 are m c and 6 t c. Short system. Laclede and Jones cars. Taylor and Buckeye engines. Pres. J. L. Caldwell, V. Pres. T. T. McCullough, Sec. & Gen. Man. F. L. Doolittle, Treas. C. L. Hafner, Sr. Capital, $250,000. Bonds, $100,000. Office, 919 2d Ave. 9 3

HUNTSVILLE, ALA.—Huntsville Belt Line & Monte Sano Ry. Co. 12 m steam, 4-8½ g, 60 lb. T r, 20 c. Pres. J. F. O'Shaughnessy, 36 Wall st. New York Capital, $200,000. Bonds, $150,000. Office, Jefferson st. 2 2

HUTCHINSON, KAN.—Hutchinson St. Ry. Co. 12 m, 4-6 g, 20 lb T r, 6 c, 30 h, 20 mu. Brownell and Laclede cars. Pres. & Gen. Man. L. A. Bigger, V. Pres. J. B. Brown, Sec. L. Taylor, Treas. & Supt. S. Bigger. Capital, $50,000. Office, 8 E. Sherman St. 9 3

I

INDEPENDENCE, MO.—Kansas City, Independence & Park Dummy Line. (See Kansas City.)

INDIANAPOLIS, IND.—Citizens' St. R. R. Co. Elec. 85 m, of which 55 are horse and 30 elec., 4-8½ g, 38 to 78 lb Johnson girder r, 145 c, of which 95 are h. c, 35 m c. and 15 t c., 940 mu. T-H, Edison, Westinghouse systems. Pres. A. L. Mason, V. Pres. W. L. Elder, Sec. & Treas. W. F. Milholland, Pur. Agt. S. F. Hazelrigg, Gen. Man. T. H. McLean. Capital $1,500,000; authorized, $3,000,000. Bonds, $950,000. Room 11 The Fair Block. 4 3

IRONTON, O.—The Ironton & Petersburg St. Ry. Co. 8 m, 4-8½ g, 32 lb T & flat r, 13 c, 42 h. Pres. C. H. Harman, Sec. & Treas. Wm. M. Kerr, Supt. T. T. Johnson. Capital, $100,000. Bonds, $65,000. Office, 32 Nassau St., New York. 1 3

IRONWOOD, MICH.—Twin City Ry. Co. 3.5 m, 3 m. c. T-H system. 11 2

ITHACA, N. Y.—Ithaca St. Ry. Co. Elec. 6 m, 4-8½ g, 45, 60 lb T r, 18 c, of which 12 are m c and 6 t c. T-H system. Brill and Gilbert cars. Ball engines. Water power. Pres. H. E. Hand, V. Pres. A. Hand, Sec., Treas. & Gen. Man. H. Bergholtz. Supt. J. A. Maxwell. Capital, $175,000; authorized, $250,-000. Office 16 East State st. 10 3

J

JACKSON, MICH.—Jackson Street Ry. Co. Elec 7 m, 4-8½ g, 45 T & lb girder r, 16 c, of which 8 are m c and 8 t c. Edison system. Brill cars. Pres. H. H. Smith, V. Pres. D. S. Smith, Sec. J. B. Corliss, Treas. & Gen. Man. H. H. Smith, Jr. Capital, $140,000; authorized, $150,000. Office, Main and Horton Sts. 9 3

JACKSON, MISS.—Jackson City R.R. 1½ m 4-8½ g, 4 4-wheel box c, 10 h. Pres. P. W. Peoples of Jackson Bank. Capital, $5,000. 3 2

JACKSON, TENN.—Jackson & Suburban St. R. R. Co. 7, m, 4 g, 30 lb tram r, 9 4-wheel box c, 30 mu Pres. & Gen. Man. J. L. Wisdom, V. Pres. J. H. Duke Sec. C. G. Bond, Supt. T. F. Dalbey, Treas. 1st Nat. Bank. Capital, $50,000. Office, Royal St. at Five Points. 5 3

JACKSONVILLE, FLA.—Main St. Ry. Co. Elec. 1½ m, 5 g, 25 lb T r, 5 4-wheel box c, 18 mu. Pres. S. B. Hubbard; V. Pres. J. M. Schumacher, Sec. & Man. H. S. Ely, Treas. A. F. Perry. Capital, $15,000. Office, 26 Main st. 1 3

Jacksonville St. R. R. Co. 12 m, 5 g, 25 & 30 lb T & 35 lb c b r, 33 c, 137 mu. Pres. H. S. Haines, Savannah, Ga.; V. Pres. Geo. R. Foster, Jacksonville, Fla.; Treas. J. M. Lee, Savannah; Supt. G. W. Haines, Brunswick, Ga.; Agent & Eng. M. H. Motte, Jacksonville. Office, Commercial st. c 9 0

JACKSONVILLE, ILL.—Jacksonville Ry. Co. Elec., 5 m, 4-8½ g, 25-45 lb r, 21 c, of which 9 are m c, 12 t c, 5 h. T-H. & Detroit systems. Pres. Wm. S Hook, Sec. Marcus Hook, Treas. Fannie Hook, Supt B. F. Sibert. Capital $50,000. 6 2

JAMAICA, N. Y.—Jamaica & Brooklyn Road Co. 12.8 m elec. 4-8½ g, 50 lb s b & flat r, 23 c of which 18 are m c and 5 t c, 3 h. Edison system. Pres. S. Spencer, V. Pres. G. W. Maslin, Sec. W. S. Townsend, Treas. R. D. Lankford, Supt. W. M. Scott. Capital, $197,480. Bonds, $415,000. Offices, 23 Wall st., New York and Jamaica, L. I. 1 3

JAMESTOWN, N. Y.—Jamestown St. Ry. Co Elec. 20 m, 4-8½ g, 30-70 lb T & girder r, 32 c, of which 27 are m c and 5 t c, 7 h. Short and Westinghouse systems. Brill cars. Noye and Phœnix engines. Pres. A. N. Broadhead, V. Pres. L. B. Warner, Sec. W. S. Cameron, Treas. S. B. Broadhead, Supt. & Pur. Agt. G. E. Maltby. Capital $250,000. Bonds $300,-000. 9 3

JANESVILLE, WIS.—Janesville St. Ry. Co Elec. 7 m, 4-8½ g, 35 lb T r, 9 c, of which 5 are m c and 4 t c. Short system. Pres. J. A. Barham, V. Pres. A. A. Jackson, Sec. & Gen. Man. W. R. Proudfoot. Capital $125,000. Office, Power House, Academy St. 9 3

JEFFERSONVILLE, IND.—Jeffersonville City Ry. Co. 5 m, 4-8½ g, 20 & 35 lb steel T r, 11 c, 35 mu. Pres., Sec. & Treas. E. J. Howard, V. Pres. G. J. Long, Supt. E. Frazer. Capital stock, $50,000. Office, 57-59 Spring st. 1 3

JERSEY CITY, N. J.—Jersey City & Bergen R. R. Co. (Controlled by New Jersey Traction Co.) Elec. 40 m, of which 30 are horse and 10 elec. 4-10½ g, 50 & 78 lb c. b. & girder r, 163 c, of which 136 are h c and 27 m c, 819 h, 56 mu. Curtis and Westinghouse systems. Stephenson and Trimble cars. Pres. Chas. B. Thurston, 1st V. Pres. G. F. Perkins, 2d V. Pres. & Gen. Man. D. Young, Sec. H. C. Ross, Treas. Joseph S. Vanzandt, Supt. Thos. M. Sayre. Capital $1,000,000. Bonds, $258,000. Office, No. 1 Exchange Pl. 9 3

JOHNSON CITY, TENN.—Johnson City & Carnegie St. Ry. Co. Elec. 3 m, 4-8½ g, 45 lb T r, 4 m c. T-H. system. Ellis cars. Power rented. Pres. E. Day, V. Pres, F. A. Stratton, Sec., Treas. & Gen. Man. E. H. Stevens. Capital $50,000. 5 3

JOHNSTOWN, PA.—Johnstown Pass. Ry. Co. Elec. 14 m, 4-8½ g, 78 lb girder r, 28 c. of which 16 are m c and 12 t c. Short system. Pres. Tom. L. Johnson, V. Pres. & Man. John B. Hoefgen, Sec. B. L. Yeagley. Capital. $250,000. Office Johnstown. 3 3

JOLIET, ILL.—Joliet St. Ry. Co. Elec. 16 m 4-8½ g, 38, 40, 58 lb. girder & T r; 30 c, of which 16 are m c & 14 t c. T-H system. Pres. & Gen. Man. J A. Henry, V. Pres. & Supt. J W. Folk, Sec. & Treas. J. Hulsizer. Capital, $150,000; authorized, $300,000. Bonds, $75,000. Office, S. W. corner Jefferson & Ottawa Sts. 1 3

JOPLIN, MO.—Joplin Electric Ry. & Motor Co 4.52 m, 4-8½ g, 56 lb Johnson girder r, 10 4-wheel box c, of which 8 are m.c. and 2 t.c. T-H system. Two 15 H. P. motors to each car. Pres. John N. Boffinger V. Prests. B. F. Hammett, J. C. Stewart; Sec. & Treas. D. R. Powell, Gen. Man. H. L. Newman, Supt C. H. Belden, Atty. D. J. Haff. Capital, $150,000 Office, 115 N. 3d st., St. Louis, Mo. 9 3

K

KALAMAZOO, MICH.—Citizens' St. Ry. Co. Elec. 12 m, 4-8½ g, 50 lb. T r, 25 c, of which 14 are m. c. and 11 t. c. General Electric system. Pres. T. P. Bailey, V. Pres. G. J. Kobusch, Sec. & Supt. E. E. Downs, Treas. J. W. Johnson, Gen. Man. G. R. Wheeler. 5 3

KANKAKEE, ILL.—Kankakee Electric Ry. Co. 6 m, 4-8½ g, 50 lb T, girder & T r, 4 m c. Westinghouse system. Pullman cars. Pres. & Gen. Man. C. H. Cobb, V. Pres. H. K. Wheeler Sec. & Treas, T. W. Adams. Capital, $50,000; authorized, $60,000. 9 3

North Kankakee Elec. Lt. & Ry. Co. 4.2 m, 4-8½ g, 40, 57 lb T & girder r, 3 m. c. Detroit and T-H Systems. St. Louis cars. Phœnix engines. Pres. B. F. Uran, Sec. E. E. Day, Treas. A. D. Ehrich, Gen. Man. & Supt. E. Powell. Capital $70,000: Bonds, $25,000. 9 3

KANSAS CITY, KAN.—Kansas City Elevated Ry. Co. (Operates Kensington Ry.) Elec. 20 m, 4-8½ g, 40, 50, 62 lb T & Duplex r, 34 m c. T-H, Edison and Westinghouse systems. Pullman and St. Louis cars. Corliss engines. Pres. J. Wilbour, V. Pres. & Gen. Man. R. Gillham, Sec. D. D. Hoag, Treas. A. H. Calif. Capital, $2,600,000. 5 3

West Side R. R. Co. Elec. 10 m, 4-8½ g, 45, 54 lb T & girder r, 16 c, of which 12 are m. c. and 4 t. c. Westinghouse system. St. Louis cars. Sioux City Corliss engines. Pres. W. N. Coler, Jr., Sec. C. F. Hutchings, Supt. J. P. Clark. Capital, $500,000. Bonds $150,000. 6 3

KANSAS CITY, MO.—Kansas City Cable Ry. Co. 20½ m cable, 4-8½ g, 42, 56 & 63 lb flat & Johnson girder r, 190 c, of which 119 are open and 71 g. c Pres. & Gen. Man. Wm. J. Smith, V. Pres. Jas. A Blair, Sec. W. H. Lucas, Asst. Gen. Man. F. C. Peck Capital, $1,575,000 Bonds $1,350,000. Office, 433 E. Ninth st. 9 3

Grand Ave. Ry. Co. 22½ m. of which 3½ are horse, 17.14 cable & 1.87 steam, 4-8½ g, 58 lb T & c b r, 90 c, of which 7 are h. c. 81 cable comb'n and 2 steam c. 44 h. Brownell cars. Allis engines. Pres. W. H. Holmes, V. Pres. V. B. Buck, Sec. D. B. Holmes, Treas. W. B. Clark, Gen. Man. C. F. Holmes, Supt. T. Barratt. Auditor, T. J. Fry Capital, $1,200,000. Bonds, $1,200,000. Office, 1500 Grand ave. 1 3

Kansas City & Independence Rapid Transit Ry. Co. 16.32 m steam, 4-8½ g, 40 lb T r, 28 c, of which 18 are pass. c, 9 flat c and 1 express c, 6 steam motors. Laclede cars. Baldwin engines. Pres. W. H. Holmes, V. Pres. C. L. Hutchinson, Sec. D. B. Holmes, Treas. W. B. Clarke, Gen. Man. C. F. Holmes, Supt. W. P. Buckner, Auditor, T. J. Fry. Capital, $1,000,000. Office 1,500 Grand Ave. 6 2

Kensington Ry. Co. (Operated by Kansas City Elevated Ry. Co.) Steam. 4 m, 4-8½ g, 50 lb T r. Pres. A. P. Smith, V. Pres. R. R. Miner, Sec. J. E Brady, Treas. W. A. Bunker. Capital $50,000. Bonds $50,000. 9 3

Metropolitan St. Ry. Co. 44 m, of which 25 are cable, 11 horse and 8 elec., 4-8½ g, 60 lb c. b. r, 289 c of which 42 are h. c, 76 g. c, 18 m. c. and 153 t. c, 76 h, 101 mu. T-H system. Laclede and Pullman cars. Armington & Sims and Hooven, Owens & Rentschler engines. Pres. & Treas. C. F. Morse, V. Pres. G. H. Nettleton, Sec. J. A. Harder, Gen. Man. & Ch. Eng. R. J. McCarty, Asst. Gen. Man. F. M. Bernardin. Capital, $2,800,000; authorized, $3,600,000. Bonds, $2,000,000. Office, 9th & Broadway. 9 3

North East St. Ry. Co. Elec. 7 m, 4-8½ g, 52 lb girder r; 12 m c, of which 10 are 4-wheel box and 2 4-wheel open. T-H system. Pres. W. McDonald Sec. W. C. Scarritt, Treas. J. H. North, Gen. Man. F W. McDonald. Capital $260,000. Bonds $260,000. 3 2

People's Cable Ry. Co. 6.8 m, 4-8½ g, 58½ lb r, 35 c, of which 15 are g. c. and 20 t. c. Auditor & Cashier, W. C. Philips, Supt. F. Philips. Capital $750,000. 3 2

South Side St. Ry. Co., 1½ m, 4-8½ g, 18 lb. strap r, 3 4-wheel box c, 21 h. Pres. A. P. Smith, Sec J. A. Harder, Gen. Man. J. McCarty. Capital $20,000. 11 2

South Suburban Ry. Co. Elec. 3.25 m, 4-8½ g, 35-56 lb. flat & girder r, 6 m. c. T-H system. St. Louis cars. Pres. G. K. Wheeler, V. Pres. & Gen. Man. D. J. Haff, Sec. C. A. Ross, Treas. I. C. Hubbell, Supt. C. Grover. Capital, $150,000. Bonds $100,000. Office, 829 N. Y. Life Ins. Bldg. 6 3

KEARNEY, NEB.—Kearney Electric Co. 5½ m Elec. 4-8½ g, 40 lb T r, 6c, of which 4 are m. c. and t. c. T-H & Edison systems. Pres. Geo. W. Frank Sec. & Treas. C. M. Rice, Supt. G. W. Frank Jr. Capital $250,000. 1 3

KENOSHA, WIS.—Kenosha Electric St. Ry. Co 3 m, 4-8½ g, 52 lb girder r, 6 c, of which 4 are m c and 2 t c. Pres. & Gen. Man. J. W. Munson, V. Pres. N A. Pennoyer, Sec. & Treas. H. B. Robinson. Capital $100,000. 9 2

KEOKUK, IA.—Gate City Electric St. Ry. Co. 6½ m, 4-8½ g, 38-45 lb T & girder r, 14 c, of which 8 are m c and 6 t c. Edison and Westinghouse systems. Pres. S. P. Townsend, Sec. W. J. Roberts, Treas. & Supt. H. C. Reiner. Capital authorized, $130,000. Bonds $85,000. 5 3

KEY WEST, FLA.—Key West Street Car Association, 5 m, 4-8½ g, 50 lb r, 12 c, 75 mu. Brill cars. Pres. J. Albertas, Sec. G. B. Paterson, Treas. Key West St. Car Co., Supt. A. Orchuela. Capital, $150,000. 6 3

KEYPORT, N. J.—Keyport & Matawan St. Ry Co. 3½ m, 4-8½ g, 38 lb girder s-b r, 6 4-wheel box c 24 h. Pres. R. R. Brown, Sec. & Treas. A. M. Brown, Supt. W. C. Smith. Capital, $30,000. 9 3

KINGSTON, N. Y.—(See Rondout.)

KINGSTON, ONT., CAN.—Kingston St. Ry Co. 8 m, 3 g, 44 lb r, 15 c, 45 h. Pres. & Gen. Man B. W. Folger, V. Pres. M. H. Folger, Sec. F. R. Sargent, Treas. B. W. Folger, Jr., Supt A. Beacance Capital $60,000. Bonds $60,000. 6 2

KNOXVILLE, TENN.—Knoxville Electric Ry. Co. 17 m, of which 13 are electric, 4 8½ g, 45 lb girder & T & 25 lb tram r, 26 c, 12 m. c. T-H system Receiver, J. C. Duncan, Supt. W. B. Palmer. 7 3

Fountain Head Ry. Co. 6 m, 4-8½ g, 45 lb T r, 11 c of which 7 are passenger and 4 freight, 3 dummies Pres. G. Borgfeldt, V. Pres. G. F. Pfeiffer, Treas. J Kahle, Gen. Man. M. O. French, Supt. R. T. Baker Capital $200,000. Office, 91 W. Depot st. 2 3

West End St. Ry. Co. 3½ m, 4-8½ g, 24 lb c. b. r, 4 c, 25 mu. Stephenson cars. Pres. R. M. Rhea, Sec., Treas. & Gen. Man. T. J. Thomas. Capital $25,000. 1 3

KOKOMO, IND.—Kokomo City St. Ry. Co. Elec 4½ m, 4-8½ g, 35 lb T r, 10 c, of which 7 are m c, and 3 t c. Detroit system. Pres. F. E. Snow, V. Pres W. A. Jackson, Sec. F. Woodruff, Treas. F. Marvin Supt. F. H. Allen. Capital $100,000. 1 3

L

LACONIA, N. H.—Laconia & Lake Village Horse R. R. 3.62 m, 3 g, 35 lb T r, 11 c, 25 h. Pres. J. C. Moore, V. Pres. & Gen. Man. Henry Tucker, Treas. Edmund Little, Supt. B. S. Kenniston. Capital $50,000. 5 3

LA CROSSE, WIS.—La Crosse City Ry. Co. 10¾ m, of which ½ is horse and 10¼ elec., 4-8½ g, 40-66 lb girder & T r, 30 c, of which 5 are h c, 11 m c and 14 t c, 20 h. Gen. Elec. system. St. Louis cars. Allis engines. Pres. B. E. Edwards, V. Pres. W. W. Cargill, Sec. H. E. West, Treas. Geo. H. Clark, Supt. (North Division) Peter Valier, Supt. (Southern Division), Geo. F. Smith, Ch. Engr. C. S. Smith. Capital $200,000. Office, 3d and La Crosse Sts. 9 3

LA SALLE, ILL.—City Electric Ry. Co. 9¼ m, elec, 4-8½ g, 51½ lb s b & girder r, 9 c, of which 6 are m c and 3 t c. Edison system. Pres. W. G. Reeve, Sec. F. X. Kilduff, Treas. L. B. Merrifield, Supt. E. S. Enyart. Capital $125,000. 3 2

LAKE CHARLES, LA.—Lake Charles St. Ry Co. 1¾ m, 3-8½ g, 30 lb T r, 4 c, 12 mu. Pres. P Crowley, V. Pres. J. Ryan, Sec. & Gen. Man. W Meyer, Treas. A. Meyer. Capital, $10,000; authorized $50,000. 1 3

LAFAYETTE, IND.—Lafayette St. Ry. Elec 10 m, 4-8½ g, 56 lb T & girder r, 8 c, of which 6 are m c and 2 t c, Edison system. Brill cars. Hamilton engines. Pres. & Treas. T. J. Levering, Sec. J. T. Henderson, Gen. Man. & Supt. J. S. Hill. Capital 150,000. 5 3

LAMPASAS SPRINGS, TEX.—Lampasas Springs St. R. R. Co 3 m, 4-8½ g, 35 lb. T r, 4 c, 16 mu. Pres. R. E. Maddox, Sec. & Treas. W. H. Little Gen. Man. E. P. Maddox. Capital $21,000; authorized, $50,000 Office, Elm st. 2 3

LANCASTER, O.—Lancaster Electric Ry. Co 4 m, bonded for elec. service, 4-8½ g, 52 lb girder r, 7 c, 16 h. Pres. & Gen. Man. A. Baumann, V. Pres. F. Barrett, Sec. H. Becker, Treas. H. B. Peters. 9 3

LANCASTER, PA.—Lancaster Traction Co. 30 m, 5-2½ g, 52, 60 lb girder & T r, 50 c, of which 40 are m c and 10 t c 7 h. Gen. Elec. system. Brill cars. Ball & Wood and Reynolds engines. Pres. J. C. Hegar, V. Pres. M. L. Herr, Sec. & Treas. H. E. Hoffer, Gen. Man. & Supt. W. A. Armstrong, Jr. Capital, $600,000. Bonds, $200,000. Office, 529 N. Prime St. 9 3

LANSING, MICH.—Lansing City Ry. Co. Elec 8 m, 4-8½ g, 35 & 45 lb s b & T r, 17 c, of which 12 are m. c. and 5 t. c. Westinghouse system. Pres. G. Macdonald, V. Pres. C. Osbund, Sec. J. P. Lee, Gen. Man. S. L. Keighley. Capital $50,000. Office, 1 106 Washington Ave., South Lansing. 9 3

LARCHMONT, N. Y.—Larchmont Horse R. R Co. 1½ m, 4-8½ g, 25 & 38 lb T & girder r, 3 box c, 12 h. Stephenson cars. Pres. C. H. Murray, V. Pres. E. E. Flint, Sec. & Treas. W. H. Campbell. Capital $25,000. 6 3

LAREDO, TEX.—International Bridge & Tramway Co. 5 m, 3-9 g, 20 lb r, 10 c & 1 freight forms 50 mu. & h. Pres. P. Ornelas.

Laredo Electric & Ry. Co. 4 m, 4 g, 25 lb T r, 6 m c. Edison system. Brill cars. Armington & Sims engines. Pres. B. M. Hammond, V. Pres., Treas. & Gen. Man. C. F. Drake, Sec. & Supt. C. F. Yaeger. Capital, $100,000. Office, Salinas & Farragut sts. 6 3

LAWRENCE, KAN.—Lawrence Transportation Co. 5½ m, 4-1 g, 38 lb Johnson girder r, 9 c, of which 6 are 4-wheel box and 3 4-wheel open, 54 h. Pres & Treas. H. Tisdale. V. Pres. J. W. Parker, Sec. H. B Lawton, Supt. W. McElheny. Capital $35,000. 9 3

LAWRENCE, MASS.—(Merrimac Valley St. R. R Owned by Lowell, Lawrence & Haverhill St. Ry. Co. See Lowell, Mass.)

LEAVENWORTH, KAN.—Leavenworth Electric Ry. Co. 15 m, of which 5 are horse and 10 elec, 4-8½ g, 22,57 lb. tram & T r, 28 c, of which 14 are h. c. 9 steam c. 3 m. c. and 2 t. c. 15 h 32 mu. Stephenson cars. Baldwin and Porter engines. Pres. H. F. Putnam, Sec. W. Dill. Treas. & Gen. Man. G. A. Baker. Capital, $300,000. 5 3

LEBANON, MO.—Lebanon Light & Water Co. Elec. ¾ m, 4-8½ g, 48 lb T r, 1 m. c. Westinghouse system. Pres. B. F. Hobart, V. Pres. E. B. Loveland Sec. & Treas. W. P. Heath, Gen. Man. & Supt. J. E. Fulkerson. Capital $250,000. Bonds, $100,000. 9 3

LEBANON, PA.—Lebanon & Annville St. Ry. Co Elec. 12 m, 5-3 g, 40-80 lb girder & T r, 12 m c, Edison system. Lebanon Mfg. Co., Lewis & Fowler and Stephenson cars. Pres. J. M. Shenk, V. Pres. S. P. Light, Sec. H. H. Light, Treas. F. H. Reinoehl, Supt. C. H. Smith. Capital $100,000. Bonds $100,000. 9 3

LEWISTON, ME.—Lewiston & Auburn Horse R. R. Co. 14 m, 4-8½ g, 42 & 45 lb tram & T r, 16 c, 80 h. Jones and Stephenson cars. Pres. & Gen. Man. Frank W. Dana, Sec. & Treas. H. C. Little. Supt. L. G. Pather. Capital $100,000. Bonds $85,000. 9 3

LEXINGTON, KY.—Passenger & Belt Ry. Co Elec. 13 m, 4-8½ g 50 lb T r; 31 c, of which 23 are m c and 8 t c. Edison and T-H systems. Pres. C. H. Stoll, V. Pres. W. J. Longbridge, Sec. F. V. Bartlett, Treas. R. P. Stoll, Supt. R. H. Smith. Capital $1,000,000. Office, Main and Cheapside sts. 5 3

LEXINGTON, MO.—Lexington & Kansas City Land & Investment Co. 2½ m, 4-4 g, 30 lb r, 2 c, 8 h. Pres. R. G. Estell, V. Pres. W. Z. Hickman, Sec. & Treas. Jas. Wentworth. 5 3

LIMA, O.—The Lima Electric Ry. Co. 7 m, 4-8½ g 66 lb Johnson steel r, 10 c, of which 7 are m c and 3 t c T-H system. New Castle cars. Pres. A. E. Townsend, V. Pres. & Treas. W. W. Hazzard, Sec. & Gen. Man. W. H. Thompson. Capital $200,000. 5 3

LINCOLN, NEB.—Lincoln St. Ry. Co. Elec. 50 m, 4-8½ g, 40, 56, 70 lb T & girder r, 80 c, of which 40 are m c and 40 t c. T-H generators, Westinghouse and Short motors. Pres. F. W. Little, Sec. W. H. Clark Treas & Gen. Man. C. C. Upham. Capital, $1,200,000; authorized, $2,000.000. Bonds, $600,000. Office 9 and K sts 9 3

Home St. Ry. Co. 11 m, of which 3 are horse and 8 elec, 4-8½ g, 35 lb T and 45 lb girder r, 9 c, of which 6 are m c and 3 t c. Westinghouse system. Pres J. H. McMurtry, V. Pres. & Gen. Man. E. Finney Sec. & Treas. K. K. Hayden. Capital $300,000. Office 133 North 12th t. 9 2

LITTLE ROCK, ARK.—Capital St. Ry. Co. (Leased and operated by City Electric Ry. Co.

The City Electric Ry. Co. (operates Capital St. Ry.) 18.2 m, of which 1 is horse and 17.2 elec. 4-8½ g, 35, 38 & 48 lb T & girder r, 72 c, of which 2 are h c 28 m c and 42 t c, 10 mu. T-H system. Pres. H. G. Allis, V. Pres. & Gen. Man. H. G. Fleming, Sec. & Treas. G. R. Brown, Supt. A. S. Grooms. Capital $500,000. Bonds, $600,000. 2 3

LOCKPORT, N. Y.—Lockport St. R. R. Co. 3½ m, 4-8½ g, 42 lb s b r, 8 4-wheel box c, 32 h. Pres & Treas. John Hodge, Attor D. M. Ashley, Supt. S A. Seabury. Capital $35,000. 3 1

Lock City Electric R. R. Co. 7 m, 4-8½ g, 77 lb s b r, 12 c, of which 6 are m. c. and 6 t. c. Brill and St. Louis cars. Pres. W. Goodwin, Sec. W. Spalding, Treas. F. Swift. Capital, $150,000. 9 3

LOGANSPORT, IND.—Logansport Ry. Co. Elec 5½ m, 4 g, 40 lb T r, 8 m. c. Edison and T-H systems. St. Louis cars. McIntosh & Seymour engines. Pres. S. Spencer, Sec. & Treas. F. D. Raymond, Gen. Man. J. T. McNary. Office 412 Broadway. 5 3

LONDON, ONT.—London St. Ry. Co. 10 m, 4-8½ g, 30 lb flat r, 30 c, 101 h. Pres. H. A. Everett, V. Pres. J. C. Grace, Sec., Treas. & Gen. Man. S. R. Break, Supt. Henry T. Smith. Capital $100.000. Office Richmond st. 1 3

LONG ISLAND CITY, N. Y.—Steinway Ry Co. of Long Island City. Elec. 32.23 m, of which 30 are horse and 2.23 elec. 4-8½ g, 47, 66, 70 lb Duplex r 99 c, of which 93 horse and 6 m c, 279 h. Pres. W. Steinway, V. Pres. W. C. Foster, Sec. L. Von Bernuth, Treas. H. D. Luer, Supt. A. D. Moulton. Capital, $2,500,000. Bonds, $600,000. Office, 111 E. 14th st New York. 9 2

Long Island City & Newtown Ry. Co. Elec. 6¾ m, 4-8½ g, 45-55 lb r, 27 c, 7 m c. Edison system. Pres Isaac Buchanan, N. Y. City, Sec. Geo. S. Crawford Brooklyn, N. Y., Treas. Patrick J. Gleason, Sec Thomas Burke, Supt. Michael Conway. Capital $150,000. Offices, 112 Front st. 3 1

Riker Ave. & Sandford's Point R. R. Co. 4 m, 4-8½ g, 47 lb c b r. Operated under lease by Steinway Ry Co. of Long Island City. Pres. J. Hempted, Supt. A. D. Moulton. Capital, $20,000. N. Y Office, Steinway Hall. 9 2

ROUND LEATHER "BELL CORD." Jas. Lyon's Superior Quality in Coils. Send for Samples and Prices. CHAS. L. McCLURE, Manufacturer's Agent, 415 Broadway, Room 522, New York.

LONGVIEW, TEX.—Longview & Junction St. Ry. 5¼ m, of which 1¼ are horse and 4 cable; 3-6 g 16 lb r, 2 c, 4 mu. Pres. W. S. Mayfield, Sec. & Treas W. D. Stallings, Gen. Man. T. H. Ruffman. Capital $4,500. 3 2

LOS ANGELES, CAL.—Pacific Ry. Co. of Chicago, Ill., 42 m, of which 21 are horse & 21 cable, 3-6 & 4-8½ g, 40 lb girder r, 134 c, of which 34 are h. c, 50 g. c. & 50 t. c, 125h, 82 mu. Receiver, D. K. Trask, Supt. J. J. Akin. Capital, $2,500,000. Bonds $2,500,000. Office, 701 Grand ave. 9 3

Los Angeles Consolidated Electric Railway Co. (Controls all roads in Pasadena except Pasadena & Mt. Wilson Ry.) 45 m, 3-6 g, 45 lb girder r, 75 c, of which 65 are m c and 10 t c. Westinghouse and Edison systems. Brill and Stockton C. H. & A. cars. Golden State & Miners' Iron Works engines. Pres. M. H. Sherman, V. Pres. & Gen. Man. E. P. Clark, Sec. F. V. McDonald, Supt. A. W. Barrett. Office, Central ave. & 7th st. 6 3

Main St. & Agricultural Park R. R. Co. 9.72 m, 3-6 g, 16 lb. T. r, 31 c, 105 h. Pres. W. J. Brodrick, V Pres. T. E. Rowan, Sec. A. C. Taylor, Treas. Farmers' & Merchants' Bank, Supt. Wm. Hawks, Capital $200,000. Office, 234 N. Main St. 9 3

Temple St. Cable Ry. Co. 4¾ m, 3-6 g, 38 lb Johnson girder r, 10 c. 10 dummies Pres. & Gen. Man. F. W. Wood, V. Pres., O. Morgan, Sec. W. N. Hamaker, Treas. Frank A. Gibson, Supt. J Fowler. Capital $400,000. Office, 129 Temple St. 9 3

LOUISVILLE, KY.—Louisville Ry. Co (includes all lines in the city). Elec. 140 m, of which 80 are horse & 60 elec, 5 g, 58½, 78, 100 lb c b & girder r, 462 c, of which 232 are h. c, 110 m c and 120 t c, 1700 mu. T-H and Short systems. Pres. J. B. Speed, V. Pres. St. John Boyle, Sec. & Treas. R. A. Watts, Gen. Man. T. J Minary, Supt. J. O. Haddox. Capital, $6,000,000. Bonds $6,000,000. Office, 500 Twelfth st. 9 3

Louisville Terminal Ry. Co. Elec. 3 m, 4-9 g, 56 lb T r. Patton motor system. Pullman cars. Pres. C. L. Danforth, Sec & Treas C. C. McCarty, Gen. Man. J. C. Fawcett, Supt. H. V. Harris. Capital $60,000. Office, Commerce Bldg. 6 3

LOWELL, MASS.—Lowell & Suburban Ry. Co Elec. 41 m, 4-8½ g, 35, 40, 45, 50, 60, 90 lb T, girder and tram r, 105 c, of which 53 are m c and 52 t c Bentley Knight, T-H & Westinghouse systems. Brill Jones, Newburyport and Stephenson cars. Pres. E. M. Tucke, V. Pres. A. Fels, Sec. & Gen. Man, P. F Sullivan, Treas. P. Parker, Supt. G. F. Wells. Capital, $400,000. Bonds $600,000. 9 3

Lowell, Lawrence & Haverhill St. Ry. Co. Pres. & Gen. Man. G. H. Campbell, Asst Treas. M. J. Ellard, Audr. G. E. Trippe. n 6 3

Lowell, Lawrence & Haverhill St. Ry. Co. (Haverhill division) Elec. 15 m, 4-8½ g, 30-35-40 lb T & flat r, 50 c, of which 40 are h. c. and 10 m. c. 125 h. T-H system. Brill, Jones, Lewis & Fowler and Newburyport cars. Providence engines. Supt. F. Woodman. 5 3

Lowell, Lawrence & Haverhill St. Ry. Co. (Lawrence division.) Elec. 17 m, 4-8½ g, 40, 45, 48 lb T, tram and girder r, 26 c, of which 25 are m c and 1 t c. T-H system. Jones and Stephenson cars. McIntosh & Seymour engines. Supt. N. E. Morton. 5 3

LYNCHBURG, VA.—Lynchburg St. Ry. Co. Elec. 5¼ m, 4-8½ g, 35-42 lb T & tram r, 8 c, of which 6 are box m. c. and 2 open m. c. Eickemeyer overhead system. Pres. Stephen Adams, Sec. P. O. Adams Gen. Man. & Supt. B. Flanagan. Capital $100,000. Office, 807 Main st. h 3 1

Lynchburg Electric Ry. Co. 5 m, 4-8½ g, 45 lb r, 4m. c. Edison system. Pres. P. J. Otey, Supt. J. A. Humphries. Capital $60,000. 6 2

Lynchburg & Rivermont Electric Ry. Co. 5 m, 4-8½ g, 45 lb T r, 4 m c. Edison system. Lewis & Fowler cars. Russell engines. Pres. J. P. Pettyjohn, V. Pres. W. I. Owen, Sec. & Treas. D. T. Mitchell, Supt. J. A. Humphries. Capital, $20,000. 9 3

LYNN, MASS—North Shore Traction Co. (See Boston, Mass.)

LYONS, IA.—Clinton & Lyons Horse Ry. Co. 10 m, 3-8 g, 30-45 lb T & girder r, 24 c, of which 10 are 4-wheel box and 14 are 4-wheel open, 44 h, 16 mu. Pres. & Gen. Man. D. Joyce, Sec. W. T. Joyce, Supt. Frank Crapser. Capital $25,000. f 3 1

M

MACON, GA.—Consolidated St. Ry. Co. Elec. 25¾ m, 4-8½ g, 20, 30, 40 lb T r, 37 c, of which 21 are m c and 16 t c. T-H system. 5 3

Macon & Indian Spring Electric Ry. Co. 6½ m, 4-8½ g, 40 lb T r, 12 c, of which 4 are m c and 8 t c. T-H system. Lamokin cars. Ball engines. Pres. & Gen. Man. T. J. Carling, Sec. J. H. Herley, Supt. Whyne. Capital, $75,000; authorized, $500,000.

McKEESPORT, PA.—McKeesport & Reynoldton Pass. Ry. Co. Elec. 9 m, 5-2½ g, 38 & 52 lb Johnson girder r, 16 c, of which 13 are m c and 3 t c. Russell engines. Pres. J. C. Smith, Sec. W. B. Peters, Treas. E. F. Woods, Supt. L. Richardson. Capital $150,000; authorized $300,000. Office, 5th ave. & Sinclair st. 2 3

McPHERSON, KAN.—McPherson St. Ry. Co. 4 m, 3-6 g, 20 lb T r, 3 2-h. c., 20 h. Pres. & Man. Wm West, Sec. F. P. Holt. Capital $100,000. 1 2

MADISON, IND.—Madison St. Ry. Co. 2½ m, 4 g, 15 lb tram r, 8 c, 4 h, 16 mu. Pres. & Treas. J. W. Thomas, Sec. J. A. Mercer, Supt. J. Wendel. Capital $13,000; authorized $15,000. Office 301 Front st. 5 3

MADISON, WIS.—Madison City Ry. Co. Elec. 8 m, 4-8½ g, 40, 50 lb T r, 13 c, of which 9 are m c and 4 t c. T-H system, St. Louis cars. Pres. G. C. Cook, Sec. & Treas. H. C. Welch, Gen. Man. & Supt. G. H. Shaw. Capital $100,000. Bonds $150,000. Office Main & Baldwin sts. 5 3

MALDEN, MASS.—East Middlesex St. Ry. Co. 16.13 m, 4-8½ g, 35 & 40 lb T & tram & Richards r, 58 c, of which 23 are box and 35 open, 204 h. Pres Amos F. Breed, Treas. D. H. Sweetser, Supt. J. Sewall. Capital, $300,000. Office, 35 Congress st., Boston. 12 2

MANCHESTER, N. H.—Manchester Street Ry Co. 12 m, 3 g, 35 lb tram r, 39 c, 189 h. Pres. C. Williams, Treas. C. H. Bartlett, Gen. Man. N. H. Walker. Capital, $25,000. Office Depot St. 9 3

Massabesic Horse R. R. Co, 6 m. Pres. C. Williams, Sec. J.W. Fellows, Treas. C. F. Morrill. Capital, $50,000. Office 859 Elm St. 6 3

MANISTEE, MICH.—Manistee, Filer City & East Lake Ry. Co. Elec. 11 m, 4-8½ g, 45 lb. T r, 16 c, of which 8 are m c. and 8 t c. Gen. Elec. system. St. Louis cars. Ide engines. Pres. & Treas. G. A. Hart, V. Pres. F. F. Davidson, Sec. W. F. Davidson, Supt. N. E. Degen. Capital, $150,000. Office, 418 River St. 6 3

MANKATO, MINN.—Mankato St. Ry. Co. 3½ m, 3-6 g, 27 lb steel r, 5 c, of which 3 are m. c, 16 h Brownell cars. Pres. S. Lamm, Sec. & Treas. John C. Noe, Gen. Man. W. M. Farr. Capital, $50,000. Office, 121 Hickory st., Mankato. 5 3

MANSFIELD, O.—Citizens' Elec. Ry., Lt. & Power Co. 7½ m, 4-8½ g, 45, 50, 60 lb girder & T r, 13 m. c. Westinghouse system. Akron, Brill and Laclede cars. Buckeye and Cooper engines. Pres. S. N. Ford, V. Pres. M. D. Harter, Sec. S. G. Cummings, Treas. & Gen. Man. R. Carpenter, Supt. S. Hennesfauth. Capital $80,000; authorized $125,000. Office, Power Station, N. Main st. 8 2

MARINETTE, WIS.—Marinette Gas, Elec. Lt. & St. Ry. Co. 5 m, 4-3½ g, 32, 35, 52 lb T & tram r 15 c, of which 6 are h c, 7 m c and 2 t c. T-H system. St. Louis cars. Hoffman-Billings Co. engines. Pres. & Gen. Man. H. C. Higgins, V. Pres. A. C. Merryman, Sec. G. W. Hanley, Treas J. F. Hancock Capital $100,000. Bonds $50,000. Office 1511 Main St. 2 3

MARION, IND.—Marion St. Ry. Co. Elec. 10½ m, 4-8½ g, 35. 38 lb T and girder r, 11 c, of which 6 are m c and 5 t c. T-H system. Pres. Eli Halderman, V. Pres. J. A. Halderman, Sec. & Treas. C. W. Halderman, Supt. W. C. Whinney. Capital, $80,000. 5 3

Queen City Electric Ry. Co. 5 m, 4-8½ g, 45, 52 lb T & girder r, 16 c, of which 14 are m c and 2 t c. T-H system. Jones and Pullman cars. Phœnix engines. Pres. R. B. Harrison. Sec. L. Wallace, Jr., Gen. Man. & Supt. A. A. Boyd. Capital, $180,000. Office cor. 13th st. & Buffalo ave. Eastern office 1 Broadway, New York. 9 3

MARLBORO, MASS.—Marlboro St. R. R. Co. Elec. 3.322 m, 4-8 g, 38, 48 lb T and girder r, 9 m c Edison system. Ellis and Newburyport cars. Pres. E. R. Alley, V. Pres. S. H. Howe, Sec. F. L. Claflin, Treas. T. T. Robinson, Gen. Man. & Supt. H. E. Bradford. Capital $50,000. Bonds $50,000. Office 59 Main st. 5 3

MARQUETTE, MICH.—Marquette City & Presque Isle Ry. Co. Elec. 5 m, 4-8½ g, 50 lb Johnson girder r, 5 c, of which 3 are m c & 2 t c. T-H system. Laclede cars. Hamilton-Corliss engines. Pres F. O. Clark, Sec. M. E. Asire, Treas. J. Connolly, Supt. C. Retallic. Capital, $200,000. 9 3

MARSHALLTOWN, IA.—Marshalltown Light Pow. & Ry. Co. 3¼ m, 4-8½ g, 40 lb T r, 5 c, of which 4 are m c and 1 t c. T-H system. Pullman cars. Ide and St. Louis engines. Pres. C. D. Jones. Sec. & Treas. M. W. Hovey. Gen. Supt. F. Andres. Capital $250,000. 6 3

MARTINSBURG, W. VA.—Martinsburg St. Ry. Co. 3½ m, 40 lb T r, 6 c of which 3 are m c and 3 t c. Edison system. Brill cars. McIntosh & Seymour engines. Pres. & Treas. J. B. Wilson, Sec. J. W. Walker. Capital, $50,000; authorized $100.000. 9 3

MARYSVILLE, CAL.—M'ville & Yuba City St R. R. Co. 4 m, 3-6 g, 16 lb T r, 5 c, 4 h, 14 mu. Pres. D E. Knight, V. Pres. S. H. Bradley, Sec. W. T. Ellis, Jr Supt. L. Graves. Capital $40,000. Office, cor. D & 1st sts. 9 3

MAYSVILLE, KY.—Maysville St. R.R. & Transfer Co. Elec. 4 m, 4-8½ g, 40 lb T r, 12 c, of which 5 are m c and 7 t c. Pres. A. M. J. Cochran, Sec Treas. & Gen, Man. R. A. Cochran, Jr., Supt. of lines cars, &c., J. Limbrick. Capital $30,900; authorized $100,000. Bonds $65,000. Office, Court st. 9 3

MECHANICSBURG, ILL.—Mechanicsburg & Buffalo Ry. Co. 7¼ m, 3-10 g, 16 & 20 lb T r, 3 4-wheel open c, 4 mu. Pres. J. B. Hunter, V. Pres. H. Thompson, Sec. J. T. Fullenwider, Treas. A. T. Thompson Capital, $12,000. b 7 1

MEMPHIS, TENN.—Citizens' St. R R. Co. (Owns City & Suburban Ry.) Elec. 45 m, 4-8½ g, 60 76 lb T & girder r, 140 c, of which 60 are m c, 50 h c and 30 t c. Edison system. Pres. C. H. Ruddock, V. Pres. L. E. Wright, Sec. & Treas. L. R. Godwin, Gen. Man. G. F. Jones. Office, 29 Hernando st. 9 3

City & Suburban Ry. Co. Owned by Citizens' St. R. R. Co.) Elec. 7½ m. 4-8½ g, 45 & 52 lb T & Johnson girder r, 10 c, of which 5 are m c and 5 t c. T-H system. Pres. Holmes Cummings, V. Pres. T. J. Latham, Sec. & Treas. J. L. Norton, Gen. Man. R. T. Sherrill. Capital stock, $150,000; auhorized, $165,000. Office, 56 E Court st. 10 2

East End Ry. Co. 5½ m steam, 4-8½ g, 35-50 lb steel T r, 8 c, 4 steam dummies. Ohio Falls cars. Baldwin engines. Pres. J. Overton, Jr, V. Pres. B. M. Stratton, Sec J. E. Wade, Treas. W. D. Bethell, Gen. Man. J. C. Sneed. Capital $150,000. Bonds $150,000. Office, 310 2nd st. 9 3

Raleigh Springs Ry. Co. 11 m, 4-8½ g, 60 lb girder & T r, 15 c, of which 9 are m c and 6 t c. T-H system. Brill cars. Allis and Hampson engines. Pres. B. L. Duke, V. Pres. & Gen Man. W. R. Hall, Sec. S. L. Finley, Treas. C. B. Buchanan. Capital $264,100; authorized $265,000. Office, 10 W. Court st. 10 3

MENOMINEE, MICH.—Menominee Elec. Ry. & Pow. Co. 6.9 m, 4-8½ g, 40 lb T r, 12 c, of which 8 are m c & 4 t c. Edison system. Pres. A. Spies, V Pres. P. A. Van Bergen, Sec., Treas. & Gen. Man E. Daniell. Capital, $110,000. Bonds, $500. 9 3

MERIDEN, CONN.—Meriden Horse R. R. Co 7 m, 4-8½ g, 35 & 40 lb T r, 21 c, 90 h. Pres. Geo. R Curtis, Sec. & Treas. Chas. L. Rockwell, Capital, $80,000. Bonds, $70,000. 5 2

MERIDIAN, MISS.—Meridian St. Ry. Co. 6 m of which 1½ are steam and 4½ horse, 4-8½ g, 25 & 36 lb T & flat r, 10 c, 50 mu. Pres. Geo. S. Covert, Sec J. M. Kelley, Supt. & Gen. Man. J. L. Handley. Capital, $30,000. 3 1

Meridian Dummy Line Ry. Co. 2 m, 4-8½ g, 40 lb T r. 6 c. Pres. J. H. Wright, V. Pres. C. C. Coffee, Sec. & Treas. G. Q. Hall, Engr. N. M. Brandon. Capital $20,000. 5 3

MERRILL, WIS.—Merrill Ry. & Lighting Co Elec. 1½ m, 4-8½ g, 38 lb Johnson girder r, 3 m c. Pres. F. P. Hixon, V. Pres. R. Werdner, Sec., Treas. & Gen. Man. E. S. King, Capital, $20,000. Bonds, $40,000. Office, 990 Main St. 5 3

MICHIGAN CITY, IND.—Lake Cities Electric Ry. Co. 4 m, 4-8½ g, 22 lb flat & T r, 5 c, 15 h. Laclede cars. Pres. R. B. Harrison, Sec. L Wallace, Jr., Man. F. H. Root. Capital, $200,000. Eastern office, 1 Broadway, New York. 5 3

MIDDLETOWN, CONN.—Middletown Horse R. R. Co. 3½ m, 4-8½ g, 36 & 38 lb Johnson & T r, 7 c, 40 h. Pres. John M. Douglas, V. Pres. A. C. Allison, Sec. & Treas. J. K. Guy, Gen. Man. & Supt. E. W. Decker. Capital, $23,000; authorized, $50,000. Office 265 Main st. 9 3

MIDDLETOWN, O.—Middletown & Madison St. R.R. Co. 2 m, 4-8½ g, 45 lb girder r, 6 c, 6 h. Pres. C. F. Gunckel, Sec. & Treas. E. W. Gunckel, Supt. D. L. Sutphin. Capital $40,000. 5 3

MILFORD, MASS.—Milford & Hopedale St. Ry. Co. Elec. 6 m, 4-8½ g, 30 & 60 lb tram r, 6 4-wheel box c. . Hopedale storage battery system. Pres. & Gen. Man. E. P. Usher, Treas. A. G. Morse. Capital $60,000. Bonds, $60,000. Office, 23 Court st, room 618 9 2

MILLEDGEVILLE, GA.—Milledgeville & Asylum Dummy Line R. R. 4 m, 4-8½ g, 30 lb r, 2 c motors. Pres. W.W. Lumpkin. Capital, $25,000. 1 8 0

MILLERSVILLE, PA.—Lancaster & Millersville St. R.R. Co. (See Lancaster, Pa.)

MILWAUKEE, WIS.—Milwaukee Electric Ry. Co 13 m, 4-8½ g, 45 lb girder r. 23 c, of which 13 are m c and 10 t c. T-H and Edison systems. St. Charles cars. Allis engines. Receiver, G. J. Melms. Capital $500,000. Office 375 Milwaukee St. 5 3

Milwaukee St. Ry. Co. (Includes Milwaukee & Whitefish Bay.) Elec. 84 m, 4-8½ g, 70 lb girder r, 155 m c. T-H and Edison systems. Pres. W. N. Cromwell, V. Pres. & Gen. Man. H. C. Payne, Sec. & Treas. C. A. Spofford, Asst. Sec. G. O. Wheatcrott, Gen. Supt. G. W. Hommell, Asst. Supt. G. M. Kimmerlein, Supt. of repairs, A. W. Lynn, Auditor, W. L. Mason, Station Engr. R. S. Stikeman. 5 3

Milwaukee & Wauwatosa Electric Co. 12 m, 4-8½ g, 65 lb girder r, 4 m c. Edison system. Pres. C. Stickney, Sec. & Treas. G. Pabst, Gen. Man. E. D. Hoyt. Capital $75,000. Office 917 Chestnut st. 11 2

Milwaukee & Wauwatosa Motor Ry. Co. Steam. 12 m, 4-8½ g, 56 lb girder r, 9 c, of which 3 are steam and 6 t c. Pres. J. Petley, V. Pres. J. W. Bingham, Sec. & Treas. A. B. Meyers, Supt. H. Mortimer. Capital, $300,000. Office, 371 Broadway. 9 3

West Side St. Ry. Co. Elec. 21 m, of which 2 are horse and 19 elec. 4-8½ g, 63 lb girder r, 61 c, of which 2 are h c, 34 m c and 25 t c. 33 h. Edison system. Jones cars. Allis engines. Pres. Washington Becker, Sec. Thos. J. Durnin, Supt. A. McNaughton. Office 200 Grand ave. 5 3

MINNEAPOLIS, MINN.—Twin City Rapid Transit Co. Elec. (Includes Minneapolis St. Ry. and St. Paul City Ry.) Minneapolis Division. 127 m, 4-8½ g, 47, 60, 78 lb T & girder r, 500 c, of which 300 are m c, and 200 t. c. Edison and T-H systems. Pres. Thos. Lowry, V. Pres. C. G. Goodrich, Treas. M. B. Koon, Gen. Man. W. J. Held, Supt. B. W. Martindale, Mast. Mech. W. Cooper. Capital, $5,000,000. Office, 200 3d ave. N. 5 3

St. Paul Division 120 m, of which 10 are cable and 110 elec, 4-8½ g, 40-76 lb Johnson girder & T r, 265 c, of which 38 are g c, 110 m. c and 117 t c. Edison and T-H systems. Allis engines. Capital $5,000,000. Office Globe Bldg, 4th St. 5 3

MOBILE, ALA.—Mobile St. Ry. Co. Elec. 31 m, 35-68 lb T & girder r, 73 c, of which 65 are 4-wheel box and 8 8-wheel box, 2 h, 270 mu. Pres. J. Stillman, V. Pres. F. J. Gasquet, Sec. W. S. Bogert, Treas. & Gen. Man. R. Semmes, Elecn. & Engr. J. F. McAviney. Capital, $500,000. Office, Anthony and Royal Sts. 1 3

Mobile Light & Ry. Co. 7½ m, 4-8½ g, 45 lb T r, 20 c, of which 9 are m c and 11 t c. T-H and Westinghouse systems. Brill and Stephenson cars. Pres. J. Wilson, V. Pres. & Gen. Man. J. H. Wilson, Sec. A. J. Peaper. Capital, $500,000. 9 3

MOHAWK, N. Y.—Mohawk & Ilion Horse R.R. Co. 1¾ m, 4-8½g, 30 lb flat & T r, 5 c, (Cars towed by contract.) no h. Pres. J. B. Rafter, V. Pres. C.W. Carpenter, Sec.H. D. Alexander, Treas. R. M. Devendorf. Capital, $15,000. 5 3

Herkimer & Mohawk St. Ry. Co. 1½ m, 4-8½ g, 30-40 lb T r, 4 c, of which 3 are 4-wheel box and 1 is 4-wheel open, 8 h. Pres., Treas. & Man. H. D. Alexander, V. Pres. H. Delmel, Sec. E. L. Prince. Capital $17,000; authorized $20,000 Office Mohawk, N. Y. 5 3

MOLINE, ILL.—Moline Central St. Ry. Co. Elec. 4 m, 4-8½ g, 35, 50 & 57 lb T & Wharton girder r, 8 c, of which 4 are m. c. and 4 t. c. Edison and Westinghouse systems. Pres. & Gen. Man. S. H. Velie, V. Pres. L. S. McCabe, Sec. E. H. Guyer, Treas. C. F. Hemenway, Supt. G. H. Moon. Capital $33,000; authorized $100,000. Bonds $17,500; authorized $48,000. Secretary's office, Rock Island, Ill. 8 3

MONTEREY, CAL.—Monterey & Pacific Grove St. Ry. & Elec. Pow. Co. 5 m. 3 6 g, 20 lb T r, 8 c, 45 h. Fitzgerald cars. Pres. O. S. Trimmer, V. Pres. H. A. Greene, Sec. & Gen. Man. J. Malarin, Treas. J. S. Metteer, Supt. A. J. Haynes. 9 3

MONTGOMERY, ALA.—Montgomery Terminal & St Ry. Co. 10¾ m, 4 g, 30, 42 & 56 lb c b & T r, 22 c, 139 mu, 1 dummy engine. Pres. J. W. Dimmick V. Pres. John D. Roquemore, Sec. J. C. Virden, Treas G. W. Craik, Gen. Man. E. L. Coolahan. Office, Madison ave. & Bainbridge st. 1 2

Montgomery & Cloverdale Electric Ry. Co. 7 m 4-8½ g, 45 lb T & 51 lb girder r, 7 m c. T-H system Pres. A. W. Le Bron, V. Pres. & Gen. Man. F. B Pickering, Sec. H. E. Heller, Treas. R. P. Dexter Capital, $350,000. Bonds, $350,000. 11 2

West End & Riverside Park Electric St. Ry. Co. 4 m, 4-8½ g, 56 lb girder & T r. Westinghouse system. Brill cars. Westinghouse engine. 8 3

MONTREAL, CAN.—Montreal St. Ry. Co. Elec 59.35 m, of which 47.35 are horse & 12 elec. 4-8½ g, 44 lb r, 200 c, 100 sleighs, 75 'buses, 1200 h. Royal, Edison and Westinghouse systems. Pres. L. J. Forget, Sec. & Treas. E. Lusher, Supt. J. J. Franklin, Engr. & Acting Man., G. C. Cunningham. Capital authorized $2,000,000. Bonds, $300,000; authorized, $1,000,000. 11 2

Montreal Park & Island Ry. Co. Elec. 8 m, 4-8½ g, 56 lb T r. Pres. L. Beaubien, V. Pres. J. R. Thibaudeau, Sec. M. Perault, Gen. Man. W. S. Williams. Capital authorized, $500,000. Office, 17 Place d' Armes Hill. 7 3

Royal Electric Co. 1 m c. Short system. 5 2

MT. CLEMENS, MICH.—Mt. Clemens St. Ry Co., Ltd. 3¼ m, 4-8½ g, 35 lb tram r, 5 c, 12 h. Jones and Stephenson cars. Pres. M. L. Williams, Sec. G. A. Skinner, Treas. & Gen. Man. M. Slush. Capital, $25,000. General office, Berea, O. 9 3

MT. VERNON, N. Y.—Mount Vernon & East Chester Ry. Co. 4 m, 4-8½ g, 48 lb c. b. r, 14 c, 33 h Pres. C. Strauss, Sec. W. H. Martens Treas. D. O'Brien, Supt. J. H. Small. Capital, $60,000. Bonds $75,000 1 3

MUNCIE, IND.—Muncie St. Ry. Co. (Owned by Citizens' St. Ry. Co.) 8 m steam 4-8½ g, 35 lb T r, 14 c, 4 steam motors. Baldwin and Porter motors. 5 3

Citizens' St. Ry. Co. Elec. 6 m, 4-8½ g, 48-60 lb T r, 16 c, of which 12 are m. c. and 4 t. c. Gen. Elec. system. St. Louis cars. Ide engines. Pres. J. S. Talley, V. Pres. J. W. Landrum, Sec. G. F. McCulloch, Treas. C. F. Miller, Gen. Man. & Supt. W. C. Gotshall. Capital, $250,000. 6 3

MUSCATINE, IA.—Muscatine Electric Ry. Co. 7¼ m, 4-8½ g, 48 lb T r, 7 c of which 5 are m c and 2 t c. Gen. Elec. system. American Car Co. Ideal engines. Pres. G. W. Seevers, Sec. & Treas. H. W. Seevers, Gen. Man. T. S. Seevers. Capital, $300,000. 9 3

MUSKEGON, MICH.—Muskegon Ry. Co. Elec 15 m, 4-8½ g, 30, 38 lb T & girder r, 33 c. of which 18 are m c and 15 t. c. Short system. Pres. F. A. Nims, V. Pres. J.W. Moon, Sec. R. A. Fleming, Treas. Wm. B. McLaughlin, Supt. F.W. Thompson. Capital $100,000. Office, Michigan and Franklin Sts. 2 3

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NANTUCKET BEACH, MASS.—Nantucket Beach St. Ry. Co. 2½ m, 5-8½ g, 35 lb T r, 2 c, 11 h. Pres. H. H. Pratt, Sec. and Treas. J. F. Simmons, Gen. Man. & Supt. T. G. Macy. Capital $50,000. Office, 55 Equitable Bldg, Boston. 9 2

NASHUA, N. H.—Nashua St. Ry. Co. 10 m, 3 g, 35, 38 lb T, tram & girder r, 27 c, 100 h. Pres. G. H. Knowles, V. Pres. J. A. Fisher, Sec. & Treas. J. D. Chandler, Supt. H. F. Webster. Office 85 Kinsley st. 5 3

NASHVILLE, TENN.—United Electric Railway 52 m, 5 g, 35, 45 lb T & girder r, 69 m c. Edison, T-H & Westinghouse systems. Pres. T.W. Wrenne, V. Pres I. T. Rhea, Sec. & Treas. G. W. Cunningham, Gen Man. E. G. Connette. Capital, $1,000,000. 5 3

Citizens' Rapid Transit Co. Elec. 5 m, 4-11¾ g, 40, 45 lb T & girder r, 5 m c. Edison system. Stephenson cars. Pres. W. H. Mitchell, Sec., Treas. & Gen. Man. Wm. S. Jones. Capital stock $18,000. Bonds $75,000. 1 3

Nashville, Elec. Lt. & Power Co. 7 m c. Detroit system. 5 2

Nashville & West Nashville St. Ry. Co. Dummy Line, 7 m, 4-8½ g, 46 lb T & Johnson r, 8 c, 4 engines Pres. L. H. Davis, V. Pres. M. S. Cockrill, Sec. J Woods, Jr. Capital. $81,000. 11 2

Overland Ry. Co. 9¼ m of which 3 are steam and 6¼ elec. 4-11¾ g, 35-45 lb T & girder r, 12 c, of which 7 are m c and 5 t c 5 dummies. T-H system. St. Louis cars. Pres. & Gen. Man. F. W. Hunter, V. Pres J. Compton, Sec. & Treas. T. Taylor, Supt. J. K. Spicer. Capital, $125,000. Bonds, $210,000. 9 3

Richland Ry. Co. Steam. 7 m, 4-8½ g, 46 lb. girder & T r, 8 c. Brill cars. Baldwin engines. Pres. L. H. Davis, V. Pres. W. S. Settle, Sec. & Treas. J. Woods, Jr. Capital, $89,300; authorized, $100,000. Office, 217 Union St. 9 3

NATCHEZ, MISS.—Natchez St. Ry. Co. 5 m 4-8½ g, 25-52 lb girder, flat & T r, 7 c, 20 mu. Pres & Supt. Maurice Moses, Sec. & Treas. A. Moses. Capital, $25,000; authorized, $100,000. Office Natchez Savings Bank. Main & Pearl sts. 9 3

Bluff City Ry. Co. 2 m, of which 800 ft. is Incline plane, 6-2 g, incline 3-6 g, remainder 24 c, 1 h, 4 mu Pres. S. E. Rumble, V. Pres. R. C. Learned, Sec. T. V Wensel, Gen. Man. & Supt. F. L. Rumble. Capital $100,000. Office, Main and Broadway. 6 3

NATICK, MASS.—Natick & Cochituate St. Ry. Elec. 3 m, 4-8½ g, 35 lb T & flat r, 7 c, of which 5 are m c and 2 t c, 1 h. Westinghouse system. Pres. H. Harwood, Clerk F. H. Hayes, Treas. W. H. Bent, Supt. Geo. F. Keep. Capital, $31,500. 6 3

Natick Electric St. Ry. Co. 6 m, 4-8½ g, 45 lb T r 9 m c. T-H & Short systems. Pres. A. C. Pond, Sec. & Treas. T. T. Robinson, Supt. H. W. True Capital $60,000. 11 2

NEBRASKA CITY, NEB.—Nebraska City St Ry. Co. 3½ m, 4-8½ g, 20, 40 & 45 lb Johnson & T r 4 c, 10 h, 16 mu. Pres. & Gen. Man. H. H. Bartling, V. Pres. W. A. Cotton, Sec. J. C. Watson, Treas. W. L. Wilson. Capital, $17,500; authorized $50,000. 11 2

NEENAH, WIS.—Menasha & Neenah St. Ry. Co. 4 m, 4 8½ g, 35 lb tram r, 2 c, 10 h. Pres. & Treas. F. Schumacher, Sec. C. Griggs, Gen. Man. T. Schumacher. Capital, $125,000; authorized $300,000. Bonds, $25,000. 9 3

NEGAUNEE, MICH.—Negaunee & Ishpeming St. Ry. Co. 4 m. c. T-H system. 12 2

NEW ALBANY, IND.—New Albany Ry. Co. 7 m, 4-10½ g, 25 lb T r, 30 c, of which 23 are box & 7 open, 82 mu. Pres. H. B. Young, Sec. & Treas. W. C. Crane, Supt. Geo. Hines. Capital, $30,000. Bonds $150,000. a 3 1

Highland R.R. Co. 2 m, 3 m c. Edison system. 7 2

NEW BEDFORD, MASS.—Union St. Ry. Co Elec. 18 m, of which 13 are horse and 5 elec. 4-8½ g, 38-80 lb girder & T r, 84 c, of which 64 are h c, and 20 m c, 229 h. T-H system. Pres. & Gen. Man. A. P. Smith, V. Pres. J. Irvine, Sec. & Treas. W. H. Allen. Capital $260,000. Bonds, $100,000. Office, Five Cent Savings Bank Bldg. Purchase St. 9 3

Dartmouth & Westport St. Ry. Co. Pres. F. W. Brightman, V. Pres. A. P. Smith, Treas. J. A. Beauvais. n 4 3

NEW BRITAIN, CONN.—Central Ry. & Electric Co. 12 m, 4-8½ g, 56 lb T r, 18 c, of which 16 are m c and 2 t c. Gen. Elec. system. Brill cars. Allis & Harrisburg engines. Pres. A. M. Young, Sec. C. S. Landers, Treas. F. G. Platt Gen. Man. Supt. E. S. Breed, Capital, $1,000,000. 9 3

NEW BRUNSWICK, N. J.—New Brunswick City Ry. Co. 4¼ m, 4-8½ g, 43 lb c. b. & girder r, 13 c, 45 h. Pres. H. Congar, V. Pres. A. Le Massena, Jr., Sec & Treas. W. B. Price, Supt. W. F. Price. Capital $100,000. Bonds, $25,000. Office, Sanford st. 6 3

NEW CASTLE, PA.—New Castle Electric St. Ry. Co. 2½ m. 4-8½ g, 45½-66 lb girder r, 4 m c. T-H & Westinghouse systems. New Castle cars. Pres. T. W. Phillips, V. Pres. & Gen. Man. W. M. Brown, Sec. & Treas. S. S. Hamilton, Supt. L. D. McClusky. Capital stock, $40,000. 9 3

NEW DECATUR, ALA.—Decatur St. Ry. Co. 5 m, 4-8½g. 20 lb. T r, 5 4-wheel box c, 32 mu. Pres W. W. Hedges, V. Pres A. C. Hartshorne, Sec., Treas & Gen. Man. W. A. Bibb. Capital, $100,000. 8 3

NEW HAVEN, CONN.—Fair Haven & Westville R. R. Co. 12 m, 4-8½ g, 50 lb T & c b r, 63 c, 355 h Pres. H. B. Ives, Sec. & Treas. L. Candee, Supt Walter A. Graham. Capital, $400,000. Office 730 Chapel st. 9 3

New Haven & Centreville Horse R.R. Co. 2¾ m 4-8½ g, 46 lb c b r, 16 c, 62 h. Pres. & Gen. Man. C Pierpont, Supt. T. R. Hull. Capital $31,000; authorized $40,000. Office, 1 Broadway. 9 3

New Haven & Morris Cove Ry. Co. Elec. 4½ m, 4-8½ g, 50 lb T r, 6 m c. Short system. Pres. J. M. Townsend, Sec & Treas. J. M. Townsend, Jr. Gen Man. J. J. Lawton. Office, 16 Exchange Bldg. 11 2

State Street Horse R.R. Co. (Includes Whitney Avenue.) 6¾ m, 4-8½ g, 42-50 lb T & c b r, 18 c, 86 h Pres. D. Correy, V-Pres. C. A. Warren, Sec. & Treas. G. A. W. Dodge. Capital $70,000; authorized $100,000. Office, 16 Exchange Bldg. 5 3

Winchester Ave. R. R. Co. (Owns and operates New Haven & West Haven R. R.) Elec. 14 m, of which 2 are horse and 12 elec., 4-8½ g, 50, 56, 60 lb T r, 60 c, of which 3 are horse, 48 m c and 9 t c. 30 h. Short & Westinghouse systems. Jones, Lewis & Fowler, Newburyport and Stephenson cars. Westinghouse engines. Pres. A. C. Pond, Sec., Treas. & Gen. Man. I. A. Kelsey, Supt. A. E. Pond. Capital, $40,000; authorized, $60,000. In addition to $100,000 of New Haven & West Haven road. Bonds, $500,000. 5 3

NEW LONDON, CONN.—New London St. Ry. Co. Elec. 8 m, 4-8½ g, 48 lb T r, 12 m c. T-H system. Newburyport cars. Pres. E. P. Shaw, Sec. W. Learned, Treas. W. A. Tucker, Gen. Man. E. P. Shaw, Jr., Supt. L. Bentley. Capital, $50,000. 9 3

NEW ORLEANS, LA.—Canal & Claiborne R. R. Co. 13½ m, 5-2½ g, 37 45 & 50 lb tram & girder r, 40 box c, 20 mu. Pres. E. J. Hart, Sec., Gen. Man. & Supt. Jos. H. DeGrange. Capital, $240,000. Bonds $150,000, Office 6 Camp st. 5 3

Algiers & Gretna Ry. Co. 3.75 m, 3 g, 30 lb T r, 4 c, 24 h. Stephenson cars, Pres., Gen. Man. & Supt. W. Halliday, Sec. & Treas. W. Royal. Capital $25,000. Bonds $25,000. Office Canal St. Ferry. 6 3

Crescent City R. R. Co. (Operated by New Orleans Traction Co.) Elec. 26 m. 5-2½ g, 35-47 lb c. b. & T r, 25 m c. T-H system. Pres. H. M. Littell, Sec. & Treas. A. H. Ford, Supt. B. B. Gilman. Capital, $1,150,000; authorized, $2,000,000. Bonds, $140,000. 5 3

New Orleans & Carrollton R. R. Co. Elec. 19 m, 4-8½g, 50, 60, 70 lb T & girder r, 70 m c. T-H system. St. Louis cars. Lane & Bodley Corliss engines. Pres. J. N. Avegno, Sec. & Treas. Walter V. Crouch, Gen. Man. & Supt. Chris. V. Haile. Capital $1,200,000. Bonds $600,000. Office Jeannette and Dublin Sts. 6 3

New Orleans City & Lake R.R. Co. 66 m, 5-2½ g, 42, 46 lb flat & T r, 218 c, of which 182 are h c and 36 steam coaches, 7 locomotives, 867 mu. Pres. H. M. Littell, Sec. & Treas. A. H. Ford, Supt. B. B. Gilman. Capital, $1,500,000. Office 102 Canal st. 5 3

New Orleans Traction Co. (operates Crescent City and New Orleans City & Lake Rys.) Pres. W. J. Henning, Sec. & Treas. H. Seligman, Gen. Man. H. M. Littell. 3 3

Orleans R. R. Co. 9½ m, 5 g, 35-40 lb T r, 32 c, 125 h, 30 mu Pres. & Supt. B. Beoubay. Sec. & Treas P. Cougot. Capital $185,000. Authorized $500,000 Bonds $21,000. Office, cor. White & Laharpe sts 10 1

St. Charles St. R. R. Co. Operates 3 lines. 11¾ m 5-2½ g, 40 lb s b r, 66 4-wheel box c, 34 h, 238 mu. Stephenson cars. Pres. & Supt. Alden McLellan, Sec. N. Riviere. Capital, $594,350; authorized $600,000. Bonds $120,000. Office, cor. Carondelet & 8th sts. 6 3

NEW ROCHELLE, N. Y.—New Rochelle Ry. & Transit Co. 8 m, 4-8½ g, 38 lb Johnson r, 14 c, of which 10 are 4-wheel box & 4 4-wheel open, 40 h Pres. Thos. E. Crimmins, Sec. & Treas. C. Strauss Supt. Frank Ryan. 3 2

NEW WESTMINSTER, B. C.—New Westminster & Vancouver Vramway Co. 18 m, 4-8½ g, 40 lb T r, 11 m c. Edison system. Pres. D. Oppenheimer, V. Pres. B. Douglas, Treas. L. N. Smith, Traffic Man G. F. Gibson. Cpital, $1,000,000. Office, Colbmbia st. 1 2

NEW WHATCOM, WASH.—Bellingham Bay Electric Ry. Co. 4 m, 4-8½ g, 50 lb T r, 6 c, of which 4 are m. c. and 2 t. c. Pres. H. Eldridge, V. Pres. & Supt. E. Cosgrove, Sec. E. B. Leaming, Treas. V. A. Roeder, Gen. Man. M. McCorby. Capital, $200,000. 12 2

Lake Whatcom Electric Ry. Co. 8 m. c. T-H system. 12 2

NEW YORK, N.Y.—Broadway & Seventh Ave. R.R. Co. (Leased to Metropolitan St. Ry. Co.) 23 m, of which 10 are cable, 4-8½ g, 47-60 lb r, 227 c, Laclede and Stephenson cars. Penna. Iron Works engines. Pres. H. H. Vreeland, V. Pres. D. B. Hasbrouck, Sec. C. E. Warren, Treas. H. S. Beattie, Supt. Henry A. Newell, Engr. G. W. McNulty. Capital. $2,000,000. Bonds, $2,200,000. Gen. Office, 761 7th Ave. Engineer's Office, 113 W. 38th st, 7 3

Central Crosstown R. R. Co. (Includes Christopher & Tenth St.) 11.7 m, 4-8½ g, 52 lb r, 157 box c, 846 h Pres. Geo. S. Hart, V. Pres. A. Cammack, Sec. Milton I. Masson, Treas. E. Burton Hart. Office, 170 Christopher st. Capital, $600,000. Bonds, $250,000. 7 2

Central Park North & East River R.R. Co. (Leased to Metropolitan Crosstown Ry. Co.). 26 m, 4-8½ g, 60 lb r, 196 c, of which 136 are box and 60 open, 1,157 h. Pres. G. H. Scribner, V. Pres. D. B. Hasbrouck, Sec. & Treas. J. R. Cuming, Supt. J. Sittler. Office, 789 Tenth Ave. Capital, $1,800,000. Bonds, $1,200,000. 7 3

Christopher & Tenth St. R. R. Co. (Leased to and operated by Central Crosstown R. R. Co.) Pres. J. Downey, V. Pres. I. Hendrix, Sec. & Treas. Geo. W. Linch. 6 3

Dry Dock, East Broadway & Battery R.R. Co. 18½ m, 4-8½ g, 181 c, 60, 90 lb c b & girder r. Pres. William White, Sec. & Treas. J. Byrns, Auditor E. T. Landon, Supt. Fred F. White. Capital, $1,200,000. Bonds, $840,000 Office, 605 Grand st. 9 3

Eighth Ave. R.R. Co. 20 m, 4-8½ g, 60 lb r, 165 c of which 125 are box and 40 open, 1155 h. Pres. Geo. Law, V. Pres. Jacob Hays, Sec. & Treas. James G Affleck, Supt. E. R. Sherman. Capital $1,000,000. Bonds $1,000,000. Office, Eighth Ave. & 50th st. 6 2

Forty-second Street & Grand Street Ferry R.R. Co. (Leased to Metropolitan Crosstown Ry. Co.) 10.25 m, 4-8½ g, 60 to 64 lb r, 72 c, of which 52 are box and 20 open, 480 h. Pres. H. H. Vreeland, V. Pres. D. B. Hasbrouck, Sec. C. E. Warren, Treas. H. S. Beattie. Capital, $748,000; authorized, $750,000. Bonds, $236,000. Office, 653 W. 42d st. 7 3

Forty-second St., Manhattanville & St. Nicholas Avenue Ry. Co. 19.82 m, 4-8½ g, 47-60 lb r, 91 c, 838 h. Pres. John S. Foster, Sec. C. F. Naething, Treas Jacob Fleischhauer, Supt. S. M. Sisson. Capital $2,500,000. Bonds, $2,725,000. Office, 118 E. 42 st. 7 2

Metropolitan St. Ry. Co. (includes Chambers St. & Grand St. Ferry R. R. Co., Broadway R. R. Co., and South Ferry R. R. Co., also operates Broadway & Seventh Ave., Sixth Ave. Ninth Ave. and 23d St. Rys.) 13 m, owned, 23 m. leased, 4 8½ g, 60 lb c b r, 45 box c, 370 h. Pres. H. H. Vreeland, V. Pres. D. B. Hasbrouck, Sec. E. C. Warren, Treas. H. S. Beattie. Capital, $8,200,000. Bonds, $500,000. Office, 415 E. 10th st. President's office, 761 7th Ave. 7 3

Metropolitan Crosstown Ry. Co. (Operates 42d St. & Grand St. Ferry R.R. and Central Park, North & East River R.R.) 4-8½ g. 60 lb girder r, 30 c. Pres. H. H. Vreeland, V. Pres. D. B. Hasbrouck, Sec. C. E. Warren, Treas. H. S. Beattie. Capital, $300,000. Bonds. 1st. mtg., $600,000; 2d mtg., $300,000. 7 3

Metropolitan Traction Co. (controls Broadway & Seventh Avenue, Metropolitan St. Ry., Ninth Avenue, Sixth Avenue, and 23d Street railways, which, are operated by the Metropolitan St. Ry. Co. Also controls Metropolitan, Crosstown, Central Park, North & East River, and 42d Street & Grand Street Ferry Rys., which are operated by Metropolitan Crosstown R. R. Co.) Pres. J. D. Crimmins, V. Pres. D. B. Hasbrouck, Sec. C. E. Warren, Treas. Thos. F. Ryan. Capital, $30,000,000. 7 3

New York & Harlem R.R. Co. 17¾ m, 4-8½ g, 47, 60 75 lb r, 185 box c, 1,680 h. Pres. C. Vanderbilt, V. Pres C. C. Clarke, Sec. & Treas. Ed. V. W. Rossiter, Supt Alfred Skitt, Pur. Agt. A. Bourne. Capital, $10,000,000. Bonds, $12,000,000. Office, Grand Central Depot 6 3

Ninth Ave. R. R. Co. (Leased to Metropolitan St. Ry. Co.,) 16 m, 4-8½ g, 45 & 60 lb T r, 60 c, of which 40 are 4-wheel box and 20 4-wheel open, 542 h. Pres. Geo. Law, V. Pres. Jacob Hays, Sec. & Treas. J. G. Affleck. Capital $800,000. No bonds. Offices 814 Ninth Ave. 7 3

North & East River R. R. Co. 3 m, 4-8½ g. 45 lb s-b r, 12 c, 75 h. V. Pres. E. T. McLaughlin, Sec. F. C. Gaffney, Treas. T. F. Carney, Supt. W. Farrell. Capital, $300,000. Bonds, $125,000. Office, 252-4 Front St. 6 3

Second Ave. R.R. Co. 28 m. 4-8½ g, 60 lb r, 337 c, of which 169 are box and 168 open, 1938 h. Pres. G. S. Hart, V. Pres. C. F. Cox, Sec. J. B. Underhill, Treas. H. E. Doremus. Capital $1,860,000, authorized $2,500,000. Bonds $1,750,000. Office Second ave. cor. 96th st. 6 3

Sixth Ave. R.R. Co. (Leased to Metropolitan St. Ry. Co.) 9⅞ m, 4-8½ g, 60 lb r, 122 c, of which 102 are box and 20 open, 925 h. Pres. Frank Curtiss, Sec. & Supt. E. H. Garrison. Capital $1,500,000. Bonds, $500,000. Office 758 6th ave. 7 3

Third Ave. R. R. Co. 28¾ m, of which 11½ are cable and 16¾ horse, 4-8½ g, 60 lb r 401 c, of which 336 are h c & 65 g c; 1750 h. Pres. A. J. Elias, V. Pres Henry Hart, Sec. Alfred Lazarus, 136 W. 61st st Treas. J. Beaver, 310 E. 124th st.; Supt. John H Robertson, 158 E. 66th st.; Mech. Engr. of 10th ave. and 125th st. C. G. Bliss. Capital, $7,000,000. Bonds $5,000,000. Office, 65th St. & Third ave. 6 3

Twenty-third St. Ry. Co. (Leased to Metropolitan St. Ry. Co.) 14¾ m, 4-8½ g, 50 lb c b & tram r, 101 c, 946 h. Brill, Jones, Lewis & Fowler, Pullman and Stephenson cars. Pres. H. H. Vreeland, V. Pres. D. B. Hasbrouck, Sec. C. E. Warren, Treas. H. S. Beattie. Capital, $600.000. Bonds, 400,000; Broadway Surface Bonds, $375,000. Office, 621 West 23d st. 7 3

Twenty-eighth & Twenty-ninth sts. R. R. Co. 9.13 m, 4-8½ g, 60 lb. steel grooved r, 40 c. Pres. J. H Crane, V. Pres. D. D. Conover,, Sec. D. J. Apgar Treas. J. H. Davis. Capital $500,000. Bonds, $500,000. Office, 45 William st. 9 3

Union Ry. Co. of New York City. Elec. 24 m, 4-8½ g, 72½ lb girder r, 90 m c. T-H system. Pres. & Gen. Man. E. A. Maher, V. Pres. C. A. Stadler, Sec. & Treas. T. W. Olcott, Supt. J. Carrigan. Capital, $2,000,000. Bonds, $2,000,000. Office, 2389 3d ave. 9 3

NEWARK, N. J.—Newark Passenger Ry. Co. (Includes Rapid Transit Ry. and controlled by New Jersey Traction Co.) 75 m, of which 45 are horse and 30 elec, 5-2½ g, 50, 57 & 60 lb tram & girder r, 277 c, of which 200 are h. c. and 77 m. c, 300 h, T-H and Edison systems. Office, Prudential Building. 9 2

Newark & S. Orange, St. Ry. Co. Elec. 13 m, 5-2½ g, 90 lb girder r, 30 m. c. Westinghouse system Pres. E. S. Ward, V. Pres. G. Kreuger, Sec. & Treas W. Scheerer, Gen. Man. & Supt. A. Radel. Capital $1,500,000. Bonds, $1,500,000. Office S. Orange Ave and S. 19th st. 1 3

New Jersey Traction Co. (Controls Newark Passenger and Jersey City & Bergen railroads) Pres. ——————V. Pres. D. Young, Act. Sec. T. H. Wentworth, Jr , Treas. E. N. Hill, Supt. D.W. Sharpe. 6 3

NEWARK, O.—Newark & Granville Elec. St. Ry. Co. (Includes Newark City Ry.) 13 m, 4-8½ g, 30-51½ lb T & girder r, 22c, of which 10 are m c & 12 t c. T-H and Edison systems. Gilbert & Lamokin Cars. Hamilton and Russell & Taylor engines. Pres. R. Scheidler, V. Pres. J. A. Flory, Sec. & Gen. Man. W. C. Christian, Treas. F. A. Crane, Supt. H. R. Scheidler. Capital, $73,000. Authorized $100,000. Bonds $120,000. 9 3

NEWBURGH, N.Y.—Newburgh St. Ry. Co. 5 m 4-8½ g, 40 lb T r, 13 c, of which 11 are box and 2 open 72 h. Pres. M. H. Hirschberg, V Pres. J. C. Adams Sec. & Treas. Wm. Moores, Gen. Man. & Supt. W P. Rayland. Office, 246 Broadway. 6 3

NEWBURYPORT, MASS.—Newburyport & Amesbury St. R. R. Co. Elec. 19.584 m, 4-8½ g, 35 & 40 lb T r, 37 c of which 20 are m c and 17 t c, 6 h T-H system. Pres. & Treas. Chas. Odell, Supt. C. F. Dennis. Capital, $80,000. Bonds, $350,000. Office, 32 Market sq. 9 3

NEWPORT, KY.—Cincinnati, Newport & Covington Ry. Co., Newport Division. (See Covington, Ky.)

NEWPORT, R. I.—Newport St. Ry. Co. Elec 4.17 m, 4-8½ g, 45 lb T r, 15 c, of which 9 are m c and 6 t c, T-H system. Ellis and Newburyport cars. Pres. & Gen Man. A. C. Titus, Sec. & Treas. Francis Burdick, Supt. R. Lee. Capital stock $100,000; authorized, $110,000. Bonds, $50,000. Office, Spring & Franklin sts. 9 3

NEWTON, KAN.—Newton City St. Ry. Co. 6 m 3 g, 20 lb T r, 6 c, 24 h. Pres. Allen Moore, V. Pres J. M. Ragsdale, Sec. & Treas. W. G Oldfield. Capital $60,000. Not being operated. 9 2

NEWTONVILLE, MASS.—Newton & Boston St Ry. Co. Elec. 5½ m, 4-8½ g, 56 lb T r, 16 m. c. T-H system. Trimble cars. Westinghouse engines. Pres. & Gen. Man. H. B. Parker, V. Pres. A. R. Mitchell, Sec. L. E. B. Smith, Treas. J. L Richards. Supt. F. G. L. Henderson. Capital, $100,000; authorized, $250,000; Bonds, $80,000. 9 3

NIAGARA FALLS, N. Y.—Niagara Falls & Suspension Bridge Ry. Co. Elec. 13 m, 4-8½ g, 60 lb girder r, 23 c, of which 15 are m c and 8 t c. T-H system. Pres. C. B. Gaskill, V. Pres. H. L. Taylor, Sec. & Treas, Chas. B. Hill, Supt. J. C. Brewster. Capital, $400,000; Bonds, $400,000. 10 3

NIAGARA FALLS, ONT.—Niagara Falls, Wesley Park & Clifton Tramway Co. 4 m, 4-8½ g, 30 & 45 lb T r, 10 c, of which 8 are 4-wheel box & 2 4-wheel open. 25 h. Pres. J. N. Mooney, Treas. John N. Hayward, Supt. C. Black. Capital $50,000. 6 3

Niagara Falls, Park & River Ry. Co. Elec. 14 m, 4-8½ g, 56 lb. T r, 40 c, of which 24 are m. c. and 16 t. c. T-H system. Pres. E. B. Osler, V. Pres. W. Hendrie, Sec. & Treas. R. A. Smith. Gen. Man. W. A. Grant. 6 3

NILES, O.—Mineral Ridge & Niles Electric Ry. Co. 3½ m, 4-8½ g, 45 lb T & girder r, 4 m. c. Edison system. American cars. Allis engines. Pres. & Gen Man. W. T. Williams, V. Pres. E. J. Ohl, Sec & Treas. J. Wilshear, Supt. E. H. Bowan. Capital, $50,000. 9 3

NORFOLK, NEB.—Norfolk St. Ry. Co. 2½ m 4-6 g, 16 lb T r, 4 4-wheel box, 10 h. and 4 mu. Pres R. A. Stewart, V. Pres. Dr. A. Bear, Sec. N. A. Rainbolt, Treas. C. B. Burrows. Supt. F. H. Foye, Capital, $51,000. Office, 400 Main st. 9 2

Norfolk St. Ry. Cons. Co., 2 m., 1 m. c. Edison system. 7 2

NORFOLK, VA.—Norfolk City R.R. Co. 5¾ m 5-2 g, 45, 50, 65 lb tram, girder & s b r, 32 c, 125 h. Pres. W. H. Taylor, Sec. & Treas. H. C. Whitehead Supt. Jas. J. Ferris. Capital, $100,000; Bonds, $125-000. Office, 125 Main st. 9 3

The Suburban & City Ry. & Improv't Co. 3½ m, 5-2 g, 40 lb s. b. r, 15 c, of which 9 are 4-wheel box & 6 4-wheel open, 62 h. Pres. Jas. W. McCarrick, Sec. & Treas. H. C. Whitehead, Supt. E. W. Savage. Capital $50,000. Bonds $75,000. Office, 125 Main st. 9 3

NORRISTOWN, PA.—Citizens' Pass. Ry. Co. Elec. 4 m 5-2½ g, 52 lb tram r, 4 m c. Curtis system Lewis & Fowler cars. Pres. John Slingluff, V. Pres. J. W. Shepp, Sec. Geo. R. Kite, Treas. G. Shannon, Gen. Man. G. W. Keim. Capital, $80,000. 9 3

Norristown Pass. Ry. Co. 4 m, 5-2½ g, 45 & 50 lb tram & girder r, 9 c, of which 8 are 4-wheel box and 1 4-wheel open, 28 h, 6 mu. V. Pres. C. Gallagher, Sec. & Treas. H. Freedley, Supt. Louis Heck. Capital, $45,000. 7 1

NORTH ADAMS, MASS.—Hoosac Valley St. Ry Co. Elec. 6 m, 4-8½ g, 40 lb. T & flat r 13 c, of which 7 are m c and 6 t c T-H system. Brill and Newburyport cars. Fitchburg engines. Pres. & Treas. C. Q. Richmond, Gen. Man. & Treas. H. A Fitzsimons Capital $50,000. 9 3

NORTH TONAWANDA, N. Y.—Tonawanda Electric R. R. Co. 6 m, 4-8½ g, 45 lb T & girder r, 8 c, of which 3 are m. c. and 5 t c. T-H system. Brill cars. Noye engines. Pres. E. H. Butler, V. Pres. M. Nellany, Sec & Treas. C. M. Howard, Gen Man. G. P. Smith, Supt. H. R. Wellman. Capital, $125,000; authorized $250,000. 3 3

Tonawanda St. R. R. Co. Elec. 3½ m, 4-8½ g, 56, 62 lb T & girder r, 5 m c. T-H system. Pres. & Gen. Man. G. P. Smith, Sec. A. J. Hathaway, Treas. G. C. Herschell. Capital $250,000. Bonds $40,000. Office, Main st., 4 3

NORTH WOBURN, MASS.—North Woburn St. Ry. Co. 7.5 m, 35, 48 lb tram & T r, 12 c, 53 h. Pres. A. F. Breed, Lynn, Mass., Sec. & Treas. D. H. Sweetser, Supt. W. L. Brockway. Capital $100,000; authorized $200,000. 2 3

NORTHAMPTON, MASS.—Northampton St Ry. Co. 3½ m, 4 8½ g, 35 lb T and tram r, 12 c, 69 h Pres. J. C Hammond, Clerk J. A. Sullivan, Treas. N. D. Winter, Supt. E. C. Clark, Jr. Capital, $150,000. 6 3

NORWALK, CONN.—Norwalk Horse R. R. Co 3½ m, 4-10 g, 56 lb T r, 8 c, 43 h. Pres. J. D. Kinney, Sec. F. T. Brady, Supt. Edwin G. Hoyt. Capital $50,000 5 3

Norwalk Tramway Co. Elec. 3½ m, 4-8½ g, 50 lb T r, 4 m c. Pres. G. N. McKibbin, Sec. G. W. Mansfield, Supt. G. M. Pierce. Capital $70,000. Office South Norwalk. 10 3

NORWICH, CONN.—Norwich St. Ry. Co. 11 m, 4-8½ g, 35, 45, 50 lb T r, 34 c, of which 21 are m c and 13 t c, 6 h. T-H system. Newburyport cars. Pres. C. P. Cogswell, Sec.. Gen. Man. & Supt. E. P. Shaw, Jr., Treas. W. A. Tucker, Capital $60,000. Bonds, $100,000. 6 3

O

OAKLAND, CAL.—Consolidated Piedmont Cable Co. Elec. 24 m, of which 6 are horse, 13 cable and 5 elec. 3-6 & 5 g, 25 & 40 lb girder r, 52 c, of which 17 are h c, 25 g. c, 5 m c and 5 t c, 120 h. Pres. E. A. Heron, V. Pres. J. L. Bradbury, Gen. Man. & Supt. H. P. Garthwaite. Capital, $1,500,000; authorized, $2,000,000. Bonds, $600,000. 6 3

Central Avenue Ry. Co. Elec. 4¼ m, 3-6 g, 40 lb girder r, 8 m c. T-H system. Pres. W. Olney, Sec. W. Olney, Jr., Supt. D. Rutherford. 5 2

East Oakland St. Ry. Co. Elec. 6 m, 4-8½ g, 45 lb combination r, 11 m. c. T-H system. Pres. E. C. Sessions, V. Pres. & Supt. E. P. Vandercook. Capital $250,000. Office. 485 9th St. 6 3

Highland Park & Fruit Vale R. R. Elec. 5½ m, 4-8½ g. 45 lb girder & T r, 7 double deck m c. T-H system. Pres. E. C. Sessions, Sec. F. J. Woodward. Supt. J. E. Morris. Capital, $500,000. 6 3

Oakland Consolidated St. Ry. Co. Elec. 30 m. 3-6 g, 40 lb combn. steel r, 28 m. c. T-H system. Pres. G. W. McNear, V. Pres. J. E. McElrath, Sec. C. S. Houghton, Treas. 1st Nat. Bank, Supt. A. K. Grim, Capital, $1,000,000. Bonds, $500,000. Office 47th st & Grove. P. O. Box 126. 6 3

Oakland R. R. Co. (Owned by Southern Pacific Ry. Co. of San Francisco) Elec. 16.2 m, of which 5.2 are cable and 11 elec. 3 g, 40, 72 lb girder r, 32 c of which 12 are cable and 20 m c. T-H system. Supt. Geo. Y. Loring. Office, San Pablo and 20th sts. 6 3

Oakland, San Leandro & Haywards Ry. Co. Elec 25 m, of which 2 are horse and 23 elec. 3-6 g, 35, 40 lb T & combination r, 32 c. of which 2 h c and 30 m c. T-H system. Carter cars. Ball and McIntosh & Seymour engines. Pres. H. W. Meek, V. Pres. W. J. Landers, Sec. A. L. Stone, Treas. C. E. Palmer. Supt. F. M. Leland. Capital, $500,000. Bonds, $250,000. Office, 908 Broadway. 8 3

OGDEN CITY, UTAH.—Ogden City St. Ry. Co. Elec. 10 m, 4-8½ g, 30 lb T r, 20 c, of which 12 are m. c and 8 t. c. Pres. H. M. Beardsley, V. Pres. H. M Jarvis, Sec. & Supt. R. M. Spivey, Treas. S. L. Conklin. Capital, $350,000. Office Power House, 1920 Washington Ave. 9 3

OGDENSBURG, N. Y.—Ogdensburg St. Ry. Co. 5 m, 4-8½ g, 25 lb T r, 7 c, 19 h. Pres. W. H. Daniels, V. Pres. & Gen. Man. H. B. Howard, Sec. E. A. Newell, Treas. A. E. Smith. Capital, $30,000. 9 3

OLEAN, N. Y.—Olean St. Ry. Co. 2.45 m. 3-6 & 4-8½ g, 25-50 lb T r, 4 box c, 14 h. Pres. & Supt. John Fobes, V. Pres. C. S. Carey, Sec. & Treas. G. H. Strong. Capital, $16,000. Office, 264 Union st. 11 2

OLYMPIA, WASH.—Olympia Light & Power Co. Elec. 4 m, 4-8½ g, 40 lb T r, 5 m c. T-H system. Brill and Pullman cars. Pres. G. D. Shannon, V. Pres. R. Frost, Sec. & Gen. Man. A. H. Chambers, Treas. W. F. Newell, Supt. C. McClelland. Capital, $250,000. Bonds $150,000. Office 5th & Chestnut Sts. 9 3

West Side Ry. Co. 2 m, 2 m c. Edison system. 12 2

OMAHA, NEB.—Omaha St. Ry. Co. Elec. 85 m, of which 19 are horse 6 cable and 60 elec., 4-8½ g, 35, 45, 58½ lb T & girder r, 270 c of which 42 are h c, 22 g c, 96 m c and 110 t c, 100 h. T-H, Edison and Westinghouse systems. American, Laclede, Pullman and Stephenson cars. Allis, Wright and Westinghouse engines. Pres. Frank Murphy, V Pres. Guy C. Barton, Sec. D. H. Goodrich, Treas. W. W. Marsh, Gen. Man. W. A. Smith, Supt. F. A. Tuckers. Capital, $5,000,000. Bonds, $2,150,000. 9 3

Dundee Place Car Line. 1½ m, 4-8½ g, 35 lb T r 2 m c. Detroit system. Pres. R. W. Patrick, Man. W. A. Smith. 9 3

ONEIDA, N. Y.—Oneida Ry. Co. 3 m, 4-8½ g, 47 lb c b r, 3 box c, 9 h. Stephenson cars. Pres. W. E. Northrup, Sec., Treas. & Gen. Man. H. C. Stone, Supt. G. Leggett. Capital, $13,500; authorized $15,000. 6 3

ONEONTA, N. Y.—Oneonta St. R. R. Co. 2¾ m 4-8½ g, 35 & 38 lb T & flat r, 4 c of which 3 are 4-wheel box and 1, 4-wheel open, 12 h. Pres. & Supt. Geo. I. Wilber, V. Pres. D. F. Wilber, Sec. & Treas. T. D Tallmadge, jr. Capital $20,000. 9 3

ONTARIO, CAL.—Ontario & San Antonio Heights Ry. Co. 8½ m, 4-8½ g, 30 lb T r, 24-wheel open c. 4 h. Pres. C. E. Harwood, V. Pres. & Gen. Man C. Frankish, Sec. W. E. Collins. Capital $150,000. 9 3

ORANGE, N. J.—Orange Crosstown and Bloomfield St. Ry. Co. 7 m, 5-2 g, 38 lb Johnson girder rail, 13 box c, 86 h. Pres. & Gen. Man. Francis M Eppley, Sec. Thos. Marsh, Treas. Edw. A. Pearson Supt. J. Waller. Capital stock, $60,000; bonds, $60,000 1 3

Suburban Traction Co. 7 m, 5-2 g, 13 c. Stevenson cars. Pres. F. W. Child, Sec. A. W. Kissam, Treas. A. P. Foster, Supt. J. C. Cotton. Capital, $1,500,000. Bonds, $1,500,000. 10 3

Orange Mountain Cable Co. 8000 ft, 8 g, 56 lb. m. p. r, 2 c. Roebling engines. Pres. A. Z. Mason, V. Pres. & Gen. Man. F. W. Child, Sec. & Treas. A. W. Kissam, Supt. W. Congdon. Capital, $350.000. Office Orange Nat. Bank Bldg. 6 3

ORANGEBURG, S. C.—Orangeburg St. Ry. Co, 2½ m, 4-9 g, 40 lb. T r, 6 c, 4 h, 6 mu. Pres. & Gen. Man J. W. H. Dukes, V Pres. N. H. Bull, Sec. & Treas. B H. Moss. Capital, $11,000. 1 2

ORLANDO, FLA.—Orlando St. Ry. 3 m, 4-9 g, 30 lb T r, 3 c, 10 mu. Pres. & Gen. Man. N. L. Mills, V. Pres. R. E. Green. Capital $10,000; authorized $50,000. 10 1

OSHKOSH, WIS.—Oshkosh St. R. R. Co. 8¾ m, 4-8½ g, 30 lb, tram r, 13 c, of which 10 are 4-wheel box & 3 4-wheel open, 57 h. Pres. Chas. Barber, V. Pres. J. H. Porter, Sec. & Treas J. H. Jenkins, Gen. Man. & Supt. C. E. Montgomery. Office, 222 Main st. 9 3

OSKALOOSA, IA.—Oskaloosa St. Ry. & Land Co 5 m. 4 g, 16, 40, 50 lb tram, T & girder r, 4 c, 14 h. Minneapolis and St. Louis cars. Pres. W. M. Peatman, Sec. C. Winter, Treas. W. G. Clark, Supt. J. M. Powell. Capital $30,000. Office, 100 High Ave., West. 9 3

OSWEGO, N. Y.—Oswego St. Ry. Co. Elec. 7 m, 4-8½ g, 51-72 lb T & girder r, 12 c, of which 7 are m c and 5 t c. T-H system. Pres. M. E. Graves, V. Pres L. Clancy, Sec. W. A. Finneran, Treas. & Man. N. McGowan. Capital, $125,000. Office, East First & Bridge sts. 6 3

OTTAWA, ILL.—Ottawa Electric St. Ry. 8 m 4-8½ g, 56 lb girder r, 8 motor and 4 trail c, T-H system. Pres. T. J. Evans, Sec. & Treas. T. P. Bailey Gen. Man. H. A. Kin. Capital, $100,000. 6 2

OTTAWA, ONT.—Ottawa Electric Ry. Co. 20 m 4-8½ g, 52, 56 lb girder & T r, 45 m c, 3 snow plows. Westinghouse system. Brill and Wylie cars. Water power. Pres. J. W. McRae, V. Pres. G. P. Brophy, Sec. & Treas. J. D. Fraser, Gen. Mans. Ahearn & Soper. Capital, $367,000; authorized, $500,000. Bonds authorized, $500,000. Office, 337 Albert St. 5 3

OTTUMWA, IA.—Ottumwa Electric Ry. Co. 7.25 m, 4-8½ g, 38 & 40 lb girder & T r, 12 c, of which 11 are m c and 1 t c. Gen. Elec. and Westinghouse systems. Pullman and St. Louis cars. Ball engines. Pres. & Gen. Man. W. R. Daum, V. Pres. J. B. Sax, Sec. T. H. Eaton, Treas. C. F. Blake, Supt W. J. Jones, Ch. Engr. W. M. Evans, Supt. of Car Service, E. M. Campbell. Capital, $300,000; authorized, $500.000. Bonds, $200,000. Office, 102 S. Market st. 6 3

OWENSBORO, KY.—Owensboro City R. R. Co Elec. 10 m, 4-8½ g, 40 lb T r, 25 c, of which 12 are m c and 13 t c. T-H system. Stephenson cars. Harrisburg engines. Pres. W. E. Whitely, Sec. R. A. Miller. Treas. J. H. Parish, Gen. Man. J. N. Alsop, Supt. R. H. Neely. Capital $50,000. Bonds, $25,000. 9 3

P

PADUCAH, KY.—Paducah St. Ry. Co. Elec. 8½ m, 4-8½ g, 35 lb T r, 22 c, of which 14 are m c and 8 t c Edison system. Pres. Geo. C. Thompson, V. Pres C. Dallam, Sec. & Treas. T. J. Flournoy, Gen. Supt. A. S. Thompson, Elec'n & Supt. Mo. Pow. D. B. Simon. Capital, $115,000; authorized, $200,000. Bonds, $100,000. Office, 1342 Broadway. 9 3

PAINESVILLE, O.—Painesville, Fairport & Richmond St. Ry. Co. 7 m, 4-8½ g, 52 lb girder r, 4 c Pres. & Gen. Man. I. K. Pierson, Sec. & Treas. W. H. Searles. Capital, $50,000; authorized, $150,000. 9 3

PALATKA, FLA.—Palatka & Heights St. Ry Co. 2 m, 3 g, 30 lb centre bearing r, 2 c, 2 mu. Pres Wm. P. Craig, Sec. Marcus Loab, Treas. & Gen. Man. W. C. Snow. Capital, $10,000. 2 3

PARIS TEX.—Paris Elec. Lt. & Ry. Co. 5 m, 4-8½ g, 22 & 36 lb T & flat r, 10 c, of which 8 are 4-wheel box & 2 4-wheel open, 45 mu. Pres. J. J. Walsh, V. Pres. S. J. Wright, Sec. & Treas. B. J. Baldwin, Jr., Supt. R. F. Grimes. Capital, $200,000; authorized, $300,000; Bonds, $150,000. Office over Farmers' & Merchants' Bank. 2 3

PARKERSBURG, W. VA.—Park City St. R. R Co. 5 m, 4 8½ g, 40 lb flat & T r, 7 c, 14 h, 14 mu Pres. D. Gould, V. Pres., & Sec. R. Covert, Treas W. H. Wolfe, Gen. Man. & Supt. W. A. McCosh. Capital, $40,000; authorized $75,000. Office 332 Juliana st. 5 3

PASADENA, CAL.—City Ry. Co. (Controlled by Los Angeles Consolidatee Electric Ry. Co.) 5¼ m, 4-8½ g, 16, 20, 30 lb T & flat r, 5 c, of which 2 are 4-wheel box & 3 4-wheel open; 12 h, 6 mu. Pres. & Gen. Man. A. J. Painter, V. Pres. C. W. Buchanan, Sec. & Treas. M. D. Painter. Capital, $20,300; authorized, $50,000. 11 2

Alhambra & Pasadena St. Ry. Co. (See Alhambra, Cal.)

Colorado St. Ry Co. (Controlled by Los Angeles Consolidated Electric Ry. Co.) 5½ m, 3-6 g, 16 lb. T r, 5 c, 9 h Pres. & Gen. Man. Geo. F. Foster, V. Pres. T. P. Lukens, Sec. E. E. Jones. Capital, $50,000. Office, 50 South Los Robles Ave. 6 3

Pasadena & Mt. Wilson Ry. Co. Pres. T. S. C. Lowe, V. Pres. P. M. Green, Sec. A. P. West, Treas. T. W. Brotherton. 6 3

Pasadena St. Ry. Co. (Controlled by Los Angeles Consolidated Electric Ry. Co.) 3½ m, 3-6 g, 16 lb T r, 5 box c, 8 h. Baker cars. Pres. & Gen. Man. W. Thomson, V. Pres. G. R. Thomas, Sec. P. G. Wooster, Treas. P. M. Green. Capital, $20,300; authorized, $50,000. Office, Wooster Block. 10 3

PATERSON, N. J.—Paterson Ry. Co. Elec. 36 m, 4-8½ g, 58½ lb c b & T r, 75 c, of which 60 are m c and 15 t c. T-H., Westinghouse and Edison systems. Gilbert and Stephenson cars. Ball engines. Pres. Garret A. Hobart, V-Pres. H. Romaine, Sec. A. A Wilcox, Treas. E. T. Bell, Gen. Man. M. R. McAdoo, Supt. M. Pettigrew. Capital $1,250,000. Bonds $1,250,000 1 3

Paterson & Little Falls Electric Ry. (Operated by Paterson Central Electric Ry. Co.) 3 m, 4-8½ g, 48 lb T r, 8 c, of which 4 are m. c. and 4 t. c. Westinghouse system. Brill cars. Capital, $50,000. 6 3

Paterson Central Electric R. R. Co. (Operates Patterson & Little Falls Electric Ry.) 4 m, 4-8½ g, 45, 58½ lb T & girder r, 18 c. Westinghouse system. Gilbert cars. Pres. F. C. Vandike, V. Pres. J. R. Lee, Sec. J. J. Scanlon, Treas. J. A. Morrisse, Gen. Man. & Supt. W. Ring. 6 3

PAWTUCKET, R. I.—Pawtucket St. Ry Co. Elec 15 m, of which 6.5 are horse and 8.5 elec; 4 g, 54-60 lb Prov. girder & T r, 50 c, of which 35 are h c and 15 m c, 142 h. T-H system. Pres. N. W. Aldrich, V. Pres. A. H. Littlefield, Sec. & Gen. Man. C. F. Luther, Treas. E. N. Littlefield. Capital $200,000. Office, 54 Broad st. 9 3

Interstate St. Ry. Co. Elec. 24 m, 4-8½ g, 50 lb T r, 32 c, of which 26 are m c and 6 t c. T-H system. Briggs and Newburyport cars. Pres. & Gen. Man. H. M. Daggett, Jr., Sec. G. E. Webster, Treas. W. N. Otis, Pur. Agt. E. Holmes, Supt. E. W. Adams. Capital, $362,500; authorized, $500,000. 9 3

PEORIA, ILL.—Central Ry. Co. Elec. 23 m 4-8½ g, 48, 80 lb girder r, 85 c, of which 43 are m c and 42 t c. T-H system. American, Laclede and St. Louis cars. Corliss engines. Pres. W. Barker, V. Pres. S. Clark, Sec. J. N. Ward, Treas. E. Callender, Gen. Man. J. Finley, Supt. J. E. Finley. Capital, $600,000. Bonds $200,000. Office, 622 S. Adams st. 6 3

Fort Clark Horse Ry. Co. Elec. 14 m, 4-8½ g, 38, 50, 75 lb girder & T r, 34 c, of which 14 are m c and 20 t c. T-H system. St. Louis cars. Ball and Ide engines. Pres. F. W. Horne, Sec. & Treas. J. A. Trawick, Supt. W. D. Allison. Capital, $250,000; authorized, $500,000. Bonds, $250,000. Office, Abington & Monroe Sts. 9 3

PETERSBURG, VA.—Petersburg St. Ry. Elec. 3½ m, 4-8½ g, 45 & 47 lb r, 8 m c. T-H system. Pres., Gen. Man. & Pur. Agt. George Beadle, Sec. W. S Phelps, Treas. A. Wright, Supt. F. G. Beadle. Capital, $100,000. Bonds, $100,000. 1 2

Petersburg & Asylum Ry. Co. Dummy. 3½ m, 4-8½ g, 50 lb T r, 1 Baldwin engine, 4 c. Pres. Treas. & Gen. Man. G. Beadle, Sec. J. Mann. Capital $20,000. Bonds $30,000. 9 3

PHILADELPHIA, PA.—Citizens' Pass. Ry. Co. (Leased by Electric Traction Co.)

Empire Pass. Ry. Co. 8½ m, 5-2 g, 45 lb r. Pres James McManes, Sec. and Treas. D. W. Dickson Capital, $600,000. Office, N. E. cor. 41st & Haverford sts. Leased to Phila. Traction Co. 9 2

Electric Traction Co., includes Lombard & South Sts. Pass. Ry., Lehigh Ave. Ry., Lombard & South Sts. Pass. Ry., Frankford & Southwark City Pass. Ry., Citizens' Pass. Ry., and Second & Third Sts. Pass. Ry.) 129 m, 5-2 g, 45, 47, 50, 78, 93 lb. girder & Tram r, 253 c, 1,705 h, 10 steam dummies. McIntosh & Seymour and Porter-Allen engines. Pres. J. J. Sullivan, V. Pres. G. S. Gandy, Sec. F. Weckerley Treas. R. C. Brewster, Supt. W. H. Janney, Ch. Engr. E. B. Ives. Capital $1,875,000. Office, 2501 Kensington ave. Engr's office, 11th & Colona sts. 12 3

Germantown Pass. Ry. Co. 29½ m, 5-2½ g, 47 lb r, Pres. C. W. Walton, Treas. J. Koch. Capital, $1,500,000. Office, 1,001 Chestnut st. Leased to People's Pass. Ry. Co. 12 3

Green & Coates R. R. Co. Pres. Moses A. Dropsie, Sec. & Treas. L. S. Renshaw. Capital $500,000. Office, 1001 Chestnut st. Leased to People's Pass Ry. Co. 12 3

Frankford & Southwark City Pass. Ry. Co. (Leased to Electric Traction Co.)

Hestonville, Mantua & Fairmount Pass. R.R. Co. 20 m, 5-4½ g, 45 lb r, 96 c, 525 h. Pres. J. Hopkins, V. Pres. I. Blum, Sec. & Treas. W. R. Benson, Ch. Engr. A. L. Johnston. Capital, $2,050,000. Office, 4,300 Lancaster ave. 12 3

Lehigh Ave. Ry. Co. (Owned by Frankford & Southwark Phila. Pass. R. R. Co.)

Lombard & South Sts. Pass. Ry. Co. (Owned by Frankford & Southwark Ry.)

People's Pass. Ry. Co. (Lessee of Germantown Pass. Ry. and is controlled by People's Traction Co.) 49 m, 5-2¾ g, 47 to 57 lb tram & girder r, 173 c, 1551 h. Own cars. Pres. H. C. Moore, Sec. & Treas. David C. Golden, Gen. Supt. J. C. Lugar. Capital, $2,250,000. Bonds $750,000. Office, 8th & Dauphin sts. 12 3

People's Traction Co. (controls People's Pass. Ry. Co.) Pres. J. Lowber Welch, Sec. & Treas. C. Kruger, Ch. Engr. L. W. McIntire 12 3

Philadelphia City Pass. Ry. Co. 12.417 m, 5-2½ g, 47 & 78 lb r. Pres. Wm. W. Colket, Sec. & Treas. T. W Pennypacker. Capital, $1,000,000. Office, 202 Walnut place. Leased to W. Phila. Pass. Ry. Co. 12 3

Philadelphia Traction Co. (Lessee of Empire Pass. Phila. & Gray's Ferry, Ridge Ave., 17th & 19th Sts. 13th & 15th Sts., 12th and 16th Sts., Phila. City Pass. Union Pass. and West Phila. Rys. 250 m, of which 156 are horse, 60 elec. and 34 cable, 5-2½ g, 47, 78, 90 lb r, 1716 c, of which 661 are h. c. 300 m. c. and 135 g c, 4172 h. Brill and Laclede cars. Westinghouse engines. Pres. P. A. B. Widener, V. Pres. W. L. Elkins, Sec. & Treas. D. W. Dickson, Gen. Man. J. T. Gorman, Ch. Engr. F. W. Darlington. Capital, $6,000,000. Office, n w cor. 41st and Haverford sts. V. Pres. office 423 Walnut st 12 3

Philadelphia & Darby Ry. Co. 6½ m, 5-2½ g, 42 lb r. Pres. Beauveau Borie, Sec. & Treas. Wm. W Colket. Office, 202 Walnut pl. Leased to Phila. City Pass. Ry. Co. Capital, $200,000. 12 3

Philadelphia & Gray's Ferry Pass. R. R Co. Pres. O. Hopkinson, Sec. & Treas. L. S. Renshaw. Capital $308,750; authorized $1,000,000. Office 1001 Chestnut st. Leased to Phila. Traction Co. 12 3

Ridge Ave. Pass. Ry. Co. Pres. E.B. Edwards, Sec. & Treas. Wm. S. Blight, Capital, $420,000; authorized, $750,000. Office Ridge & Susquehanna aves. Leased to Phila. Traction Co. 12 3

Schuylkill River Pass. Ry. Co. Leased to Philadelphia & Gray's Ferry Pass. R. R. Co. 12 3

Second & Third Sts. Pass. Ry. Co. (Owned by Frankford & Southwark Phila. City Pass. R. R. Co.

Seventeenth & Nineteenth Sts. Pass. Ry. Co. 8.12 m Pres. Matthew S. Quay, Sec. & Treas. John B. Peddle. Capital, $500,000. Leased to Phila. Traction Co. a 12 3

Thirteenth & Fifteenth Sts. Pass. Ry. Co. 15 m, 5-2 g, 47 lb tram r, 89 4-wheel box c, 640 h. Pres. B. S Kunkel, Sec. & Treas. I. P. Richardson. Office, Fidelity Insurance & Safe Deposit Co. 325 Chestnut St Leased to Phila. Traction Co. 12 3

Union Pass. Ry. Co. 70 m, 348 c, 1,724 h. Pres. P. A. B. Widener, V. Pres. W. L. Elkins, Sec. & Treas. John B. Peddle, Capital, $1,500,000 Leased to Phila. Traction Co. 12 3

West Philadelphia Pass. Ry. Co. 22½ m, 5-2½ g, 47 & 78 lb r. Pres. P. A. B. Widener, Sec. & Treas. D. W Dickson, Supt. Jas. T. Gorman. Capital, $750,000 Office, 41st & Haverford sts. Leased to Phila. Traction Co. 12 3

PHILLIPSBURG, N. J.—Phillipsburg Horse Car R. R. Co. 2¾ m, 4-8 g, 3 lb r, 4 c, 13 h. Pres. Daniel Runkle, Sec. & Treas. James W. Long. Sold to Easton Transit Co. 9 0

PHŒNIX, ARIZ. T.—Phœnix City Ry. Co. 10 m. of which 5 are horse and 5 elec. 3-6 and 4-8½ g, 20, 30, 35 lb T r. Pres. M. H Sherman, Sec. & Man. B. N. Pratt. 6 3

PIERRE, S. DAK.—Pierre City Ry. Co. 4.1 m 4-8½ g, 27-35 lb r, 5 open c, 7 h, 16 mu. Pres. W. G Warden, V. Pres. Randal Morgan, Sec., Supt. & Gen. Man. S. B. Wallace. Capital $75,000. 6 3

PINE BLUFF, ARK.—The Citizens' St. Ry. Co 12½ m, 4 & 4-8½ g, 20, 35, 45 lb T r, 28 m. c. 4 h, 140 mu. Pres. T. S. James, Sec. A. Murray, Treas. & Gen. Man. & Supt. W. Jones. Capital $200,000. Bonds $90,000. Office, 207½ Main St. 11 2

PIQUA, O.—Piqua St. Ry. Co. Elec. 4 m, 4-8½ g, 45 lb Johnson girder and 35 lb T r, 10 c of which 6 are m c and 4 t c. Edison system. Pres. A M. Orr V. Pres. D. Spencer, Sec. & Gen. Man.. F. C. Davies Treas. L. M Flesh. Capital $75,000. 11 2

PITTSBURGH, PA.—Allegheny Traction Co. 7 m, 5-2½ g, 45 lb tram r, 18 c, 100 h & mu. Stephenson cars. Pres. G. B. Hill, Sec. A. M. Neeper, Gen. Man. G. F. Greenwood. Capital $350,000. Offices, Market and Liberty Sts., Pittsburgh, and Beaver and Iland Aves., Allegheny. 9 3

Birmingham, Knoxville & Allentown Traction Co 1.4 m. horse and 1,600 ft. cable, 5 g, 45 lb steel & T r 9 c, 24 h. Pres. H. S. A. Stewart, Sec. Danl. Beech Treas. T. H. Given, Supt. M. S. Holden. Capital $100,000. 11 1

Central Traction Co. 8½ m, of which 5 are cable & 3½ elec. 5-2½ g, 65 lb girder r, 26 c, of which 20 are g c and 6 m c. Westinghouse system. Brill and Pullman cars. Wetherill and Westinghouse engines. Pres. Geo. I. Whitney, V. Pres. T. A. Gillespie, Sec. J. F. Miller, Treas. G. F. Wright, Supt. W. C. Smith. Capital, $1,500,000; bonds $375,000. Office 33d st. & Herron Avenue, 9 3

Citizens' Traction Co. 30 m of which 6 are horse, 12 cable and 12 elec. 5-2½ g, 54 & 65 lb girder & tram r-90 c, of which 4 are h c, 66 g c and 20 m c, 28 h. Westinghouse system. Gilbert, Pullman and Stephenson cars. Buckeye and Wetherill engines. Pres. Jno. G. Holmes, V. Pres. H. S. A. Stewart, Sec. J. G. Bright, Treas. N. Holmes, Jr., Gen. Man. J. E. Rugg. Capital $3,000,000. Bonds $1,250,000. General office 537 Penn Ave., business office 3104 Penn Ave. 10 3

Duquesne Inclined Plane Co. 1,586 ft., 5 g, 60 lb T r 2 c. Pres. S. Severance, V. Pres. F. B. Nimick, Sec. K. Q. Brigham, Treas. S. Severance, Jr., Supt. Geo. L. Holliday. Capital, $50,000. 9 2

Duquesne Traction Co. Elec. 28 m, 5-2½ g, 48 lb girder r, 60 m c, T-H. system. Pres. C. L. Magee, V. Pres.————, Sec. Jas. L. McDevitt, Treas. Jno F. Steel. Capital, $3,000,000. Bonds, $1,500,000 Leased to Pittsburgh Traction Co, 9 2

Fort Pitt Inclined Plane Ry. Co. 350 ft., 10 g, 2 c Pres. Wm. Flinn, Sec. & Supt. S. H. French, Treas. F. L. Stephenson. Capital, $60,000. Office 125 Fourth Ave. 3 2

Knoxville Inclined Plane Co. 2,640 ft. 9 g, 60 lb. T r, 2 c. Capital $150,000. Office 96 Diamond st.

Monongahela Inclined Plane Ry. Co. 2 planes, 640 ft, 5 & 12 g, 45 & 80 lb T r, 2 pass. 2 freight c. Pres. Jas. M. Bailey, Sec. Treas. & Supt. John L. Awl Capital, $200,000 3 2

Penn. Inclined Plane Ry. 840 ft, 10 g, 60 lb T r Pres. Joshua Rhodes, 1st ave.

Pittsburgh & Manchester Traction Co. Elec. 18 m, of which 1¼ are horse and 16¾ elec. 52½ g, 63 lb girder r, 72 c of which 1 is h c, 61 are m c, and 10 t c. T-H system. Pres. J. H. Dalzell, V. Pres. Joshua Rhodes, Sec. A. M. Neeper, Treas. W. Montgomery Gen. Man. G. F. Greenwood. Capital, $3,000,000. Bonds, $1,500,000. Office, S. Market & Liberty sts. and Beaver st & Island ave, Allegheny. 6 3

Pittsburgh & Birmingham Traction Co. Elec. 13 m 5-2½ g, 63½ lb girder r, 42 m c. Westinghouse system. Gilbert cars. Hamilton-Corliss engines. Pres. H. S. McKee, Sec. F. J. Tener, Treas. Daniel Beach, Gen. Supt. Miller Elliott. Capital $3,000,000. Bonds $1,500,000. Office, 30th & Carson sts. 6 3

Pittsburgh & Castle Shannon R. R. (Includes 2 inclines). 6¾ m, 3-4 g, 60 lb r, 7 c. Incline No. 1, 1,375 ft. 10 g, 60 lb T r, 2 c. Incline No. 2, 2,112 ft. 10 g, 60 lb T r, 2 c. Jackson & Sharp cars. Pittsburgh engines. Pres. Walter Chess, V. Pres. J. M. Bailey, Sec. & Treas. E. J. Reamer, Supt. O. A. Rogers. Capital, $481,000. Bonds, $200,000. 1 3

Pittsburgh & West End Pass. Ry. Co. 16 m, 5-2½ g, 78 lb tram r, 44 c of which 18 are h c and 26 m c, 6 h. Westinghouse system. Laclede and Stephenson cars. Russell engines. Pres. John C. Reilly, V. Pres. Thomas S. Bigelow, Sec. W. W. Callery, Treas. & Gen. Man. William J. Burns. Capital, $1,500,000. Bonds $75,000. Office, Wabash ave. 9 3

Pittsburgh Traction Co. Cable. 12.67 m, of which 10.67 are cable and 2 elec, 5-2 g, 65 lb. girder r, 74 c 2 m. c. Short system. Pres. Geo. W. Elkins, V. Pres. C. L. Magee, Sec. and Treas. J. G. Traggard, Gen. Man. W. L. Elkins, Supt. —— McDowell Ch. Eng'r J. M. Gorman. Capital $2,500,000. Bonds $75,000. Office, 310 Fifth ave. 9 2

Schenley Park & Highlands Ry. Co. Elec. 3¾ m. 5-2½ g, 40, 45, 60 lb T & girder r, 5 m c. Daft system Gilbert cars. Pres.———————— V. Pres. & Gen. Man. S. J. MacFarren, Sec. F. G. Kay, Treas. T. A. Noble. Capital $100,000. Bonds $50,000. Office 15 Lewis Block. 6 3

Second Avenue Pass. Ry. Co. Elec. 10¼ m, 5-2½ g 54 lb Johnson & T r. T-H & Westinghouse systems Pres. Jas. D. Callery, Sec. C. G. Milnor, Treas. John W. Taylor, Gen. Man. W. J. Burns, Supt. John Murphy. Capital, $300,000. Bonds $150,000. Office Glenwood, 23d Ward. 9 2

St. Clair Incline Plane Ry. Co. .40 m, 5 g, 56 lb T r, 2 box c. Pres. & Supt. W. S. Hughes, Sec. W. S. Jones. Treas. R. B. Mellon. Capital, $150,000. Bonds $75,000. Office, 514 Smithfield St. 9 3

Suburban Rapid Transit St. Ry. Co. Elec. 7 m 5-2½ g, 52 lb Johnson girder r, 16 m, c. N. E. T. Co.'s system. Fischer engines. Pres. H. Miller, Sec., Treas. & Gen. Man. Thos. A. Noble, Supt. J. F. Saitz. Capital $100,000; authorized, $120,000. Bonds $100,000. 7 3

PITTSFIELD, MASS.—Pittsfield Electric St. Ry Co. 3½ m. 4-8½ g, 56 lb flat r, 10 c of which 5 are m. c. and 5 t. c., 3 h. Westinghouse system. Pres. Jos. Tucker, Sec. J. M. Stevenson, Treas. & Gen. Man. P. C. Dolan. Capital $40,000. Office Seymour & Wahconah Sts. 12 3

PLAINFIELD, N. J.—Plainfield St. Ry. Co. Elec. 3½ m, 5-2¼ g, 72 lb tram r, 5 m c. T-H. system. Brill cars. Pres. T. N. Nevins, V. Pres. T. J. Tritts, Sec. & Treas. C. W. Riker, Gen. Man. & Supt. J. H. Adelman. Office West 10th St. 9 3

PLYMOUTH, MASS.—Plymouth & Kingston Ry. Co. Elec. 6½ m, 4-8½ g, 35, 40 lb T r, 12 c, of which 11 are m c and 1 t c. T-H system. Briggs and Newburyport cars. Pres. J. H. Cunningham, Sec. T. Loring, Treas. J. D. Thurber, Supt. & Gen. Man. C. E. Barnes. Capital $100,000. Bonds $35,000. 6 3

POMONA, CAL.—San Antonio & Holt Ave. St. R. R. Co. 2 m, 3-6 g, 16 lb T r, 3 c, 6 mu. Pres. H Eno, V. Pres. J. E. Packard, Sec. H. S. Finney, Treas O. F. Giffin, Supt. F. G. Haley. Capital, $50,000. 3 2

Orange Grove St. R. R. Co. 4 m, 3-6 g, 16 lb T r, 3 c, 8 mu. Pres. & Treas. B. B. Nesbit, Sec. C. E. Rice Gen. Man. & Supt. P. C. Towner. Capital $25.000. 11 2

PORT ARTHUR, ONT.—Town of Port Arthur Electric Ry. 8 m elec. 4-8½ g, 40 lb T r, 3 m c. Edison system. Capital $115,000. J. M. Neelin, Chairman of the Elec. Ry. Committee, Sec. W. H. Langworthy, Treas. J. McTague. 9 3

PORT HURON, MICH.—City Electric Ry. Co. 9 m, 4-8½ g, 45 lb T r, 20 c, of which 12 are m c and 8 t c, T-H system. Pres. W. Canham, Sec. & Treas. F. J. Dixon, Gen. Man. A. Dixon. Capital $100,000 Bonds $43,500. 8 3

PORT NORFOLK, VA.—Port Norfolk Electric Ry. Co. 4 m, 4-8½ g, 40 lb T r, 7 c. of which 5 are h c and 1 steam motor. Pres. W. H. Stewart, Sec. E T. Powell. Treas & Gen Man. M. W. Mason. Capital $60,000; authorized $500,000. Bonds 60,000. Office Mt. Vernon Ave. 6 3

PORT RICHMOND, S. I., N. Y.—Port Richmond & Prohibition Park R. R. Co. Elec. 2 m, 4-8½ g, 56 lb girder r, 10 c, of which 5 are m c and 5 t c. Edison system. Stephenson cars. Ball engines. Pres. C. A. Starbuck, V. Pres. J. C. Thompson, Sec. & Treas. R. C. Vilas, Gen. Man. & Supt. H. C. Vilas. Capital $100,000. Bonds $75,000. 9 3

PORT TOWNSEND, WASH.—Port Townsend St. Ry., Light & Power Co. 4¼ m, 4-8½ g, 38 & 40 lb T & girder r 3 m. c. T-H system. Pres. F. W Hastings, V. Pres. & Gen. Man. J. V. Shephard, Sec & Treas. C. P. Swigert. Capital, $150,000. 5 1

Port Townsend Belt Ry. Co. 4 m, 2 m c. Edison system. 12 2

PORTLAND, CONN.—Portland R. R. Co.

PORTLAND, ME.—Ocean St. R.R. Co Operated by Portland R. R. Co.

Portland R. R. Co. Elec. 14.6 m, of which 3½ are elec, 4-8½ g, 35-45 lb T & s b r, 53 c, of which 31 are box & 21 open, 8 m c, 265 h. T-H system. Pres. W. R. Wood, Treas. & Gen. Man. E. A. Newman. Capital $200,000. Office 471 Congress st. 3 1

PORTLAND, ORE.—Barnes Heights & Cornell Mt. Ry. Co. 3½ m, 3 m c. T-H system. 12 2

City Cable Co. 7½ m, 3-6 g, 22, 38 comb. r, 23 g c. Receiver & Gen. Man. F. I. Fuller. Bonds $400,000. Office Mill & Chapman Sts. 3 3

City & Suburban Ry. Co. Elec. 46 m, of which 35 are elec. and 11 steam, 3-6 g, 30, 40 lb T & girder r, 56 c, of which 52 are m c and 4 t c, 7 steam motors, 13 coaches. T-H system. Pullman cars. Baldwin engines. Pres H. Failing, V. Pres T Woodward. Sec. & Treas. C. F. Swigert, Gen. Man. H. C. Campbell. Capital, $1,000,000. 9 3

City & West Portland Park Motor Co. 7 m, of which 6 are steam and 1 elec. 4-8½ g, 45, 50 T r, 17 c, 2 steam motors. Edison system. Pres. E. T. Johnson, V. Pres., Treas. & Gen. Man. T. A. Wood, Sec. W. H. Wood. Capital $100,000. Bonds $100,000. Office Room 1, I. O. O. F. Temple. 9 3

East Side Ry. Co. (Includes Mt. Tabor R. R.) Elec. 22 m of which 4½ are steam and 17½ elec., 4-8½ g, 30, 40 lb T r, 19 c of which 15 are m c and 4 t c, 3 steam motors. Edison and T-H systems. Baldwin engines. Pres. & Gen. Man. G. A. Steel, V. Pres. & Treas. J. Steel, Sec. J. B. Cleland. Capital $195,300; authorized $250,000. Bonds $153,000. Office 212 Madison St. 9 3

Portland Consolidated St. Ry. Co. Elec. 29.1 of which 6.6 are steam & 22.5 elec. 3, 3-6, 4-8½ g, 35, 40 lb T r, 80 c. of which 3 are steam motors 7 coaches, 9 flat c, 56 m c, and 5 t c. Edison & Westinghouse systems. Pres. G. B. Markle, V. Pres. J. Steel, Sec D. F. Sherman, Treas. J. L. Hartman, Supt. J. E Thielsen. Capital, $525,000; authorized $1,000,000 Bonds $660,000. Office 224½ Washington St. 6 3

Portland St. Ry. Co. 2 m, 4-8½ g, 30 lb tram r, 4 c, 30 h. Pres. J. Holladay, V. Pres. G. W. Weidler, Sec. T. Gray. 9 3

PORTSMOUTH, O.—Portsmouth St. R. R. & Lt. Co. Elec. 5 m, 4-8½ g, 45 lb T & girder r, 8 c, of which 4 are m c and 4 t c. T-H system. St. Louis cars. Ball & Wood engines. Pres. G. Davis, V. Pres H. Grimes, Sec. & Treas. S. B. Timmonds, Gen. Man. F. L. Smith. Capital, $125,000. Bonds, $83,000. 8 3

PORTSMOUTH, VA.—Portsmouth St. Ry. Co 4.17 m, 4-8½ g, 30 lb s b r, 9 c, 26 h & mu. Pres., Treas. & Gen. Man. B. Bruenn, V. Pres. Wm. H. Stewart, Sec. P. G. Chamberlain, Supt. W. T. Cross. Capital $50,000. Bonds, $50,000. 9 3

POTTSTOWN PA.—Pottstown Passenger Ry. Co. Elec. 6 m, 4-8½ g, 57, 68 lb T & girder r, 6 c, of which 4 are m c and 2 t c. Westinghouse system. Brill cars. Ball engines. Pres. G. Maltzberger, Sec. & Treas. C. Fegley, Gen. Man. & Supt. L. P. Muthart. 5 3

POTTSVILLE, PA.—People's Ry. Co. Elec. 4½ m, of which 3½ are steam and 1 elec., 4-8½ g, 50, 60 lb flat T r, 8 c. Short system. Pres. T. A. Reilly Sec. & Supt. Wm. D. Pollard. Office, 221 S. Centre st. 6 3

Schuylkill Electric Railway Co. 8½ m, 4-8½ g, 40, 52 lb T & girder r, 15 c, of which 14 are m c and 1 t c. Short system. Brill and Peckham cars. Ball engines. Pres. & Gen. Man. J. K. Sigfried, V. Pres. F. G. Yuengling, Sec. J. Newlin, Treas. J. F. Zerby. Capital, $150,000. Bonds, $95,000. 8 3

POUGHKEEPSIE, N. Y.—City R. R. Co. 4½ m 4-8½ g. 42 lb s b & c b r, 10 c, 49 h. Pres. J. W. Hinckley, Sec. I. DeGroff, Treas. J. Doheny, Supt. C. M. Davis. Capital $80,000. Office, 491 Main st. 11 2

PROVIDENCE, R. I.—Union R. R. Co. Elec 65 m, of which 55 are horse and 10 elec; 4-8½ g, 54.70, 90 lb girder r, 329 c, of which 302 are h c and 27 m c, 1,543 h. T-H system. Pres. N. W. Aldrich, Sec. Henry V. A. Joslin, Treas. C. A. Babcock, Gen. Man. A. T. Potter. Capital, $2,000,000; authorized, $3,000,000. Office, 18 Westminster St. 6 3

Providence Cable Tramway Co. 3.2 m cable. Also run over 6 m of Union R. R. with horses, 4-8½ g, 38 & 50 lb girder r, 58 c of which 14 are g c and 44 t c, 168 h. Own and Stephenson cars. Harris engines. Pres. B. A. Jackson, Sec. H. V. A. Joslin, Treas. C. A. Babcock, Gen. Man. A. T. Potter, Supt. M. H. Bronsdon. Capital, $300,000; authorized, $400,000. Office, 18 Westminster St. (Stock held by Union R. R. Co.) 6 3

PROVO CITY, UTAH.—Provo City Ry Co. 9 m 4.8½ g, 30 lb steel T r, 8 c, of which 5 are closed and 3 flat, 2 steam motors. Pres. T. Holbrook, V. Pres R. H. Dodd, Sec. M. Snow, Gen. Man. R. Bachman Jr. Capital, $55,000. Address P. O. Box 278. 7 1

PUEBLO, COLO.—Pueblo City Ry. Co. Elec. 25 m. 4 g, 35 & 40 lb T r. 40 c, of which 24 are m c and 16 t c. T-H system. Woeber cars. Ellis engines. Pres. J. E. Downey, V. Pres. F. J. Chamberlain, Sec. J. B. Downey, Treas. G. H. Hard, Gen. Man. H. E. Chubbuck, Supt. W. A. Martin, Capital, $500,000. 6 3

PUNXSUTAWNEY, PA.—Punxsutawney St. Pass. Ry. Co. Elec. 2 m, 4-8½ g, 51½ lb girder r, 3 m c. Westinghouse system. Newcastle cars. Greene engines. Pres. S. E. Wilson, V. Pres. J. K. North, Sec. A. J. Truit, Treas., Gen. Man. & Supt. L. C. Myers. Capital, $18,000. Bonds, $14,000. 8 3

PUT-IN-BAY, O.—Put-In-Bay Water Works, Light & Ry. Co. Elec. 3.75 m, 4-8½ g, 45 lb T r, 8 c, of which 4 are m c, and 4 t. c. T-H system. Pres. G. H. Ketchum, V. Pres, and Gen. Man. J. K. Tillotson, Sec. and Treas. F. M. Ohl. 8 1

Q

QUEBEC, CAN.—Quebec St. Ry. Co. 3 m, 4-8¾ g, 45 lb Phila. r, 12 c, 8 busses, 11 sleighs, 62 h. Pres Chas. St. Michel, V. Pres. W. Hossack, Sec., Treas Supt. & Man., F. T. Boomer. Capital $50,000. Authorized $100,000. Box 74, Crown St. 6 3

St. John St. Ry. Co. Lim. 1¾ m, 4-8¾ g, 35 lb s.b. r, 4 4-wheel box c, 24 h. Run a 'bus service out 4 m. from city limits, connecting with car service Pres. A. Robertson, V. Pres. W. DeQuincy Sewell, Sec. & Man. W. W. Martin. Capital, $30,000. Office, 564-6 St. John St. 6 3

QUINCY, ILL.—Quincy Horse Ry. & Carrying Co., Elec. 11½ m, 5 g, 38, 45, 52 lb T & girder r, 23 c of which 16 m c & 7 t c, 4 mu, T-H. system. Pres W. S. Warfield, V. Pres. W. McFaden, Sec. & Supt. E. K. Stone, Jr., Treas. F. W. Meyer. 9 3

QUINCY, MASS.—Quincy St. R. R. Leased to Quincy & Boston St. Ry. Co.

Quincy & Boston St. Ry. Co. Elec. 13 m, 4-8 g, 35, 58 lb T & flat r, 20 m c. T-H system. Pres. J. R. Graham, Sec. & Treas. F. H. Smith, Supt. B. J. Weeks. Capital, $50,000. 9 3

R

RACINE, WIS.—Belle City St. Ry. Co. Elec. 15 m, 4 g, 45, 52 lb T & girder r, 26 c, of which 20 are m c and 6 t c. Detroit system. American, Lamokin and St. Louis cars. Bullock-Corliss engines. Pres. & Treas. C. H. Holmes, V. Pres., Sec. & Gen. Man. A. Shewmon. Capital $100,000. Bonds $200,000. Office, 323 Lake ave. 8 3

RALEIGH, N. C.—Raleigh St. Ry. Co. Elec 6 m, 4-8½ g, 30, 35 lb T & flange r, 11 c, of which 8 are m c and 3 t c. Edison system. Brill cars. Frick engines. Pres. J. C. George, Sec. & Treas. W. G. Weld, Gen. Man. S. W. Huff. Capital stock, $25,000. Bonds $125,000. 6 3

RAPID CITY, S. DAK.—Rapid City St. Ry. Co 2 m, 4 g, 25 lb r, 2c, 4 h. Pres. E. B. Chapman, V Pres. James Halley, Sec., Treas. & Supt. J. W. Post Capital $100,000. 10 1

READING, PA.—Reading City Pass. Ry. Co. (Leased to Reading Traction Co.) Elec. 28 m, of which 7 are horse and 21 elec. 5-2½ g. 52, 60 & 93 lb girder r, 104 c of which 75 are h c add 29 m c. Gen. Elec. system. Brill and St. Louis cars. Pres. B. F. Owen, Sec. & Treas. H. A. Muhlenberg, Supt. S. E. Rigg. Capital $10,000. Bonds $104,000. 9 3

East Reading Electric Ry. Co. (Leased to Reading Traction Co.) Elec. 5½ m, 5-2½ g, 42 lb T and girder r, 9 c of which 8 are m c & 1 t c. Edison and Westinghouse systems. Brill, Gilbert and Stephenson cars. Pres. A. J. Brumbach, V. Pres. J. G. Leinbach, Sec. A. H. Fegley, Treas. I. W. Levan, Gen. Man. M. Shaaber, Asst. Gen. Man. C. E. Lenhart. Capital $100,000. 6 0

Neversink Mountain R. R. Elec. 12 m, 4-8½ g, 56 lb T r, 13 c, of which 7 are m c and 6 t c. Edison system. Brill cars. Water power. Pres. H. T. Kendall, V. Pres. G. Brooke, Sec. M. C. McElhain, Treas. D. W. Stehman, Gen. Man. Paul D. Milholland. 9 3

Reading & South Western St. Ry. Co. Elec. 5½ m 4-8½ g, 40-56 lb T & girder r, 14 c, of which 8 are m c and 6 t c. Curtis, T-H & Edison systems. Brill, Lewis & Fowler and Stephenson cars. Ball engines Pres. J. W. Shepp, V. Pres. J. B. Sterley, Sec. & Treas. V. S.Seltzer, Gen. Man. & Supt. G. W. Keim. Capital, $130,000. Office, Water st., below Chestnut. 8 3

RED CLOUD, NEB.—Red Cloud Street Ry. 1 m, 3 c, 6 mu. Proprietor, L. Crabill. 2 3

REDLANDS, CAL.—Redlands St. Ry. Co. 3½ m, 4-2 g 20 lb T r, 1 open c, 8 mu. Pres. A.E. Sterling V. Pres. S. J. Hayes, Sec. E. W. Wilmot, Treas. First National Bank. Capital, $50,000. 11 2

RED OAK, IA.—Red Oak St. R.R. Co. 1¼m, 4-2½ g. 20 lb flat r, 2 c, 4 mu. Pres. Gen. Man. & Supt. M. Bonham, V. Pres. J. Hayes, Sec. F. M. Byriket. Capital $75,000. 7 1

RICHMOND, IND.—Richmond City Elec. St. Ry Co. 11 m, 4-8½ g, 40, 60 lb T r, 24 c. of which 14 are m c and 10 t. c. T-H system. Pres. J. F. Miller, Sec. R. B Harrison, Treas. D. G. Reid, Gen. Man. A. D. Titsworth, Elec. Supt. E. Kessler. Capital $200,000. 10 3

RICHMOND, VA.—Richmond Ry. & Electric Co. 50 m, 4-8½ g, 45-55 lb flat and c b r, 112 c. Edison and Westinghouse systems. Pres. J.P. Munn, Treas. & Gen. Man. G. E. Fisher; Supt. City Division, C. Selden; Supt. Union Division, J. W. Wilbur; Supt. Manchester Division, B. R. Selden. Capital, $1,250,000; authorized, $2,000,000. Office, 909 Bank st. New York office, 261 Broadway. 3 3

North Side Land & Highland Park R. R. Co. Elec 3 m, 50 lb T & flat r. Westinghouse system. Pres. N. V. Randolph, V Pres. B. F. Johnson, Sec. & Treas. F Mosby, Gen. Man. J. D. Mosby. Operated by Richmond & Manchester Ry. Co. 8 1

RIVERSIDE, CAL.—Riverside & Arlington St. Ry. 12½ m, 4-6 g, 22-34 lb T r, 6 c, of which 3 are 4-wheel box & 3 4-wheel open, 20 mu. St. Louis cars Pres. S. C. Evans, V. Pres. O. Backus, Sec. F. A. Miller, Treas. Riverside Banking Co., Gen. Man. G. O. Newman, Supt. J. C. Little. Capital $40,000; authorized $200,000. 6 3

ROANOKE, VA.—Roanoke St. Ry. Co. Elec. and steam. 23 m, 4-8½ g, 50 lb T r, 14 c, of which 9 are m c. and 5 t c. Westinghouse and Edison systems. Pres. S. W. Jamison, V. Pres. & Treas. J. T. Engleby Sec. G. C. McCahan, Gen. Man. & Supt. W. F. Carr. Capital, $300,000; authorized, $500,000. Bonds, $200,000. Office, 301 Terry Bldg. 9 3

ROCHESTER, PA.—People's Electric St. Ry. Co. 4 m, 5-2½ g, 45 lb T & girder r, 4 m c. T-H system. Laclede cars. Phœnix engines. Pres. H. P. Brown, Sec. J. P. Stone, Treas. C. H. Bentel, Supt. C. A. Danals. Capital, $150,000. Bonds $50,000. 9 3

ROCHESTER, N. Y.—Rochester Ry. Co. Elec 76 m, 4-8½ g. 40, 78 lb girder & T r, 207 c, of which 151 are m c and 56 t c, 80 h. Short and Westinghouse systems. Pres. John N. Beckley, V. Pres. B. Graham, Sec. C. A. Williams, Treas. F. P. Allen, Supt. W. Rosborough. Capital, $5,000,000. Bonds $3,275,000. Office, 267 State st. 11 2

Grand View Beach Railway Co. Elec. 9½ m, 4-8½ g, 40 lb T r, 7 c, of which 5 are m c and 2 t c. Gen. Elec. system. Newburyport cars. McIntosh & Seymour engines. Pres. H. H. Craig, V. Pres. Sec. Treas. & Gen. Man. M. Doyle, Supt. W. H. Gillette. Capital, $100,000. Bonds, $200,000. 9 3

Rochester, & Irondequoit Bay Electric Ry. Co. Pres. S. Remington, V. Pres. C. Goetzmann, Sec. & Treas. F. J. Hone. Capital, $1,000,000. n 12 2

Rochester Electric Ry. Co. 8.86 m, 4-8½ g, 40 lb T r, 18 c, of which 11 are m c. and 7 t. c. T-H. and Short systems. Gilbert and Stephenson cars. Armington & Sims and Woodbury engines. Pres. A. Luetchford, V. Pres. J. N. Beckley, Sec. & Treas. M. H. Briggs, Gen. Man. & Supt. C. A. Derr. Capital $200,000. Office Charlotte. 1 3

ROCK ISLAND, ILL.—Rock Island & Milan St Ry. Co. 6½ m, 4-8½ g, 20, 30 & 40 lb r, 8 pass c, 8 ft c 7 h, 2 motors, Pres. H.C. Connelly, Sec. J. M. Buford Treas. P. Fries, Supt. J. Huntoon. p 1 3

ROCKAWAY, N. Y.—The Rockaway Village Ry. Co. 1 m, 4-8½ g, 47 lb c. b. r, 3 c, of which 2 are box and 1 open, 10 h. Pres. C. A. Cheever, V Pres. J. D. Cheever, Sec. J. S. Auerbach, Treas. D. L. Haight. Capital $25,000. Bonds $25,000. Office, 13 Park Row, New York. 9 3

ROCKFORD, ILL.—Rockford City Ry. Co. Elec 15 m. 4-8½ g, 40-45 lb tram & T r; 18 m. c, 6 h. T-H system. Pres. R. N. Baylis, Sec. G. W. Carse, Treas W. H. McCutchen, Gen. Man. & Supt. T. M. Ellis, Capital $150,000. Bonds $120,000. 11 2

West End St. Ry. Co. Elec. 13.20 m, 4-8½ g, 40,45 lb T & girder r, 16 c, of which 13 are m. c. and 3 t c. Short system. Northern cars. Ide engines. Pres., Treas. & Gen. Man. J. S. Ticknor, V. Pres. O. W. Haegg, Sec. Treas. & Supt. F. A. Ticknor. Capital, $61,000; authorized, $75,000. Bonds, $100,000. Office, 205 S. Main st. 6 3

ROCKLAND, MASS.—Rockland & Abington St. Ry. Co. Elec. 18 m, 4-8½ g, 45, 56, 60 lb T & girder r, 10 m c. Jones cars. Pres. E. P. Reed, Sec. G. W. Kelley, Treas. C. N. Cobb, Supt. A. H. Walcott, Capital $60,000. 3 3

ROCKLAND, ME.—Rockland, Thomaston & Camden St. Ry. Co. Elec. 14½ m, 4-8½ g, 50 lb T r, 23 c. Edison system. Briggs cars. Hamilton-Corliss engines. Pres. & Gen. Man. G. E. Macomber, V. Pres. H. L. Shepherd, Sec. H. M. Heath, Treas. A. D. Bird, Supt. H. C. Weston. Capital, $300,000. 9 3

ROCKPORT, TEX.—Aransas Pass St. Ry. Co 4 m, 4 g, 20 lb T r, 2 c, 4 mu. Pres. H. W. Davis V. Pres. W. P. Poland, Sec. & Treas. C. W. Booth Capital, $25,000. Address Box 129, P. O. 9 3

ROME, GA.—Rome St. R. R. Co. (Operates North & South St. Ry.) 6½ m, 4-8 g, 40, 45 lb. T r, 10 c, of which 4 are m c and 6 t c. Edison system. Brill and Lamokin cars. Ball engines. Pres. & Gen Man. John S. Laurence, Sec. L. A. Dean, Treas. J. King. Capital, $100,000. Bonds, $100,000. Office, East First St. 2 3

ROME, N. Y.—Rome City St. Ry. Co. Elec. 6¾ m 4-8½ g, 38½ lb girder r, 14 c, 15 h. Stephenson cars. Pres. J. S. Wardwell, V. Pres. A. C. Kessinger, Sec. & Treas. W. P. Rayland. Capital, $50,000. Bonds, $125,000. Offices, 115 John st. 9 3

RONDOUT, N. Y.—Kingston City R. R. Co. Elec 2.77 m, 4-8½ g, 72 lb girder r, 6 m c. Gen. Elec. system. Pullman cars. Payne engines. Pres. S. D. Coykendall, Sec. & Treas. Peter E. Schoonmaker, Auditor Oscar L. Eastman, Gen. Man. Geo. Coykendall. 9 3

ROXBOROUGH, PA. — Manayunk & Roxborough Incline Plane & Ry. Co. 7½ m, 5-2½ g, 48 lb r, 5 c, 36 h. Pres. G. M. Brill, Sec. F. Pearson, Treas. C. J. McGlinchy, Supt. J. Bramble. Capital, $58,475. Office, Roxborough. 9 3

RUTLAND, VT.—Rutland St. Ry. Co. 8 m, 4-8½ g, 20 lb Tr 10 c, of which 8 are 4-wheel box & 2 4-wheel open, 30 h. Brill and Stephenson cars. Pres. J. W. Cramton, Sec. S. M. Willson, Treas. N. K. Chaffee. Supt. M. McKeough. Capital $50,000. Bonds $28,000. Office 60 State St. 9 3

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SACRAMENTO, CAL.—Central St. Ry. Co. Elec. (includes Sacramento City and Highland Park). 19½ m, 4-8½ g, 30 to 65 lb girder & T r, 27 c, of which 24 are m c and 3 t c. T-H and Edison systems. Pres. J. H. Henry, V. Pres. L. L. Lewis, Sec. H. A. Lewis, Treas. National Bank (D. O. Mills & Co.). Gen. Man. J. B. Edson, Supt. C. M. Spangler. Capital, $500,000. Bonds $265,000. Office, 28 and N sts., Sacramento. 9 3

SAGINAW, MICH.—City of Saginaw St. R. R. Co. 3¾ m, 4-8½ g, 42 lb c. b. r, 16 c, of which 9 are 4-wheel box & 7 4-wheel open, 80 h. Pres. David H Jerome Sec. & Treas. Geo. L. Burrows. Supt. Fred G. Benjamin. Capital $30,000. Office, 426 N. Hamilton st. 6 3

Saginaw Union St. Ry. Elec. 25 m, of which 1 is horse and 24 elec., 4-8½ g, 35-60 lb T and tram r, 45 c, of which 1 is h c, 27 m c and 17 t c, 12 h. Detroit system. Brill, Gilbert and Jones cars. Bartlett-Corliss engines. Pres. F. E. Snow, V. Pres. W. A. Jackson, Sec. & Treas. J. M. Nichol, Gen. Man, W. J. Hart. Capital, $200,000. Bonds, $325,000. 9 3

ST. CATHARINE'S, ONT.—St. Catharine's, Merritton & Thorold St. Ry. Co. Elec. 8½ m, 4-8½ g, 30 lb T & flat r. 10 c, of which 8 are m. c. and 2 t. c. Van Depoele system. Pres. W. B. Gilleland. V. Pres. & Gen. Man. T. Nihan, Sec. & Treas. T. E. Nihan, Jr. Capital, $80,000. Office, St. Paul st. 3 2

ST. CLOUD, MINN.—St. Cloud City St. Car Co. Elec. 10 m, 4-8½ g, 40 lb T r, 8 m c. T-H system. St. Louis cars. Pres. H. M. Byllesly, V. Pres. C. K. Stearns, Sec. W. P. Johnson, Treas. G. C. Duffie, Supt. C. S. Benson. Capital $100,000. Bonds, $125,000. 9 3

St. Cloud & Sauk Rapids Ry. Co. 3 m, 2 m c. T-H system. 9 3

ST. JOHN, N. B.—The Consolidated Electric Co., Ltd., 5 m, 4-8½ g, 45-60 lb r, 5 m c. Edison system. Pres. John F. Zebley, Sec. H. B. Zebley, Gen. Man. C. D. Jones, Supts. A. R. Bliss, J. R. Purdy. 4 3

ST. JOSEPH, MICH.—St. Joseph & Benton Harbor Electric Ry. & Light Co. 5½ m, 4-8½ g, 45 & 52 lb T & Johnson r, 12 c, of which 6 are m c and 6 t c. T-H system. Pres. & Gen. Man. W. W. Bean, V. Pres. G. M. Bell, Sec. W. H. Hull, Treas. W. G. Keith, Supt. H. C. Mason. Capital, $100,000. 6 3

ST. JOSEPH, MO.—People's St. Ry., Electric Light & Power Co. 12 m, 4-8½ g, 40 lb T r, 16 m c. T-H & Edison systems. Pres. J. T. Gardner, V. Pres. & Man. W. T. Van Brunt (St. Joseph). Supt. J. H. Van Brunt. Office, 511 Francis st. 11 2

Union Ry. Co. Elec. 10 m, 4-8½ g, 40 lb. T r, 25 c, of which 21 are m c and 4 t c. T-H and Edison systems. Pres. J. T. Gardiner, V. Pres. & Gen. Man. W. T. Van Brunt, Supt. J. H. Van Brunt. 11 2

Wyatt Park Ry. Co. Elec. 8 m, 4-8½ g, 40 lb T r, 13 c. of which 9 are m c and 4 t c. T-H & Edison systems. Pres. J. T. Gardiner, V. Pres. & Gen Man W. T. Van Brunt, Supt. J. H. Van Brunt. 11 2

ST. LOUIS, MO.—Baden & St. Louis R. R. 3 m, 4-10 g, 24,28,42½ lb T & tram r, 10 c, 27 h. Pres. & Gen. Man. Geo. S. Case, V. Pres. F. J. McMaster Supt. H. Nelson. Capital, $50,000. Office, Broadway near Baden ave. 11 2

Benton-Bellefontaine Ry. Co. Elec. 13 m, 4-10 g, 78 lb girder r, 50 m c. T-H system. Philadelphia-Corliss engines. Pres. James Campbell, V. Pres. & Gen. Man. Robert McCulloch, Sec. W. F. Reed, Supt. J. W. Todd. Capital, $325,000; authorized, $500,000. Bonds, $500,000. Office, 4238 N. 20th st. 6 3

Cass Avenue & Fair Grounds Ry. Co. (Includes Northern Central and Union Rys.) 35 m, 4-10 g, 78, 70 lb. girder r, 70 m c. T-H system. Pres. D G. Hamilton (Chicago), V. Pres. & Gen. Man. Robt. McCulloch, Sec. & Treas. C. N. Duffy, Capital $2,000,000; authorized, $2,500,000. Bonds, $2,000,000. Office 3,820 Easton Ave. 6 3

Citizens' Ry. Co. 16 m, 13 of which are cable, & 3 horse 4-10 g, 63 lb girder r, 172 c, of which 57 are box, 60 open & 55 g. c, 67 h & mu. Pres. D. G. Hamilton (Chicago), V. Pres. & Gen. Man. Robt. McCulloch Sec. & Treas. C. N. Duffy. Capital $1,500,000. Office, 3,820 Easton Ave. 6 3

Denverside St. Ry. Co. (Operated by St. Louis & E. St. Louis Electric Ry. Co.) Elec. 3 m, 4-10 g, 36 lb T r, 4 c, 12 mu. Pres. G. W. Ballantine, V. Pres., Sec. & Supt. J. Scherrer, Treas. J. T. McCasland, Gen. Mans. Scherrer & Son. Capital, $250,000. 6 3

Forest Park & Laclede Ave. & Fourth St. Ry. Co Elec. Operated by Missouri R. R. Co.

Fourth St. & Arsenal Ry. Co. 5 m, 4-10¾ g, 44 lb steel tram r, 12 box c, 90 h. Pres. Chas. Green, V Pres. & Gen. Man. J. Mahoney, Sec. & Treas. R. J. Macdonald. Capital $150,000. Office 1,801 Park ave. 1 2

Jefferson Ave. Ry. Co. 5.7 m, 4-10 g, 56 lb tram r 40 c, of which 20 are box & 20 open, 190 mu. Pres P C. Maffit, Sec. W. D. Henry, Supt. T. W. Murphy Gen, Man. J. Scullin. Capital $112,000. Office, Jefferson ave. & Gravois road. 3 1

Lindell Ry. Co. Elec. 35 m, 4-10 g, 78, 81 lb girder r, 190 c, of which 30 are comb'n c and 160 m c and t c. Edison and Short systems. Brill and St. Louis cars. Porter-Allen engines. Pres. E. Whitaker, V. Pres. C. D. McLure, Sec. & Treas. Jas. Adkins, Gen. Supt. Geo. W. Baumhoff. Capital, $2,500,000. Bonds $1,500.000. Office, 2330 Chouteau Ave. 6 3

Midland St. Ry. Co. Elec. 3 m, 4-10 g, 35 lb T r, c, of which 1 is m c and 2 t c. T-H system. Pres F. Kuhn, V. Pres. E. C. Robbins, Sec. & Treas. G. Kingsland, Gen. Man. E. H. Benoist. Capital $20,000. Office, 823 N. 2d St. 6 3

Missouri R.R. Co. Elec. 27.52 m, 9.06 of which are cable and 18.46 elec. 4-10 g, 63 lb girder r, 290 c, of which 40 are g. c. 44 m. c. and 206 t. c. T-H. system. American, Brill and Brownell cars. Harris & Hamilton engines. Pres. & Gen. Man. P. C. Moffit, V. Pres. J R. Lionberger, Sec. & Treas. F. R. Henry, Supt. James F. Davidson. Capital $2,300,000; authorized $2,400,000. Office, 10 S. Compton Ave. 9 3

Mound City Ry. Co. Elec. 8 m. 25 m, c., 25 t. c. T-H system. Pres. John Scullin, V. Pres. Frank Carter Sec. Jas. H. Roach, Treas. C. M. Seaman, Supt. Jas Scullin. Capital $525,000; authorized $1,525,000. Office, 2,500A St. Louis ave. 11 2

People's R. R. Co. Cable. 9½ m, 4-10 g, 78 lb girder r 100 c, of which 40 are g c and 60 t c, 12 h. Brownell and Stephenson cars. Hooven, Owens & Rentschler engines. Pres. Chas. Green, V. Pres. & Gen. Man. J. Mahoney. Asst. Sec. & Treas. D. J. Mahoney. Capital, $300,000; authorized, $1,000,000. Office, 1,801 Park ave. 9 3

Southern Electric Ry. Co. Elec. 16 m, 4-10 g, 78 lb girder r, 120 c, of which 40 are m c and 80 t c. T-H system. Allis and Ball engines. Pres. Tom L. Johnson, Sec. Treas. & Gen. Man. Jos. S. Minary, Supt. J. C. Allen. Office, 4,041 So. Broadway. 9 3

St. Louis R. R. Co. Cable. 14½ m, 4-10 g, 78 lb girder r, 240 c, of which 80 are g. c. 80 box & 80 open c, Pres. D. G. Hamilton (Chicago), V. Pres. C. Pepper Sec. & Treas. R. B. Jennings, Gen. Man. Robt. McCulloch. Capital, $2,000,000. 6 3

St. Louis & East St. Louis Electric Ry. Co. (Operates Denverside Ry.) 2 m, 4.10 g, 48-56 lb Johnson girder r, 12 m. c. T-H system. Pres. D. R. Powell, V. Pres. C. C. Carroll, Sec. D. T. Breck, Asst. Supt. W. H. Williams. Capital $250,000. Bonds $75,000. Office, 115 N. 3d st. 6 3

St. Louis & Suburban Ry. Co. Elec. 28 m, 4-10 & 3 g, 35,40,69 lb T & girder r, 45 m c and 60 t c. T-H system. Pres. C. H. Turner, V. Pres. S. M. Kennard, Sec & Treas. S. D. Barlow, Jr., Gen. Supt. T. F. Sneed Capital, $2,500,000. 6 2

Union Depot R. R. Co. Elec. 54 m, 4-8½ g, 50 & 78 lb girder r; 196 c, of which 80 are m c and 116 t c T-H system. Pres. J. Scullin, V. Pres. H. Scullin, Sec. Jas. H. Roach, Gen. Supt. T. W. Murphy. Capital $1,200,000; authorized $1,200,000. Bonds $1,000,000 Office, Geyer & Jefferson aves. 11 2

ST. PAUL, MINN.—Twin City Rapid Transit Co (see Minneapolis, Minn).

St. Paul & White Bear Ry. Co. 11½ m, 4-8½ g, 50 lb T r, 13 c, of which 9 are m c and 4 t c. T-H system. Laclede and Pullman cars. Baldwin engines. Pres. & Gen. Man. W. S. Norton, V. Pres. L. K. Stone Sec. & Treas. W. Ruan, Supt. S. B. Livermore. Capital, $200,000. Bonds, $200,000. 9 3

ST. THOMAS, CAN.—St. Thomas St. R. R. Co. 2 m, 3-6 g, 30 lb tram r, 4 c, 8 h. Pres. Cameron Currie, V. Pres. J. Winter, Sec. C. W. Smith, Treas S. Hendrie, Man. J. Campbell. Office, St. Thomas Ont. f 10 0

SALEM, MASS.—(See Lynn).

SALEM, N. C.—Winston-Salem Ry. & Elec. Co (See Winston, N. C.)

SALEM, O.—Salem Electric Ry. Co. 3½ m, 4-8½ g 45 lb Johnson girder r, 6 c, of which 4 are m. c. and 2 t. c. T-H system. Pres. & Treas. M. Davis, V. Pres. J. M. Evans, Sec. & Gen. Man. D. L. Davis. Capital, $100,000. Bonds, $50,000. Office, 210 E. Main st. 9 3

SALEM, ORE.—Salem Consolidated St. Ry. Co. 8 m, 4-8½ g, 40 lb. T r, 9 m c. Edison system. Brill, Pullman and Stockton cars. Beck, Sioux City and Westinghouse engines. Pres. C. B. Markle, V. Pres. E. P. McComack, Sec. F. H. Page, Treas. A. P. Fuller, Gen. Man. F. R. Anson, Supt. L. McGrew. Capital, $289,900; authorized. $500,000. Bonds, $250,000. Office, 179 Commercial St. 9 0

SALINA, KAN.—Consolidated St. Ry. & Lt. Co 4 m, 4 8½ g, 52 lb T r, 4 m c. Detroit system. V. Pres. E. H. Chandler, Sec. & Treas. C. F. French, Supt. C. L. Baum Capital, $100,000. Bonds, $50,000.. 11 2

SALT LAKE CITY, UTAH.—Salt Lake City R. R. Co. Elec. 42 m, 4-8½ g, 30, 35, 40, 72, lb. T r, 63c, of which 57 are m c and 6 t c. Westinghouse, T-H & Edison systems. Stephenson cars. Fraser & Chalmers engines. Pres. A. W. McCune, V. Pres. R. C. Chambers, Sec, & Treas. Joseph S. Wells, Supt Walter P. Read. Capital, $650,000; authorized $1,000,000. Bonds $650,000. Office Hooper building. 9 3

Salt Lake Rapid Transit Co., Elec. 32 m, 4-8½ g, 35 40, 79 lb T & girder r, 41 c, of which 30 are m. c. and 11 t c. 3 h. T-H., Edison and Westinghouse systems. Stephenson & Woeber cars. Ide engines. Pres. & Gen. Man. J. S. Cameron, V. Pres. J. M. Donnellan, Sec. C. B. Jock, Treas. G. S. Gannett, Supt. A. M. Hinckley. Capital, $500,000. Office, 176 State st., Rooms 14, 15, 16. 9 3

West Side Rapid Transit Co. Elec. & Steam. 8 m, of which 6 are steam and 2 elec, 4-8½ g, 30 lb T r, 5 c of which 2 are steam comb'n m c, 2 m c and 2 t. c. T-H system. Pres. S. F. Walker, Sec. F. Harris, Treas. W. S. McCormick, Gen. Man. & Auditor, J. G. Jacobs, Supt. C. S. Wilkes. Capital $300,000. Bonds $400,000. Office Eagle Block. 3 3

SAN ANTONIO, TEX.—San Antonio St. Ry. Co. Elec. 40 m, 40, 50, 56 lb T r, 55 c, of which 40 are m c and 15 t c. T-H system. Pres. & Treas. W. H. Weiss, V. Pres. C. H. Weiss, Sec. E. R. Norton, Supt. J. W. Greer. Capital, $200,000; authorized, $1,000,000. Bonds, $200,000. 11 2

Citizen's Electric Power & St. Ry. Co. 13 m, 4-8½ g, 40, 48 lb T r, 20 c, of which 10 are m c and 10 t c. T-H system. Lewis & Fowler cars. Pres. W. J. Clark, V. Pres. H. E. Barnard, Sec. & Treas. A. H. Dollard, Gen. Man. C. E. Harris, Supt. S. F. Walker. Capital, $300,000; authorized $600,000. Bonds $300,000. Office, 415 Navarro St. 9 3

San Antonio Rapid Transit St. Ry. Co. Elec. 5 m 4-8½ g, 40 lb T r, 3 m c. T-H system. Pres. W. J. B Patterson, V. Pres. R. H. Russell, Sec. & Gen. Man G. S. Simons, Treas. C. W. Ogden, Supt. B. W Randall. Capital, $200,000. Bonds, $100,000. 6 3

West End St. Car Co. Elec. 5½ m, 4-0 g, 30 lb T r, 6 c, of which 3 are m c and 3 t c. T-H system. Pres. & Gen. Man. G. W. Russ, V. Pres. F. H. Baldwin, Sec. J. N. Groesbeck, Treas. Thad. W. Smith, Gen. Man. G. W. Russ, Supt. F. M. Dowden. Office, 285 Commerce St. 11 2

SAN BERNARDINO, CAL.—Southern California Motor Road Co. 12 m, 4-8½ g, 40 lb T r, 6 c, 3 Baldwin motors. Receiver I. H. Polk, Sec. & Treas. W. S. Hooper, Supt. H. C. Guiteau. Capital, $1,000,000. Office, 3rd & E Sts. 2 3

San Bernardino St. Ry. Co. 1½ m, 3 ft. g, 20 lb T r, 2 c, 2 h. Pres. I. R. Brunn, Sec. & Treas, W. S Hooper. Capital $50,000. 6 3

SAN DIEGO, CAL.—San Diego Cable Ry. Co. 10¼ m, 3-6 g, 20-30 Z & T r, 14 c of which 10 are comb'n & 4 open. Receiver, G. H. Hensley. 11 2

San Diego Electric Ry. Co. 20 m, of which 5 are horse and 15 elec, 4-8½ g, 38, 40, 52½ lb T & girder r, 40 c, of which 30 are h c and 10 m c. T-H system Pres. A. B. Spreckels, V. Pres. E. S. Babcock, Sec., Treas. & Gen. Man. J. A. Flint. Capital $500,000 authorized $350,000. Office E and Arctic sts. 9 3

San Diego, Old Town & Pacific Beach R. R. Co. Dummy. 11½ m, 4-8½ g, 35, 40 lb T r, 11 passenger c, and 3 motors. Pres. & Gen. Man. H. Dabury, Sec R. P. Dabury. Capital, $250,000. 11 2

SAN FRANCISCO, CAL.—California Street Cable R.R. Co. 11 m, 3-6 g, 34 lbs-b r, 60 c. Pres. J. B. Stetson, V. Pres. Antoine Borel, Sec. Albert Stetson Treas. A. Borel & Co., Gen. Man. & Supt. J. W. Harris. Office, Cor. California & Hyde sts. 6 3

Market St. Ry. Co. (Controls Central, City, Ferries & Cliff House, Geary St. & Ocean, North Beach & Mission, Omnibus and Potrero & Bay View Railroads) 175 m, of which 76 are cable, 75 orse 10 elec and 15 steam, 3-6, 4-8½, 5 g, 37, 40, 45, 51, 62 lb combination r, 677 c, of which 200 are g c, 15 dummies, 19 steam c 463 h. Pres. C. F. Crocker, V. Pres. H. E. Huntington, 2d V. Pres. & Gen. Man. M. D. Stein, Sec. & Controller S. L. Willcutt, Treas. N. T. Smith. Supts. A. W. Barron, N. J. Bailey, J. F. Clark, H. O. Rogers, M. Skelly, H H. Lynch, Man. of Purchases and Supplies, R. P. Schwerin, Engrs. G. H. Fairchild, L. M. Clement. Capital $18,000,000. Office, 4th & Townsend sts. 10 3

Metropolitan St. Ry. Co. 11 m, 5 g, 40 lb girder r, 72 m c. T-H system. Pres. W. Easton, V. Pres. P. N. Lilienthal, Act. Sec. C. C. Miniffe, Supt. H. A Iddings. 6 3

Presidio & Ferries R. R. Co. 11½ m of which 7½ are cab.e, 2 horse & 2 steam, 5 g, 40 & 42 lb c b r, 30 c of which 5 are h c and 25 g c, 30 h. Pres. G. A. Newhall, V. Pres. H. M.A. Miller, Sec. John B. Leighton, Treas. J. C. Johnson, Supt. I. F. Kydd. Capital $10,000. Bonds $250,000. Office, 1,111 Union St. 6 3

San Francisco & San Mateo Ry. Co. 21 m, 4-8½ g 50 lb T & comb'n r, 33 c, of which 30 are m c and 3 t c. T-H system. Pres. & Gen. Man. B. Joost, V Pres. C. C. Butler, Sec. G. T. Smith, Treas. Nevada Bank of San Francisco, Supt. F. C. Simpson. Capital $2,000,000. Bonds $1,100,000. Office 30th St. & San Jose Ave. 6 3

Sutter St. Ry. Co. 13 m of which 1.3 are horse & 11.7 cable, 5 g, 46 lb s b r, 50 c, 100 h. Pres. R. F Morrow, V. Pres. J. L. Schmitt, Sec. A. K. Stevens Treas. M. Schmitt, Supt. J. Reynolds. Office, corner Sutter & Polk sts. Capital $2,000,000. 9 3

SAN JOSE, CAL.—San Jose & Santa Clara R.R. Co Elec. 12 m, of which 1 is horse & 11 elec. 3 g, 20 & 35 lb T r, 26 c, of which 4 are h c, 13 m c and 9 t c. T-H & Edison systems. Pres. J. H. Henry, V. Pres. & Gen Man. J. P. Burke, Sec. J. T. McGeoghegan, Supt. W W. Skinner. Capital $500,000. Bonds $200,000. Office The Alameda. 6 3

First St. R. R. Elec. 10 m, 3 g, 30 lb steel T r, 12 c of which 7 are m. c. and 5 t. c. T-H system. Jacob Rich, Sole Owner; Sec. E. M. Rosenthal. 2 2

First St. & San Pedro St. Depot R. R. Co. Pres. Frank C. Bethel.

San Jose & Alum Rock Park Motor Road. 4 m, 3 g, 30 lb T r; 18 c, of which 6 are Damar Best Electro Vapor motor cars and 12 t c. Capital $150,000. Address R. H. Quincey, San Jose. 3 2

Willow Glen R.R. 2½ m, 3 g, 20 lb steel T r, 3 c, 20 h Sole owner Jacob Rich, Sec. E. M. Rosenthal. 7 0

SAN LUIS OBISPO, CAL.—San Luis St. Ry Co. 2½ m, 3 g, 16 lb T r, 5 c, of which 2 are 4-wheel box & 3 4-wheel open, 10 h. Owned by West Coast Land Co. Pres. J. L. Howard, V. Pres. R. E. Jask, Sec & Gen. Man. C. H Phillips. Office, Higura St. 11 2

SANDUSKY., O.—Sandusky St. Ry. Co. Elec. 1½ m, 4-8½ g, 45 lb T and girder r, 14 c, of which 12 are m c and 2 t c. Westinghouse system. Brownell and Gilbert cars. Pres. A. J. Stoll, V. Pres. C. Moss, Sec. & Treas. G. F. Anderson, Supt. E. G. Schmidt. Capital $119,000; authorized $150,000. Bonds $40,000. 6 3

People's Electric Railway Co. 6¼ m, 4-8½ g, 40-45 lb T & girder r, 8 m c. Westinghouse system. Pres. H. C. Post, V. Pres. G. Barney, Sec. & Treas. A. W. Prout, Gen. Man. T. Wood, Supt. E. L. Crawford Capital $80,000; authorized $100,000. Bonds $31,500 Office 122 Lawrence st. 2 3

Sandusky, Milan & Huron Electric Ry. Co. Receiver, J. C. Gilchrist, Jr. Capital, $80,000; authorized $100,000. Office, 122 Laurence St. n 8 3

SANFORD, ME.—Mousam River R. R. Co. Elec 2½ m, 4-8½ g, 60 lb T r, 4 c of which 2 are m c and 2 t c. Westinghouse system. Amesbury and Briggs cars. Somersworth engines. Pres. E. M. Goodall, V. Pres. C. B. Goodall, Sec. G. B. Goodall, Treas. G. F. West, Gen. Man. & Supt. E. K. Day. Capital, $75,000. 9 3

SANTA ANA, CAL.—Santa Ana, Orange & Tustin St. Ry. Co. 10 m, 3-6 g, 16 & 25 lb steel T r, 6 c, 10 h, 6 mu. Pres., Supt. & Gen. Man. M. J. Bundy, V Pres. Noah Palmer, Treas. Commercial Bank, Sec Miss. M. A. Ross-Lewin. Office, 419 North Main St Capital $35,660; authorized $50,000. 11 2

SANTA BARBARA, CAL.—Santa Barbara St. R.R. Co. and Citizens' St. R. R. Co. of Santa Barbara. 7 m, 3-6 g, 20 lbs T r, 7 c, 36 mu. Pres. Warren Gillilen, Sec. & Supt. C. R. Diver, Treas. G. H. Bonebrake. Capital $50,000; bonds $50,000. Office, State st. 6 3

SANTA CRUZ, CAL.—Santa Cruz Electric Ry. Co. (Operates Pacific Ave. R. R.) 7 m, 3-2 g, 35, 40 lb girder & T r, 8 m c. T-H system. Pres. J. H. Logan, V. Pres. E. G. Green, Sec. F. W. Swanton, Treas. Bank of Santa Cruz County, Gen. Man. F. W. Ely. Capital $500,000. 6 3

SANTA ROSA, CAL.—Santa Rosa, St. R. R. Co. 1½ m, 3-6 g, 12 lb T r, 5 c, 4 h, 3 mu. Pres. M. L. McDonald, Sec. & Treas. M. L. McDonald, Jr. Capital, $25,000. 5 3

Central St. Ry. Co. 3 m, 3-6 g, 24, 35 lb flat r, 4 c. Pres. J. D. Barnett, Sec. J. W. Warboys, Treas, W. Prindle. Capital, $25,000. 5 3

Union St. Ry. Co. 4 m, 3 6 g, 35 lb flat r, 8 c. Pres. B. M. Spencer, Sec. J. M. Farnham, Treas. J. H. Bush. Capital, $50,000. 5 3

SARATOGA, N. Y.—Union Electric Ry. of Saratoga. 10 m, 4-8½ g, 50 lb T r, 20 c, of which 8 are m c and 12 t c. T-H system. Pres. C. E. Arnold Sec. M. Nussbaum, Treas. E. J. Slattery. Capital $300.000. Bonds, $100,000. 9 2

SARNIA, ONT.—Sarnia St. Ry. Co. 4 m, 4-8½ g, 40 lb Tr, 9 c, 21h. Pres. Jas. S. Symington, V. Pres James Smith, Sec. & Gen. Man. H. W. Mills. Capital, $30,000. Office, Industrial Bank Building. 9 3

SAUGATUCK, CONN.—Westport & Saugatuck Horse R. R. Co. (See Westport, Conn.

SAULT STE. MARIE, MICH.—Sault Ste. Marie St. Ry. Co Elec. 4.25 m, 4-8½ g, 20 lb T r, 5 m. c. Detroit system. Pres. Thos. Ryan, V. Pres. B. F. McEvoy, Sec. & Treas. James R. Ryan, Gen. Man. Lorenzo G. Cody, Supt. G. A. Cody. Capital, $25,300. Cash paid in to equip, $60,000. 2 3

SAVANNAH, GA.—City & Suburban R. R. Co. (Includes Savannah, Thunderbolt & Isle of Hope Ry. Co.) Elec. 29 m, of which 4 are steam and 25 elec. 5 g, 35-52 lb c b & T r, 50 c, of which 10 are steam c. 30 m c and 10 t c. T-H system. Cope-Corliss engines. Pres. J. H. Johnson, V. Pres. H. Parsons, Sec. E. J. Thomas, Treas. E. Schmitt, Gen. Man. F. E. Laughton. Capital, $50,000. 9 3

Savannah St. Ry. Elec. 12¾ m, 4-8½ g, 50 lb T & c b r, 26 c, of which 17 are m c and 9 t c. T-H system. Pres. W. G. Cooper, Sec. H. C. Cunningham Treas. & Gen. Man. Clement Saussy. Capital, $100,000 authorized, $500,000. Bonds, $250,000. Office, Haversham & St. Thomas sts. 2 3

SCHENECTADY, N.Y.—Schenectady St. Ry. Co Elec. 5¼ m, 4-8½ g, 60 lb T and girder r, 11 m. c. Edison system. Gilbert and Jones cars. Westinghouse engines. Pres. John Kreusi, V. Pres. E. H. Lewis, Treas. W. E. Gilmore, Gen. Man. H. S. Cooper, Supt. P. J. Mynderse. Capital $300,000. Bonds $250,000. Office. 224 State st. 6 3

SCRANTON, PA.—People's St. Ry. Co. Elec (Operates Nayaug, Crosstown, Scranton & Suburban and Scranton Passenger). 30 m, 4-8½ g, 40 & 52 lb girder & T r, 88 m c. Westinghouse system. Dickson-Corliss engines. Pres. P. S. Page, V. Pres. & Gen. Man. H. H. Archer, Sec. & Treas. Horace E. Hand, Supt. C. H. Smith. Capital, $600,000. 9 3

Scranton Passenger Ry. Co. Westinghouse system. Capital, $50,000. Bonds, $100,000. Owned and operated by People's St. Ry. Co. 9 3

Scranton & Suburban Ry. Co. (Merged with Nayaug and Crosstown Ry.) Westinghouse system. Capital, $100,000. Bonds $200,000. Leased to and operated by People's St. Ry. Co. 9 3

Scranton Traction Co. (Operates People's, Nayaug, Crosstown, Scranton & Suburban and Scranton Pass. Rys.) Pres.————————V. Pres. J. P. Ilsley, Sec. & Treas. C. F. Stevens. Gen. Man. H. H. Archer. Gen. Supt. C. H. Smith. Audr. J. H. Gormley. Capital $2,000,000. Bonds $1,000,000. 9 3

SEARCY, ARK.—Searcy & West Point R.R. Co 8½ m, of which 3½ are horse & 5 steam, 4-8½ g, 35 lb T r, 4 c, 1 mu. St. Louis cars. Porter engines. Pres. W. H. Lightle, V. Pres. E. A. Robbins, Sec. W. S. Lay, Treas. J. S. Sanford, Gen. Man. & Supt. J. Hicks. Capital $75,000. 9 3

SEATTLE, WASH.—Grant Street Electric Ry. Co. 7 m, 3-6 g, 56 lb girder & T r, 12 m c. Sander cars. Westinghouse engines. Pres. & Gen. Man. F E. Sander, V. Pres. N. B. Sander, Sec, & Treas. L. D. Bruns, Supt. R. E. Sander. Capital, $200,000. Bonds, $125,000. 9 3

Green Lake Electric Ry. Co. 4½ m elec. 4-8½ g, 40 lb T r, 4 c, of which 2 are m c and 2 t c. T-H system. Pullman cars. Pres. W. D. Wood, V. Pres. J. Ledoy, Sec. & Treas. C. A. Kilbourne, Gen. Man. E. C. Kilbourne. Capital, $60,000; authorized, $70,000. Bonds, $50,000. Office, 815 Second St. 2 3

Madison St. Cable Ry. Co. (Controls South Seattle Cable Ry.) 12½ m, of which 7½ are cable and 5 elec. 3-6 and 4-8½ g. 45 lb steel r, 16 comb'n c, 2 m c. T H system. Pres. H. G. Struve, V. Pres. R. H, Denny Sec. M. McMicken, Treas. J. Furth, Asst. Sec. W. B. Goodrich, Supt. S. Gibson. Capital $1,200,000. Office Madison St. Power House. 6 3

Rainier Avenue Electric Ry. Co. 8 m, 4-8½ g, 30-45 lb T & girder r, 20 c, of which 4 are m c and 16 t c, T-H system. Northern cars. Corliss type engine. Pres. J. K. Edmiston, Sec. & Treas. A. C. Marconnier, Supt. & Engr. W. M. Camp. Capital, $250,000. 2 3

Seattle City Ry. Co. Cable. 5 m. 3 g, 16 lb T r, 28 c, of which 12 are g. c. and 16 t. c. Pres. & Gen. Man. F. E. Sander, V. Pres. N. B. Sander, Sec. L. D. Bruns, Supt. R. E. Sander. Capital, $600,000. Bonds, $1,000,000. Office Power House, Yessler Ave. 9 3

Seattle Consolidated St. Ry. Co. (Controls Front St. Cable, North Seattle Cable and Rainier Ry. & Power Co) Elec. 40½ m, of which 7 are cable and 33½ elec. 4-8½ g, 40-45 lb T & girder r, 54 c, of which 38 are m. c. and 16 cable c. T-H system. Jones and Pullman cars. Reynolds-Corliss engines. Pres. D. T. Denny, V. Pres. J. B. Denny, Sec. V. H. Smith, Treas. R. R. Spencer, Man. D. Thomas Denny, Gen. Supt. C. S. Clark, Audr. A. Dunn. Capital, $1,200,000; authorized $1,500,000. Bonds $871,000. Office, 200 Pike st. 6 3

Union Trunk Line. 12 m, of which 10 are elec and 2 cable; 4-8½ g, 19 c, of which 11 are m c and 8 g c. T-H and Edison systems. Lane & Bodley engines. Pres. E. F. Wittler, V. Pres. J. F. McNaught, Sec. J. D. Lowman, Gen. Supt. E. B. Hussey. Capital, $1,000,000. Office James St. Power station. 6 3

West Seattle Cable Ry. Co. 2 m, 3-6 g, 4 c. Wheelock engines. Pres. T. Ewing, Man. J. H. Watson. Capital $150,000. 12 1

West St. & North End Electric Ry. Co. 8 m, 4-8½ g, 35 & 45 lb T & girder r, 14 c, of which 13 are m c and 1 t c. T-H system. Northern Car Co. cars. Hamilton-Corliss engines. Pres. J. Leary, V. Pres. B. Pelly, Sec. E. C. Kellogg, Treas. W. R. Ballard, Gen. Man. & Supt. T. Imeson. Capital, $1,000,000. Office, cor. Alva & 3d ave. E. 6 3

Woodland Park Electric Ry. Co. 1½ m, 4-8½ g, 60 lb T r, 1 m c. T-H system. Brill cars. Pres. & Gen. Man. G. C. Finney, Sec. & Treas. C. J. Brenton. Office 110 Seneca St. 4 3

SEDALIA, MO.—The Electric Ry., Light & Power Co. of Sedalia. 9 m, 4-8½ g, 35 lb T r, 20 c, of which 4 are h. c, 10 m c. and 6 t. c. Edison system. Pres. W. E. Sterne, V. Pres. R. R. Moore, Sec. Treas. & Man. D. C. Metsker, Supt. Chas. Carroll. Capital, $200,000. Bonds, $175,000. Office, 207 E. 3d St 6 3

SELMA, ALA.—Selma St. & Suburban Ry. Co. Dummy. 8 m, of which 2½ are horse and 5½ steam 4-8½ g, 20 & 35 lb T r, 10 c, of which 6 are h c and 4 t c, 1 steam motor, 20 mn. Pres. S. H. March, Sec. Treas. & Gen. Man. R. H. McFaddin. Capital, $30,000. 11 2

SENECA FALLS, N. Y.—Seneca Electric Ry Co 3½ m, 4-8½ g, 40 lb T r, 6 c, of which 2 are m c, & 4 t c. T-H system. Brill cars. Pres. S. L. Phillips, V. Pres. & Treas. J. H. Gould, Sec. C. H. Williams, Supt. E. F. Slack. Capital, $50,000. 2 3

SHAMOKIN, PA.—Shamokin Electric St. Ry. Co 3 m, 5-2 g, 35, 48½ lb T and girder r, 6 c, of which 4 are m c and 2 t c. T-H. system. Brill cars. —— engines. Pres. R. S. Aucker, Sec. S. Heckert, Treas. M. Markle, Gen. Man. & Supt. G. Marshall. Capital $50,000; authorized, $80,000. Bonds, $22,500 6 3

Shamokin & Mt. Carmel Electric Ry. Co. 15 m, 4-8½ g, 50 lb. T r 12 c, of which 6 are m c and 6 t c. Pres. E. C. Hamilton, Sec. D. J. Lewis, Treas. H. S. Robins. Office, 321 Independent St. 9 3

SHARON, PA.—Shenango Valley St. Ry Co. Elec 4½ m, 5-2½ g, 45 lb T & girder r, 4 m c. T-H system New Castle cars. Phœnix engines. Pres. J. C. Whitla, V. Pres. H. W. Reeves. Sec. & Gen. Man. M. L. Knight, Treas. F. G. Barker. Supt. J. O. Patterson. Capital, $150,000. 9 3

SHEBOYGAN, WIS.—Sheboygan City R. R. 8 m, 4-8 ½ g, 35-40 tram r, 11 c, 30 h, 30 mu. Laclede cars. Pres. J. M. Saemann, Sec. & Treas. F. Saemann, Supt. C. F. Bacon. Address, J. M. Saemann & Son. Capital, $50,000. 8 3

SHEFFIELD, ALA.—Sheffield St. Ry. Co. 9 m, 4-8½ g, 35 lb steel r, 5 c, 2 steam motors. Pres. H. B. Tompkins, Supt. W. S. White, Asst. Supt. P. N. Totten, Sec. M. McTyer, Treas. C. D. Woodson. Capital $50,000. p 12 2

SHERMAN, TEX.—Sherman City R. R. Co. 4 m 4 8½ g, 20,35 lb T r, 9 c, 50 mu. Pres. Gen. Man & Owner C. W. Batsell, Sec. J. M. Batsell, Treas. C. W. Batsell Jr. Capital, $50,000. 8 3

College Park Rapid Transit Co. Elec. 4½ m, 4-8½ g 25 lb T r, 5 m. c, Edison system. Pres. J. M Cullers, V. Pres. J. R. Cole, Sec. C. W. Lewis, Treas J. P. Harrison, Supt. H. C. Morrow. Capital, $24,000 authorized, $100,000. 11 2

SHREVEPORT, LA.—Shreveport City R.R. Co. 1½ m, 4-4 g, 46 lb r, 6 c, 14 h. Pres. S. Levy, Jr., V. Pres. P. J. Trezovant, Sec. Jules Dreyfuss. 9

Shreveport Ry. & Land Improvement Co. Elec. 5½ m, 4-8½ g, 40-45 T & Johnson girder r, 8 c, of which 4 are m. c. & 4 t. c. T-H system. Pres. S. B. McCutchen, Sec. W. B. Jacobs, Gen. Man. J. R. Jones, Supt. J. G. Keller. Capital, $32,000; authorized $100,000. Bonds $100,000. Office 525 Spring St. 9 2

SING SING, N. Y.—Ossining Electric Ry. Co. 3 m, 4-8½ g, 50 lb. T r. 10 m c. T-H system. Gilbert cars. Ball & Wood and McIntosh & Seymour engines. Pres. A. S. Underhill, V. Pres. J. V. Cockcroft, Sec. F. L. Young, Treas. S. E. Tompkins, Gen. Man. S. D. Lake, Supt. J. Champlain. Capital, $100,000. Bonds $100,000. 6 3

SIOUX CITY, IA.—Sioux City St. Ry. Co. Elec 17 m, 4 g, 30, 40, 45 & 68½ lb. girder r, 50 c, of which 27 are m. c. and 23 t. c., T-H, Westinghouse & Edison systems. Pullman cars. Allis engines. Receiver, J. C. French, Cashier, F. L. Brown, Supt. I. B. Walker. Capital, $300,000; authorized $1,500,000. Office, 510 United Bank Bldg. 8 3

Riverside Park Ry. Co. 9 m elec., 4-8½ g, 40 lb steel T r, 20 c, of which 6 are m. c. 8 t. c, and 6 freight c Westinghouse system. Northern Car Co. cars. Westinghouse engines. Pres. O. J. Taylor, V. Pres. Jas. E. Booge, Sec. & Treas. C. M. Swan, Supt. B. J. Jones Capital $250,000. Office, United Bank Bldg. 2 3

Sioux City & Morning Side Ry. Co. Dummy. 6 m, 4-8½ g, 50 lb T r, 6 c. Pres. J. N. Jackson, Sec. T. C. Prescot, Treas. D. L. Pratt. Capital $100,000. 6 3

Sioux City & Leeds Electric Ry. Co. 5.6 m, 4-8½ g 45 lb T r, 5 m c. Detroit system. Pres. A. M. Coffman V. Pres. C. C. Pierce, Sec. W. M. Stevens, Treas. E. W. Skerry, Supt. C. J. Lever. Capital, $200,000. 6 3

Sioux City Cable Ry. Co. 7 m, 4-8½ g, 45 lb Johnson girder r, 34 c, of which 14 are g c and 20 t c. Laclede and Trimble cars. Williams engines. Pres. J. Peirce, Sec. D. T. Hedges, Treas. W. V. Hedges, Gen. Man. & Supt. C. Moller. Capital, $250,000. 2 3

Sioux City Rapid Transit Co. Steam. 5½ m, of which 2 m are elevated track; 4-8½ g, 35 &50 lb T r, 6 c, 2 engines. Northern cars. Porter engines. Pres. E. Haakinson, V. Pres. A. M. Jackson, Sec. A. V. Larimer, Treas. E. C. Peters, Gen. Man. C. E. Haakinson, Supt. T. L. Miller. Capital, $1,000,000. Office, Chamber of Commerce Bldg. 2 3

Washington Park & Spring Grove Ry. Co. 4½ m, 4-8½ g, 50 lb T r, 3 c. Porter Engines. Pres. E. Haakinson, V. Pres. D. T. Hedges, Sec. & Treas. C. E. Haakinson. Capital, $250,000. 8 3

SIOUX FALLS, S. DAK.—City St. Ry. Co. 9 m 4-g½ g, 30 lb. r, 6 c, 20 h 20 mu. Pres. R. F. Pettigrew, V. Pres. L. T. Dunning, Sec. & Treas. S. L. Tate, Supt. D. P. Beach. 11 2

S. Dakota Rapid Transit Ry. Co. Elec. 7¾ m, 4-8½ g, 35, 45 lb T & tram. r, 5 c, of which 3 are m c and 2 t c. Edison system. Pullman cars. Armington & Sims engines. Pres. W. R. Kingsbury, V. Pres. C. W. Hubbard, Sec. J. H. Voorhees, Treas. F. H. Files, Gen. Man. C. C. Crandall, Supt. R. L. Wells Capital, $100,000. Bonds, $75,000. 6 3

SOUTH BEND, IND.—South Bend & Mishawaka St. Ry. Co. Elec. 14 m, of which 9½ are horse and 4½ elec; 4-8½ g, 35, 65 lb T r, 22 c, of which 4 are h c, 10 m c and 8 t c, 10 h. T-H system. Stephenson cars. Allis engines. Pres. J. McM. Smith, V. Pres. O. H. Lawrence, Sec. & Treas. I. B. Newcombe. Capital, $200,000; authorized, $250,000. Bonds, $250,000. 6 3

SOUTH CHICAGO, ILL.—See Chicago.

SOUTHINGTON, CONN.—Southington & Plantsville Tramway Co. Elec. 2 1-6 m, 4-8½ g, 25 lb T r, 2 m. c. T-H. system. Pres. J. H. Osborne, V. Pres. R. W. Cowles, Sec. & Gen. Man. L. E. Southworth, Treas. S. Walkley, Supt. T. L. Dawson. Capital, $20,000. Bonds, $16,000. Office, Centre st. 6 3

SPOKANE WASH.—Spokane & Montrose Motor R. R. Co. Elec. 3¼ m, 3-6 g, 30 & 35 lb T r, 4 m c T-H and Short systems. Pres. & Treas. Francis H. Cook, V. Pres. E. A. Routhe, Sec. L. C. Cook. Capital $50,000. Bonds $40,000. 3 2

Arlington Heights Motor Ry. Co. 2 m, 4-8½ g, 30 lb r, 1 m c. Edison system. Pres. W. Hughson. Capital, $50,000. 3 3

City Park Transit Co. Elec. 7 m, 4-8½ g, 35 lb. T r, 5 m. c. T-H system.. Pres. D. Glass, Sec. & Treas. C. Glass, Supt. E. J. Comley. Capital $250,000. 3 3

Ross Park St. Ry. Co. Elec. 10½ m, 4-8½ g, 35 lb T r, 8 m c. T-H system. Pullman cars. Water power. Pres. H. N. Belt, Sec. & Gen. Man. W. S. Norman, Treas. J. D. Sherwood, Supt. E. E. Knowles, Auditor C. S. Smith. 8 3

Spokane St. Ry. Co. (Controlled by Washington Water Power Co. Includes Spokane Electric Ry. and Spokane Cable Ry.) Elec. 25 m, of which 3 are cable and 22 elec., 4-8½ g, 30, 35 & 40 lb T r, 46 c, of which 6 are g c, 26 m c and 14 t c. T-H and Edison systems. Water power. Pres. H. Bolster, Treas. J. D. Sherwood, Gen. Man. W. S. Norman, Supt. E. E. Knowles, Audr. C. S. Smith. Capital, $500,000. Bonds of all roads authorized, $600,000. Office, Hazel Block. 3 3

SPRINGFIELD, ILL.—Springfield Consolidated Ry. Co. (Comprises Springfield City Ry. Co. and People's Elec. Ry. Co.) Elec. 22 m, 4-8½ g, 40, 60 lb T r, 51 c, of which 33 are m c and 18 t c. T-H and Detroit systems. Bates-Corliss engines. Pres. T. J. Minary, V. Pres. B. Wilson, Treas. & Gen. Man. C. K. Minary, Supt. F. P. McNeil. Capital, $750,000. Bonds, $650,000. 8 3

SPRINGFIELD, MASS.—Springfield St. Ry. Co. Elec. 33 m, 4-8½ g, 56 lb T r, 110 c, of which 100 are m c and 10 t c. T-H system. Pres. John Olmsted, Treas. & Man. A. E. Smith. Capital $1,000,000. Office cor. Main & Carew sts. 6 3

SPRINGFIELD, MO. — Metropolitan Electric Ry Co. 17 m, 4-8½ g, 45 lb Johnson girder r, 30c of which 16 are m. c. and 14 t. c.. Westinghouse system. Pres. B. F. Hobart, Sec. & Gen. Man. Frank B. Smith. Capital, $550,000; authorized, $600,000. Bonds, $550,000. 6 3

Robberson Ave. Ry. Co. 6 m c. T-H system. 12 2

SPRINGFIELD, O.—Springfield Ry. Co. Elec. 25 m, 4 g, 45, 60 lb girder & T r, 25 m c. Westinghouse system. Brownell, Laclede and St. Louis cars. Russell & Co. engines. Pres. W. B. McKinley, V. Pres. R. S. Hunter, Sec. B. Hood, Treas. D. W. Slack, Gen. Man. S. L. Nelson, Supt. C. E. Miley. Capital, $1,000,000. Bonds, $500,000. 8 3

STAMFORD, CONN.—Stamford Street R. R. Co. 7 m, 4-8½ g, 25, 60 lb T r, 11 c, 48 h. Feigel, Jones and Stephenson cars. Pres. & Treas. R. A. Fosdick, V. Pres. Wm. W. Gillespie, Sec. L. J. Curtis, Supt. G. W. Pierce. Capital $92,500; authorized $100,000. Bonds $52,000. Office, Fessenden Block. 6 3

STATEN ISLAND, N. Y. — Staten Island Belt Line R. R. Co. 9 m, 4-8½ g, 25 lb T r, 10 c, 3 h. Receiver James D. Van Hoevenburg, 189 Broadway New York, Pres. M. E. Graves. Office, Tompkinsville 9 2

STAUNTON, VA.—City St. Car Co. 5½ m, 4-8½ g 25 & 42 lb. T & girder r, 13 4-wheel box c, 70 mu Pres. E. K. Sibley, New York; V. Pres. D. D. Parmley; Treas. Andrew Spotts, New York; Gen. Man. R. D Apperson, Staunton, Va. Capital $50,000. 1 3

STEUBENVILLE, O.—Steubenville St. Ry. Co. 5 m, 4-8½ g, 35 lb girder r, 6 m c. Edison system. Pres. D. B. Toucey, V. Pres. W. B. Donaldson, Sec. & Treas. T. N. Motley, Supt. J. F. Flood. Capital, $70,000. Office, 261 Broadway, New York. 8 3

STERLING, ILL.—Union St. Ry. of Sterling & Rock Falls. 7 m, 7 m c. Edison system. Pres A.H. Howland, Sec. & Supt. W. J. Watson, Treas. G A. Ellis. 7 2

STILLWATER, MINN.—Stillwater St. Ry. Co. Elec. 5 m, 4-8½ g, 30 lb. T & tram r, 8 m. c. Edison system. Pres. W. L. Allen, V. Pres. T. O. Swiney Sec. & Treas. E. D. Allen, Supt. J. S. Barrett. Office Davenport, Ia. 7 1

STILLWATER, N. Y.—Stillwater & Mechanicville St. Ry. Co. 4½ m, 4-8½ g, 25-30 lb T & flat r, 6 c, 8 h. Pres. Gen. Man. & Supt. W. L. Denison, V. Pres. P. Van Vechten, Sec. & Treas. Edw. I. Wood. Capital, $11,650; authorized, $40,000. 6 3

STOCKTON, CAL.— Stockton Electric Ry. Co Elec. 12 m, 3-6 g, 45 lb. s. b. & T r, 22 c. of which 11 are m. c. and 11 t. c. Westinghouse and T-H systems. Stockton cars. Pres. I. S. Bostwick, Sec. J. Fyfe, Treas. E. R. Hedges, Supt. G. E. Ladd. Capital $500,000. 8 3

STREATOR, ILL.—Streator Ry. Co. Elec. 5½ m 4-8½ g, 56-67 lb T & girder r, 6 m c. T-H. system Pres. P. F. Barr, V. Pres. D. Heenan, Sec. W. Reeves, Treas. J. C. Barlow, Gen. Man. W. Miller. Capital $250,000. 3 2

STROUDSBURG, PA.—Stroudsburg Passenger Ry. Co. 1½ m, 4-8½ g, 28-30 lb T r, 3 box c, 9 h 3 mu. Pres. & Treas. J. Lantz, Sec. Jacob Houser Gen. Man. W. Kistler. Capital, $25,600. 3 1

SUNBURY, PA.—Sunbury & Northumberland St Ry. Co. Elec. 3½ m, 5-2 g, 56 lb girder r, 4 m. c. Westinghouse system. Stephenson cars. Harrisburg Fdry. & Mach. Co. engines. Pres. D. Coolidge, Sec. & Treas. S. P. Wolverton, Gen. Man. C. M. Clement Supt. M. Withington Capital $125.000. 8 3

SYRACUSE, N. Y.—People's R. R. Co. 20 m, 4-8½ g, 47, 57, 66½ lb. r, 72 c, of which 31 are box and 41 open, 300 h. Pres. A. N. Palmer, Sec. H. H. Durr. Treas. F. W. Baker, Gen. Man. J. H. Moffitt. Capital, $1,000,000. 5 3

Syracuse, Eastwood Heights & De Witt R. R. Co. Elec. 10 m, 4-8½ g, 40 lb T r, 2 m c. Short system. Pres. N. S. Williams, Treas. G. B. Leonard, Supt. L. A. Williams. 6 3

Syracuse Consolidated St. Ry. Co. (includes Fifth Ward, Fourth Ward, Genessee & Water St., Seventh Ward, Syracuse & Geddes, Third Ward and Woodlawn & Butternut railways). Elec. 36 m, of which 16 are horse and 20 elec, 4-8 g, 35 to 66½ lb girder, s b & T r, 100 c, of which 52 are box, 17 open and 31 m c, 320 h. T-H system. Pres. J. Dunn, Jr., V. Pres. P. T. Brady, Sec. W. P. Gannon, Treas. W. R. Kimball, Gen. Man. E. F. Rice. Supt. A. Bartlett. Capital, $1,250,000. Office, 3 Syracuse Sav. Bank Bldg. 4 2

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TACOMA, WASH.—Tacoma Ry. & Motor Co. Elec. 48 m, of which 46 are elec. and 2 cable, 3-6 g, 40, 45, 60, 66 lb T & girder r, 31 c, of which 26 are m c and 5 g c. T-H and Edison systems, Pullman cars. Corliss, Frick and Stearns engines. Pres. Paul Schulze, V. Pres. S. Z. Mitchell. Sec. P. H. Kershaw, Treas. T. B. Wallace. Supt. J. H. Davis, Aud'r, G. W. Bird. Capital $750,000. Office, A & 13th sts. 6 3

Tacoma & Puyallup R. R. Co. Dummy. 16 m, 3-6 g 40 lb T r, 19 c, of which 5 are pass. & 14 frt. Pres. R F. Radebaugh, V. Pres. & Treas. Frank O. Meeker Sec. G. W. McAllister, Supt. O. Woods. Capital $100,000. Office 113 Railroad st., Tacoma. a 3 1

Point Defiance, Tacoma & Edison Ry. Co. 13 m 3-6 g, 40 lb T & steel r, 13 m c. T-H and Edison systems. Brill and Pullman cars. Pres. C. N. Parker, V. Pres. H. W. Topping, Sec. & Treas. C. S. Milliken, Gen. Man. S. Rice, Supt. N. Lawson. Capital $500,000. Office, 915 Railroad st. 6 3

TAMPA, FLA.—Tampa St. Ry. & Power Co Elec. 5 m, 4 8½ g, 25, 30 lb T r, 10 m c. General Elec. system. Brill cars. Porter engines. Pres. & Gen. Man. J. H. Ahern; V. Pres. J. R. Ritter, Sec. J. Wright, Treas. A. G. Clay. Capital $500,000; authorized $600,000. Bonds $250,000. Office, Gulf Bank Bldg. 8 3

TAUNTON, MASS.—Taunton St. Ry. Co. Elec. 14 m, 4-8½ g, 40, 45, 60 lb T & girder r, 47 c, of which 23 are h c and 24 m c. Jones and Stephenson cars. McIntosh & Seymour engines. Pres. J. N. Beckley, Sec. O. A. Barker, Treas. S. M. Thomas, Supt. Geo. C. Morse. Capital, $100,000. 8 3

TERRE HAUTE, IND.—Terre Haute St. Ry. Co Elec. 16 m, 4-8½ g, 40, 45, 60 lb T & Johnson girder r, 37 c, of which 28 are m c and 9 t c. Westinghouse system. Centropolis, Northern and Pullman cars, Westinghouse engines. Pres. B. Harrison, V. Pres. W. Kidder, Sec. L. D. Thomas, Treas. P. P. Thomas, Supt. M. F. Burke, Elecn. C. B. Kidder. Capital, $200,000. Office 100 N. Ninth st. 6 3

TEXARKANA, ARK.—Texarkana St. Ry. Co Elec. 5 m, 4-g, 30 lb T r, 8 c, of which 6 are 4-wheel box & 2 4-wheel open, 38 mu. Pres. J. Deutschman V. Pres. B, Collins, Sec. F. W. Offenhauser, Treas G.W. Fouke, Supt. B. M. Foreman. Capital $40,000 k 3 1

TIFFIN, O.—Tiffin St. Ry. Co. 5½ m, 4-4½ g, 35 lb. girder r, 17 c, 36 h. Pres. D. A. Lindley, Sec. & Treas. T. B. Williams, Supt. Joseph Murphy. a 5 0

The Electric Ry. & Pow. Co. 7 m 4 8½ g, 50, 80 lb T & girder r, 13 c, of which 8 are m c and 5 t c. T-H system. Laclede cars. Pres. G. D. Loomis, V. Pres. C. J. Yingling, Sec. J. F. Bunn, Treas. B. W. Crobaugh, Supt. J. P. Meyers. Capital, $50,000. 8 3

TOLEDO, OHIO.—Toledo Consolidated St. Ry Co. Elec. 65 m, 4 8½ g, 48½, 56, 70, 75 lb girder r, 120 c, of which 109 are m c and 11 t c. Westinghouse system. Hooven, Owens & Rentschler engines. Pres. Norman B. Ream (Chicago), V. Pres. & Gen. Man. Albion E. Lang, Sec. Chas. L. Wight, Treas. W. E. Hale, Supt. Chas. A. Denman. Capital $1,500,000. Bonds $1,500,000. Office, 336 Summit st. 8 3

Toledo Electric St. Ry. Co. 27 m, 4-8½ g, 45, 52, 85 90 lb Johnson girder & T r, 80 m c, 9 h. T-H and Westinghouse systems. Brill cars. Cooper engines. Pres. D. Robison, Jr., V. Pres. L. S. Baumgardner, Sec. & Gen. Man. J. J. Robison, Treas. W. F. Robison, Div. Supts. C. L. Hulbut, E. F. Adler. Capital, $800,000. Bonds $800,000. Office, cor. Madison & Summit Sts. 8 3

TOPEKA, KAN.—Topeka Ry. Co. Elec. 35 m of which 3 are horse and 32 elec., 4 & 4-8½ g, 25, 35, 40 lb T, girder & tram r, 92 c, of which 25 are h c, 40 m c and 27 t c, 25 h. T-H. system. Allis engines. Pres. C. C. Baker, V. Pres. M. A. Low, Sec. & Treas. R. M. Gage, Gen. Man. J. M. Patten, Supt. E. H. Littlefield. Capital $2,000,000. Office, 1112 Jackson st. 6 3

Topeka Belt Ry. Co. Steam. 4 m, 4-8½ g, 45 lb T r, 11 c, 2 Baldwin motors. Pullman cars. Pres. Chas. S. Gleed, Sec. & Treas. J. Mackenzie. Gen. Man. J. D. Livingston, Supt. E. H. Littlefield. Capital, $1,000,000. Office 110 W. 10th st. 6 3

West Side Circle Ry. Co. Steam. 6½ m, 4 8½ g, 40 lb T & girder r, 2 c, 3 Baldwin motors. Pres. C. S. Gleed, Sec. & Treas. G. H. Nolte, Asst. Sec. & Treas. F. H. Poole. Capital, $50,000; authorized, $100,000. Bonds, $50,000. Office, Knox Building. 8 3

TORONTO, ONT.—Toronto Ry. Co. 70 m. 4-10¾ g, 30 lb r, 252 c, 1,380 h. Pres. W. McKenzie, V. Pres. & Man. H. A. Everett, Sec. & Treas. J. C. Grace. Supt. James Gunn. Elec. Engr. W. E. Davis, Offices Canada Life Assurance Bldg., King st., west. 11 3

Metropolitan St. Ry. Co. Elec. 4½ m, 4-10¾ g, 56 lb T r. 5 c. of which 3 are m c. and 2 t c. T-H system. Pres. C. D. Warden, Sec & Treas. R. Jenkins Capital, $130,000; authorized $250,000. 12 2

Toronto & Scarboro Electric Ry. Lt. & Pow. Co. 3 m, 4-8½ g, 56 lb T r 2 m c. T-H system. Patterson & Corbin cars. Pres. D. G. Stephenson, V. Pres. J. J. Foy, Sec. & Gen. Man. A. W. Dingman, Supt. C. A. Crawford. Capital, $50,000; authorized $400,000. Office, 38 King St. 8 3

TRENTON, N. J.—Trenton Pass. Ry. Co. Elec 35 m, of which 19 are horse and 16 elec.; 45-78 lb tram & girder r, 75 c, of which 50 are h c and 25 m c 175 h. 6 mu. Short system. Pres. & Gen. Man. L Perrine, Jr., V. Pres. S. K. Wilson, Sec. J. H. Solomon Treas. G. H. Parker, Supt. P. E. Hurley. Office cor. Greenwood and S. Clinton Aves. 6 3

TROY, N. Y.—Troy & Albia Horse R. R. Co. Elec 3.33 m, 4-8½ g, 35-45 lb. r, 26 c, of which 7 are box, 7 open and 12 m. c, 52 h. T-H. and Edison systems. Pres. Chas. Cleminshaw, V. Pres A. N. Brady, Sec. J. J. Hagen, Supt. W. H. Bean. Capital $50,000. Office, Albia stable. *a* 3 1

Troy City Ry. Co. (Lessee of Troy & Lansingburgh and Waterford & Cohoes Rys.) Elec. 26 m, of which 4 are horse and 22 elec. 4-8½ g, 63½ lb girder & s. b. r, 118 c. of which 20 are h. c. and 98 m. c. T-H and Edison systems. Gilbert and Jones cars. Greene-Corliss engines. Pres. C. C. Cleminshaw, 1st V. Pres. A. N. Brady, 2d V. Pres. J. B. Carr, Sec. & Treas. J. J. Hagen, Gen. Man. C. Cleminshaw, Supt. C. H. Smith. Capital, $2,000,000. Bonds $2,000,000. Office, 361 River St. 6 3

Troy & Lansingburgh R. R. Co. Elec. 25 m, of which 3½ are horse and 21½ elec, 4-8½ g, 63½ lb girder r, 117 c, of which 45 are h c and 72 m c. 87 h. Edison and T-H systems. Capital, $600,000; authorized, $700,000. Bonds, $300,000. Office 209 River st. Leased to Troy City Ry. Co. 6 2

TROY, O.—Miami Valley Electric R. R. n 8 3

TUSKALOOSA, ALA.—Tuskaloosa St. Ry. Co (Owned by Tuskaloosa & Castle Hill Real Estate & Mfg. Co.) 4 m, 4-8½ g, 20, 25 lb T r, 9 box c, 8 mu. Stephenson cars. Pres. Jas. H. Fitts, Sec., Treas. & Gen. Man. S. F. Alston. Capital, $100,000. Office, Main st. 6 3

Tuskaloosa Belt Ry. Co. 4½ m, 4-8½ g, 35 lb. T r 1 c, 1 steam motor. Lessee, F. W. Brown, Pres. W. C. Jemison, Sec. & Treas. J. L. Wallace. Capital $25,000. 6 3

TYLER, TEX.—Tyler St. Ry. Co. 3 m, 4-8½ g 20, 40 lb T & flat r, 4 c, 9 mu. Pres. & Sec. Tyler, Smith Co., Gen. Man. W. C. Scott. Capital, $12,000. 8 3

U

UNION SPRINGS ALA.—Union Springs St. Car Co. 2 m, 5-1 g, 20 lb T r, 4 flat c for freight, 1 or 2 for pass., 4 mu. Pres. Wm. Stakley, Sec. & Treas. T. H. Mabson, Jr., Supt. A. D. Fielder. Capital, $10,000. p 12 2

UNIONTOWN, PA.—Uniontown St. Ry. Co. Elec 3 m, 5-2½ g, 45, 61, 62 lb girder & T r, 56 c, 5 m c. Edison system. Pres. S. E. Ewing, V. Pres. G. H. McCormick, Sec. & Treas. R. F. Hopwood, Gen. Man W. C. McCormick, Supt. R. A. Smith. Capital, $50,000. 7 2

UTICA, N.Y.—Utica, Clinton & Binghamton St. R. R. Pres. Jas. J. Scollard, Sec. & Treas. Robt. S. Williams. Capital, $849,485. Leased to and operated by Utica Belt Line St. R. R. Co. Office, 157 Genesee st. 6 3

Deerfield & Utica. (See Deerfield.)

Oneida St. R. R. Co. 1½ m, 4-8½ g, 35 lb c b r, 3 c of which 2 are box and 1 open, 8 h. Pres. & Gen. Man. Henry Ney, V. Pres. Dan'l L. Jones, Jr., Sec. & Treas. Wm. C. Willcox. Capital $40,000. Office, 69 Genesee st. 11 2

Utica & Mohawk R. R. Co. Elec. 3¾ m, 4-8½ g, 40, 45 lb T r, 14 c, of which 8 are m c and 6 t c. Edison system. Stephenson cars. Pres. & Gen. Man. Jas. F. Mann, V. Pres. R. W. Sherman, Sec. Wm. E. Lewis, Treas. Geo. D. Dimon. Supt. F. L. Everts. Capital $51,000. Bonds $75,000. Office Mann Bldg. 8 3

Utica Belt Line St. R. R. Co. Elec. (Operates Utica, Clinton & Binghamton St. R. R.) 27 m, 4-8½ g 40, 42, 47 & 60 lb. T r, 56 c, of which 25 are m c and 31 t c. T-H system. Pres. W. E. Baker, V. Pres. J. W. Boyle, Gen. Man. & Supt. ———— Receiver, C. E. Benton. Capital, $150,000. Bonds, $500,000. 8 3

V

VANCOUVER, B. C.—Vancouver Electric Ry. & Light Co. Ld. 7½ m, 4-8½ g, 40 lb T r, 10 c, of which 9 are m. c. and 1 t. c. T-H & Westinghouse systems Pres. J. Oppenheimer, V. Pres. T. Dunn, Sec. H. T Cepuley, Treas. & Business Manager, W. E. Brown Supt. C. F. Hutchings. Capital, $300,000; authorized $500,000; Bonds $300,000. Office, 523 Hastings st. W. 10 2

VANCOUVER, WASH.—Columbia Land & Improvement Co. 3 m, 3-6 g, 30 lb T r, 2 c, 7h. Pres. J Gibbon, V. Pres. & Gen. Man. L. M. Hidden, Sec. C Brown, Treas. 1st Nat. Bank. Capital $280,000. Address, P. O. Box 44. 3 2

VERNON, IND.—North Vernon & Vernon St. R. R. Co. 2 m, 5-2½ g, 35 lb girder r, 3 c, 4 h, 2 mu. Laclede cars. Pres. S. H. Grinstead, Jr., V. Pres. L. T. Wilkerson, Sec. E. Wagner, Treas. J. C. Cope. Capital $15,000. 8 3

VICTORIA, B. C.—National Electric Tramway & Lighting Co. 14 m, 4-8½ g, 40 lb girder & T r, 16 c of which 14 are m c and 2 t. c. T-H, Edison & Westinghouse systems. Pres. & Gen. Man. D. W. Higgins, V. Pres. T. L. Jones, Sec. C. T. Dupont, Supt. F. W. McCrady. Capital $205,000; authorized $1,000,000. Office Store st. 9 3

VICTORIA, TEX.—Victoria St. Ry. & Improvement Co., 2¼ m, 4 g, 20 lb. r, 3 box c. 10 mu. V. Pres G. A. Levi, Sec. J. E. Carpenter. Supt. C. L. Thurmond Capital, $10,000; authorized, $25,000. 11 2

VINCENNES, IND.—Citizens' St. Ry. Co. Elec 5 m, 4-8½ g, 40. 55 lb T & girder r, 16 c, of which 7 are m. c. and 9 t. c, 2 mu. Westinghouse system. Calumet and Ellis cars. Westinghouse engines. Pres. A. Tindolph, Sec., Gen. Man. & Supt. E. F. Tindolph, Treas. B. G. Hudnut. Capital $15,000. Bonds $100,000. Office, 16 Fair View ave. 8 3

W

WACO, TEX.—Citizens' Ry. Co. Elec. 16 m, 4-8½ g, 30, 40 & 45 lb girder & T r, 13 m. c. St. Louis cars. Hamilton Engines. Pres. & Gen. Man. H. C. Scott, Sec. J. L. Brockenbrough. Supt. J. L. Griffith. Capital, $350,000. Bonds, $350,000. Office, 4th & Washington sts. 8 3

Waco Electric Ry. & Lt. Co. 10 m, 4-8½ g, 35 lb T r, 10 c, of which 8 are m c and 2 t c. T-H system St. Louis cars. Armington & Sims and Sioux City engines. Pres. W. J. Hobson, V. Pres. B. Moore, Sec. & Supt. S. A. Hobson, Treas. & Gen. Man. C. W. Hobson. Capital, $250,000. Bonds, $200,000. 2 3

WAKEFIELD, MASS.—Wakefield & Stoneham St. Ry. Co. Elec. 4 m, 4-8½ g, 50 lb T r, 8 c, of which 4 are m c and 4 t c. Westinghouse system. Pres. & Gen. Man. C. F. Woodward, Sec. E. M. Southworth, Treas. J. F. Shaw, Engr. J. A. Bancroft. Capital $50,000. 8 3

WALLA WALLA, WASH.—Walla Walla St. Ry. & Investment Co. 4 m, 3-6 g, 30 & 35 lb T r, 6 4-wheel box c, 24 h. Pres. W. P. Winans, V Pres. Miles C. Moore, Sec. J. W. Langdon, Treas., Supt. & Man. J. M. Hill. Capital $72,000; authorized $100,000. 3 2

WARREN, O.—Trumbull Electric R. R. Co. 1 m, 4-8½ g, 45, 69 lb T & girder r, 7 m c. T-H system. Pres. H. C. Christy, V. Pres. A. R. Silliman, Sec & Treas. E. D. Kennedy. 2 3

WARREN, PA.—Warren St. Ry. Co. 2 m, 4-8½ g, 45 lb T & girder r, 2 m c. Westinghouse system. New Castle cars. Pres. T. B. Clawson, Sec. J. Roy, Treas. & Gen. Man. D. H. Siggins. Capital $12,000; authorized $25,000. Office 342 Water st. 8 3

WASHINGTON, D. C.—Capitol, No. O St. & So Washington R.R. 13½ m, 4-8 g, 80 lb girder r, 72 c. 308 h. Pres. Geo. White, V. Pres. C. Flint, Sec. & Treas H. K. Gray, Supt. Andrew Glass. Office, 3d & B sts S. W. 6 2

Brightwood Ry. Co. 15 m, 4-8½ g, T & girder r, 19 c of which 11 are m. c. and 8 t. c. Edison system. Pres. H. S. Cummings, V. Pres. E. O. McNair, Sec. & Treas. C. P. Williams. Capital, $108,500. Bonds, $250,000. 5 3

Columbia R. R. Co. 6 m, 4-8½ g, 36 & 68 lb girder r, 44 c, 180 h. Pres. W. J. Stephenson, V. Pres. E. G. Davis Sec. & Treas. R. F. Baker, Supt. Theo. J. King, Capital, $400,000. Office, 15th & H sts., N. E. 6 3

Eckington & Soldiers' Home Ry. Co. Elec. 9 m, of which 2½ are horse and 6½ elec, 4-8½ g, 80 lb girder r, 39 c, of which 12 are h c, 14 m c and 13 t c, 54 h. T-H and Westinghouse systems. Brill, Robinson and Stephenson cars. Armington & Sims and Ball engines. Pres. H. Munnikhuysen. V. Pres. & Gen. Man. W. H. Schoepf, Sec. & Treas. H. K. Gray, Supt. R. I. Todd. Capital, $352,000. Bonds, $129,600. Office, McGill Bldg., 908-914 G St., N. W. 8 3

Georgetown & Tenalleytown Ry. Co. Elec. 9½ m 4-8½ g, 45, 60 lb. groove & T r, 19 m. c T-H system Brill, Gilbert, Jones and Stephenson cars. Pres. M. W. Offutt, V. Pres. R. D. Weaver, Sec. & Treas. J. E. Beall, Supt. & Elecn. J. H. Mills, Capital $200,000. Bonds $20,000. Office, Power House, 32d st. 6 3

Glen Echo R. R. Co. Elec. 6½ m, 4-8½ g, 40 lb T r 8 c, of which 6 are m c and 2 t c. Westinghouse system. Brill cars. Westinghouse and Frick engines. Pres. Edwin Baltzley, V. Pres. F. W. Pratt, Sec. Edward Baltzley, Treas. J. C. Pratt, Supt. J. Hanson. Capital, $100,000. Office, Room 7 Sun Bldg. 6 3

Metropolitan R. R. Co. 19.44 m, 4-8½ g, 62 lb grooved r, 150 c, 653 h. Pres. & Pur. Agt. W. J. Stephenson, V. Pres. A. A. Wilson. Sec. & Treas. Wm. J. Wilson, Supt. R. W. Wilkinson. Capital $732,000; authorized $1,000,000. Office, 2411 P st. N. W. 6 3

Rock Creek Ry. Co. Elec. 15 m, 4-8½ g, 50. 62 lb T r 30 c, of which 12 are m. c. and 18 t. c. T-H system Pres. F. G. Newlands, V. Pres. E. J. Stellwagen, Sec H. S. Nyman, Treas. T. M. Gale, Gen. Man. A. J Warner. Capital $800,000. Office, 1324 F. Street N. W. 11 2

Washington & Arlington Ry. Co. Elec. 3 m, 4-8½ g, 50 lb T r, 4 m c. Edison system. Brill cars. Phœnix engines. Pres. D. L. King, Sec. & Treas. W. Hazlett, Gen. Man. & Supt. W. Chapman. Capital $500,000. Bonds authorized $300,000. Office 95-96 Corcoran building. 1 3

Washington & Georgetown R.R. Co. Cable. 22 m 4-8½ g, 80 lb English groove girder r, 389 c, of which 94 are g c and 295 t c, 30 h. Pres. H. Hurt, V. Pres J. G. Parke, Sec. & Treas. C. M. Koones, Gen. Supt C. C. Sailer, Engr. D. S. Carll. Capital, $500,000. Bonds, $3,500,000. Office, 3,222 M St. 6 3

WASHINGTON, PA.—Washington Electric St Ry. Co. Elec. 3½ m, 5-2½ g, 45 lb girder r, 5 m. c Westinghouse system. Pres. A. E. Townsend, Sec. J. F. Bristor, Treas. Brit Hart, Supt. F. G. Marshall. Capital $40,000; authorized $60,000. Bonds $8,000. 8 3

WATERBURY, CONN.—Waterbury Traction Co. 6½ m, 4-8½ g, 40 lb T r, 27 c, of which 15 are 4-wheel box & 12 4-wheel open, 125 h. Brill, Lewis & Fowler and Stephenson cars. Pres. D. S. Plume, Sec. A. M. Young, Treas. J. R. Smith, Supt. & Gen. Man. E. A. Bradley. Capital $50,000; authorized $1,000,000. Bonds $50,000. 8 3

WATERLOO, IA.—Waterloo St. Ry. Co, 2 m, 3 g, 22, 35 lb T r, 3 c, 8 h. Pres. J. E. Sedgwick, V. Pres G A. Whitney, Sec. & Treas. A. A. Hungerford Capital, $40,000. Office, 181½ Bridge St. 8 3

WATERLOO, ONT.—Berlin & Waterloo St. Ry Co. 2¾ m, 4-8½ g, 25 & 30 lb flat & T r, 8 c, 16 h. Pres. & Treas. Thos. M. Burt, Sec. Alex. Millar. Office, Waterloo. Capital, $40,000. Bonds $20,000. 8 3

WATERLOO, N. Y.—See Seneca Falls, N. Y.

WATERTOWN, S. DAK.—Watertown & Lake Kampeska Ry. Co. Dummy. 5½ m, 4-8½ g, 30 lb T r 2 m. c, Pres. & Gen. Man. Charles Joscelyne, Sec R. B. Spicer. Office, Kemp ave. & Oak st. a 3 1

WATERTOWN, N. Y.—Watertown St. Ry. Co Elec. 6 m, 4-8½ g, 50 lb girder & T r, 19 c, of which 11 are m c, and 8 t c. Edison system. Stephenson cars. Pres. J. C. Thompson, V. Pres. C. A. Starbuck, Sec. & Treas. G. S. Goodale, Gen. Man. & Supt. G. W. Adams. Capital $40,000. Bonds $75,000. Office, 172 Main St. 10 3

WATERVILLE, ME.—Waterville & Fairfield Ry. & Lt. Co. Elec. 5m, 4-8½ g, 35 lb T r, 8 c, of which 3 are m c and 5 t c. Westinghouse system Pres. & Gen. Man. A. F. Gerald, Sec. H. M. Heath Treas. H. D. Bates. Capital, $200,000. Bonds, $175,000 Office, Fairfield. 9 2

WAXAHACHIE, TEX.—Waxahachie St. Ry Co 2 m, 4-8½ g, 20 lb T r, 3 c, 16 h. Pres. T. A. Ferris, V Pres. W. F. Lewis, Sec., Treas. & Gen. Man. O Goodwin. Capital, $24,000. 8 3

Lake Park St. Ry. Co. 2 m, 4-8½ g, 20 lb T r, 4 c 14 mu. Pres. & Gen. Man. J. F. Strickland, V. Pres. W. F. Lewis, Sec. J. F. Philips, Treas. W. G. Williams, Supt. W. J. Stevenson. Capital, $8,000; authorized, $20,000. 8 3

WEATHERFORD, TEX.—Weatherford City & Suburban R. R. Co. 3½ m, 4-8½ g, 16 & 20 lb T r 6c, 17 mu. Pres. G. P. Levy, Supt. S. E. Willbanks. Capital, $100,000. 8 3

WEBB CITY, MO.—Southwest Missouri Elec; tric Ry. Co. Connecting Joplin, Webb City, Carterville and Prosperity 10 m, 4-8½ g, 48, 75 lb T & girder r, 12 c. T-H and Westinghouse systems. Laclede cars, Cooper engines. Pres A. H. Rogers, V. Pres. E. Z. Wallower, Sec. & Treas. W. M. Donaldson, Supt, J. M. Maret. Capital, $500,000. Bonds, $100,000 authorized, $200,000. 10 3

WEST BAY CITY, MICH.—(See Bay City, Mich.)

WEST CHESTER, PA.—West Chester St. Ry Co. Elec. 6 m, 5-2½ g, 9 c, of which 5 are m. c. and 4 t. c. Edison and Westinghouse systems. Brill cars. Pres. W. M. Hayes, Sec. W. S. Harris, Treas. F. W. Wollerton. Capital, $60,000. Bonds $30,000. 6 3

WEST NEWTON, MASS.—Newton St. Ry. Co Elec. 8½ m, 4-8½ g, 45, 56 lb T r, 31 c, of which 27 are m c and 4 t c. T-H system. Jones, Hollings and Newburyport cars. Pres. H. B. Parker, V. Pres. E. Stearns, Sec. J. C. Lane, Treas. C. W. Smith, Supt. F. G. L. Henderson. Capital $125,000; Bonds $100,000 Office, West Newton, Mass. 8 3

WEST SUPERIOR, WIS.—Superior Rapid Transit Ry. Co, Elec. 26 m, 3-6g, 35 lb T r, 35 c, of which 25 are m c and 10 t c. T-H system. Pres. & Gen. Man. S. T. Norvell, Treas. F. W. Hanson. Capital, $1,000,000. 8 3

WESTPORT, CONN.—Westport & Saugatuck Horse R. R. Co. 1¾ m, 4-8 g, 40 lb r, 4 c, 6 h. Pres. A. S. Hurlbutt, Sec. and Treas. B. L. Woodworth Supt A. F. Downes. 3 2

WHEELING, W. VA.—Wheeling Ry. Co. Elec. 15 m, 5-2 g, 35, 78, 85 lb girder r, 52 c, of which 35 are m c and 17 t c. T-H system. Pres. J. Jacob, Sec. Frank P. Hall, Supt. A. M. Jolly. Capital, $700,000. 5 3

Wheeling & Elm Grove R. R. Dummy. 8½ m, 4-8½ g, 60 lb T r, 23 c, of which 20 are pass. c, 2 freight c and 1 baggage c, 4 Baldwin motors, 1 h. Pres. A. Reymann, Sec. & Treas. J. Roemer, Gen. Man. H. E. Weisgerber Capital, $250,000; authorized, $300,000. Office, 16th st 6 3

WHITMAN, MASS.—(See Brockton, Mass.)

WICHITA, KAN.—Wichita Electric Ry. & Lt. Co. 25 m, 4-8½ g, 35 & 46 lb T & Johnson r, 30 c, of which 22 are m c and 8 t c. T-H system. Pres. C. E. Dustin, V. Pres. A. T. Batchelder, Sec. & Gen Man. J. W. O'Neill. Treas. G. A. Litchfield, Supt. F. W. Sweet. Capital, $450,000. Office, 100 W. Douglas Ave. 6 3

WILKESBARRE, PA.—Wilkesbarre & Kingston Pass. R. R. 4 m, 5-2 g, 35 lb tram r, 12 box c, 24 h Pres. J. J. Patterson, Sec. & Treas. J. Graham. Capital, $100,000. Leased to Wyoming Valley Traction Co. 3 2

Coalville Passenger R. R. Co. 2½ m, 4-8½ g, 24 lb tram & T r, 4 c, 20 h. Pres. J. J. Patterson, Sec. & Treas. J. Graham. Capital, $62,375. Leased to Wyoming Valley Traction Co. 7 2

Nanticoke St. Ry. Co. Elec, 8 m, 4-8½ g, 40 lb. T r 6 m. c. Short system. Pres. J. J. Patterson, Sec. & Treas. J. Graham. Leased to Wyoming Valley Traction Co. 7 2

Pittston St. Car Co. 1¾ m, 5-2 g, 42½ lb flat r, 4 4-wheel box c, 6 h. Pres. J. J. Patterson, Sec. & Treas. J. Graham. Capital, $10,000. Leased to Wyoming Valley Traction Co. 7 2

Pittston, Moosic & Pleasant Valley Ry. Co. Elec 7 m, 4-8½ g, 40 lb. T r, 4 m. c. Short system. Pres J. J. Patterson, Sec. & Treas. J. Graham. Leased to Wyoming Valley Traction Co. 7 2

Plymouth St. Ry. Co. Elec. 4 m, 4-8½ g, 40 lb. T r 6 m. c. Short system. Pres. J. J. Patterson, Sec & Treas. J. Graham. Leased to Wilkesbarre & Wyoming Valley Traction Co. 7 2

West Pittston & Wyoming St. Ry. Co. Elec. 20½ m, 4-8½ g, 40 lb. T r, 4 m. c. Short system. Pres J. J. Patterson, Sec. & Treas. J. Graham. Leased to Wyoming Valley Traction Co. 7 2

Wilkesbarre & Suburban St. Ry. Co. Elec. 7½ m 5-2½ g, 52 lb girder r, 9 4-wheel box c, 17 motors Edison system. Pres. M. B. Williams, V. Pres. C. A Miner, Sec. E. H. Chase, Treas. C. Walter, Supt. & Gen. Man. ————; Capital $100,000. Leased to Wyoming Valley Traction Co. 7 2

Wilkesbarre & West Side Ry. Co. Elec. 3½ m, 4-8½ g, 35 45 & 56 lb T & girder r, 5 c, of which 3 are box & 2 open. Edison system. Pres. J. J. Patterson, Sec & Treas. J. Graham. Leased to Wyoming Valley Traction Co. 7 2

Wilkesbarre & Wyoming Valley Traction Co. 40½ m, of which 8¾ are horse and 31¾ elec. 18 m c, Short system. Pres. B. F. Myers, Sec. W. G. Eno, Treas. & Gen. Man. J. Graham, Supt. J. H. Gibson. 1 3

WILLIAMSPORT, PA.—Williamsport Pass. Ry. Co. Elec. 7¾ m, 4-8½ g, 60 lb c b r, 10 m c. Westinghouse system. Pres. H. R. Rhoads, Sec. J. F. Starr Treas. John Lawshe, Supt. H. C. Young. Capital $250,000. Office 760 W. 4th st. 8 3

WILLIAMSVILLE, N. Y.—Buffalo & Williamsville Ry. Co. Elec. 4½ m, 4-8½ g, 56, 66 lb T & girder r, 4 c, of which 12 are m c and 2 t c. T-H system. Noye engines. Pres. L. F. W. Arend, V. Pres. Gen. Man. & Supt. J. Chalmers, Sec. S. H. Cowles, Treas. L. L. Grove. Capital, $75,000 6 3

WILMINGTON, DEL.—Front & Union St. Pass. Ry. Co. (Operated by Wilmington City Ry.) 1¾ m, 5-2 g, 32 & 63 lb tram & girder r, 10 c, 80 h. Pres. F. B. Colton, Sec. & Treas. F. L. Kurtz. Capital $50,000. Office, Front & Union sts. 2 3

Wilmington City Ry. Co. Elec. 16.75 m, of which 1 is horse and 12.75 elec, 5-2 g, 47, 52, 64, 91 lb girder & tram r, 64 c, of which 12 are h c, 40 m c and 10 t c, 16 h. Edison & Westinghouse systems. Pres P. Lea, V. Pres. W. Saulsbury, Sec., & Gen. Man. W. S. Heger, Treas. C. G. Blandy. Office, Delaware ave. & Dupont st. 11 2

WILMINGTON, N. C.—The Wilmington St. Ry. Co. Elec. 5½ m, of which 1½ m is steam and 4 elec. 4-8½ g, 45, 60 lb T & girder r, 12 m c. T-H system. Pres. C. A. Lieb, V. Pres. & Gen. Man. J. H. Barnard, Sec. B. F. O'Connor, Treas. J. G. White. Capital, $100,000; authorized, $300,000. Office 29 Broadway, New York. 8 3

WINDSOR, ONT.—Windsor Electric St. Ry. Co. 1½ m, 3-6 g, 25 lb T r, 1 motor, 4 c, 9 h. T-H system. Steam power. Pres. W. M. Boomer, Sec. & Treas. M. A. S. Boomer. Office, cor. Mercer & Sandwich sts. W. 11 2

Sandwich, Windsor & Amherstburg Ry Co. Elec 10 m, 4-8½ g, 56 lb girder & T r, 14 c, of which 10 are m. c. and 4 t. c. Westinghouse system. Brill, Laclede, Ottawa and St. Louis cars. Brown & Robb engines. Pres. J. Coventry, V-Pres. G. M. Hendrix, Sec. & Treas. W. I. Pulling. Supt. R. Canfield. Capital, $315,000; authorized $500,000. 9 3

WINFIELD, KAN.—Union St. Ry. Co. 5 m, 4 g, 16-20-35 lb T & Johnson r, 5 c, 20 mu. Pres. Wm Matthewson, Sec. W. J. Kennedy, Treas. Geo. M Robinson, Gen. Man. C. Ferguson. Capital 25,000 2 3

WINNIPEG, MAN.—The Winnipeg St. Ry. Co. Elec. 9 m, of which 5 are horse & 4 elec, 4-8½ g, 35-40 lb r, 23 c, of which 15 are h c, 5 m c and 3 t c, 80 h. Edison system. Pres. Jas. Austin, Sec. & Man. Albert W. Austin, Supt. Geo. A. Young. Capital $100,000. 1 3

WINONA, MINN.—Winona City Ry. Co. (Owned by Winona General Electric Co.) Elec. 4 m, 4-8½ g, 40 lb r, 7 m c. T-H system. Pres. G. C. Duffie, Sec. & Treas. W. H. Moore. Office, 403 Sibley st., St. Paul. 3 3

WINSTON, N. C.—Winston-Salem Ry. & Elec. Co. (Operated and leased by Twin City Construction Co.) 7 m 4-8½ g, 45 lb Johnson girder r, 12 c, of which 9 are m c and 3 t c. Edison system. Brill cars. Ball engines. Pres. J. H. McClement, V. Pres. F. J Sprague, Sec. & Treas. R. G. Day, Asst. Sec. & Treas. W. H. Barham, Supt. & Elec'n. F. W. McClement. Capital, $150,000. Bonds, $200,000. 8 3

WOODLAND, CAL.—Woodland St. Ry. Co. 1 m, 3 g, 30 lb T r, 3 c, 3 h. Pres. T. Ross, V. Pres. G D. Fiske, Sec. L. W. Hilliker, Treas. T. Armstrong Gen. Man. M. McCutcheon, Supt. J. D. Lawson. Capital $30,000. 9 3

WOONSOCKET, R. I.—Woonsocket St. Ry. Co. 6.65 m, 4-8½ g, 35 to 50 lb T r, 16 c, 62 h. Pres. J. P. Ray, Treas. W. Whittlesey, Gen. Man. J. M. Klingelsmith. Capital $24,000; authorized $100,000. Bonds, $59,000. 10 2

WORCESTER, MASS.—Worcester Consolidated St. Ry. Co. (Controlled by Worcester Traction Co.) 24 m, of which 21 are horse and 3 elec. 4-8½g, 36, 45, 50 lb flat, T and Johnson girder r, 107 c, of which 96 are h c and 11 m c, 474 h. Pres. Chas. B. Pratt, Treas. A. H. Stone, Gen. Man. J. N. Akarman. Capital, $700,000. Bonds, 150,000. Office, 15 Market st. 3 3

North End St. Ry. Co. Elec. 5 m, 4-8½ g, 45, 55, 65 lb T r, 12 c, of which 11 are m. c. and 1 t. c. Westinghouse system. Jones, Lewis & Fowler and Stephenson cars. Pres. & Gen. Man. W. P. Searls, V. Pres. G. A. Barnard. Sec. G. F. Barnard, Treas. G. A. Smith, Supt. C. L. West. Capital, $80,000; authorized, $110,000. 6 3

Worcester & Millbury St. Ry. Co. Elec. 4-8½ g, 70 lb girder & T r, 14 c, of which 8 are m c and 6 t c. T H system. Pres. S. Winslow, Sec. & Treas. T. T Robinson, Supt. J. B. Gorman. Capital, $150,000. 9 3

Worcester & Shrewsbury St. Ry. Co. 3,300 ft. 4-8½ g, 58 lb T r, 2 m c. Edison system. Lewis & Fowler cars. Pres. & Treas. H. H. Biglow, Supt. I. E. Biglow. Capital $20,000. Office 19 Foster st. 2 3

Worcester, Leicester & Spencer St. Ry. Co. Elec. 13 m, 4-8½ g, 48 lb T r, 26 c, of which 23 are m. c. and 8 t. c. T-H & Detroit systems. Pres. & Gen. Man S. Winslow, Treas. & Clerk, T. T. Robinson, Supt. J. B. Gorman. Capital $250,000. 9 3

Worcester Traction Co. Pres. E. J. Moore, Sec. T. C. Barr, Treas. C. F. Stevens, Gen. Man. J. N. Akarman. Capital $5,000.000. Bonds $150,000. 4 3

WYMORE, NEB.—Wymore & Blue Springs Ry. Co. 3½ m, 3-6 g, 22 lb T r, 4 4-wheel box c, 10 h Pres. J. H. Reynolds, V. Pres. Ben. Reynolds, Sec & Treas. E. P. Reynolds, Jr., Supt. T. Bauman, Gen Man. O. P. Newbranch. Capital, $36,700; authorized $50,000. 6 2

Y

YARMOUTH, N. S.—Yarmouth St. Ry. Co. 2 m, 4 g, 45 lb T r, 5 c, of which 2 are m c and 3 t c. Edison system. Pres. R. Cale, V. Pres. W. D. Lovitt, Sec., Treas. & Gen. Man. B. B. Law, Supt. J. W. Burton. Capital $40,000; authorized, $100,000. 1 3

YONKERS, N. Y.—Yonkers St. Ry. Co. Elec. 7½ m, 4-8½ g, 42-48 lb r, 14 c, of which 12 are m c and 2 t c, 88 h. Eickemeyer system. Pres. C. H. Montague. Capital, $200,000. 2 3

YORK, PA.—York St. Ry. Co. 7 m, 4-8½ g, 45, 70 lb girder & T r, 21 c, of which 15 are m c and 6 t c. T-H system. Brill and Lamokin cars. Pres. & Gen. Man. W. H. Lanius, V. Pres. D. K. Trimmer, Sec. G. S. Schmidt, Treas. G. Hersh, Supt. C. E. Long. Capital, $138,000; authorized, $200,000. Office, 27 E. Market St. 8 3

YOUNGSTOWN, O.—Youngstown St. Ry. Co. Elec. 10½ m, 4-8½ g, 48, 70 lb Johnson r, 29 c, of which 22 are m c. and 7 t. c. Edison and Sperry systems. Pres. James Parmelee, V. Pres. H. M. Garlick, Sec., Treas., Gen. Man. & Supt. F. W. Brown. Capital $500,000. Bonds, $300,000. 8 3

Z

ZANESVILLE, O.—Zanesville St. Ry. Co. Elec 8 m, 5-2½ g, 48½, 50 lb. girder & T r, 21 c, of which 11 are m c and 10 t c. Edison system. Lamokin cars. Pres. A. L. Conger, V. Pres. F. M. Atterholt, Sec. F. A. Wilcox, Treas. & Gen. Man. F. A. Seiberling, Supt. A. H. Johnson. Capital $200.000. Bonds $180,000. 2 3

PROJECTED ROADS.

A

ASHLAND, WIS.—Belt Line Association. Pres. J. W. Cochran, V. Pres. T. Bardon, Sec. & Treas. R. C. Heydlauff. n 5 3

B

BELDING, MICH.—Belding St. Ry. & Imp. Co. Steam. 2½ m. 4 8½ g, 40 lb r. Pres. & Gen. Man. B. Stone, V. Pres. M. J. Demorest, Sec. E. R. Hale, Treas. G. S. Rosefelt. Capital, $6,000; authorized, $20,000. 2 3

BELFAST, ME.—Belfast St. Ry. Co. N. F. Houston, Pres., Belfast; J. H. Quimby, Clerk & Treas. 8 3

BOONSBORO, MD.—South Mountain Electric Ry., St. & Power Co., of Boonsboro. 3 m, 4-8½ g, 80 lb T r. Pres G. W. Jacobs, V. Pres. C. H. Young, Sec. G. A. Davis, Treas C. E. Schafer. 11 3

BOSTON, MASS.—Boston & Winthrop St. Ry. Co. Elec. 3½ m, 4-8½ g, 50 lb. T r, 4 c. Pres. L. Pingst, Sec. W. Goodwin. Treas. M. E. Clemons. Capital, $35,000. Office, 53 State St., No. 807. 6 3

BRAINTREE, MASS.—Braintree Street Ry. Co 4.15 m. Pres. F. A. Hobart, Treas. J. T. Stevens 7 2

BROOKLYN, N. Y.—Twenty-third St. Ferry & Newtown R. R. Co. Pres. H. B. Scharman, Sec & Treas. F. Jenkins. n 1 3

C

CANFIELD, O.—Canfield & Youngstown Elec. Ry. Co. Pres. J. R. Johnson, V. Pres. S. Ewing, Sec. J. C. Ewing, Treas. A. Dickson. n 6 3

CHAMBERSBURG, PA.—Chambersburg Electric St. Ry Co. 6 m. 5-2½ g, 50 lb. girder r, 8 c, of which 5 are m c and 3 t c. Capital, $50,000. Address Albert E. Hay, Altoona, Pa. 4 3

CHICAGO, ILL.—Hammond & Chicago Electric & St. Ry. Co. 17 m, 4-8½ g, 60 lb girder r, 15 m c. Westinghouse system. Pres. W. H. Fitzgerald, V. Pres. C. F. Griffin, Sec. & Treas. L. Silverman, Gen. Man. C. E. Loss. Capital, $200,000. Office, 621 Pullman Bldg.

COLUMBIA, PA.—Columbia & Washington St. Ry. Co. Elec. 4 m, 5-2½ g, 6 m c. Pres. A. J. Kauffman, V. Pres. W. H. Grier, Sec. B. Kauffman, Treas. J. W. Yocum, Supt. H. C. Young. Capital, $40,000; authorized, $100,000. 9 3

COLUMBUS, O.—Columbus Central Ry. Co. Elec. 38 m, 4-8½ g, 50 70 lb r. Pres. M. H. Neil, V. Pres. T. A. Simons, Sec. J. F. Barry, Gen. Man. G. W. Meeker. Capital, $500,000. To be constructed in Spring of 1894. 11 3

Worthington, Clintonville & Columbus St. Ry. Co. Elec. 4 m, 4-8½ g, 45 lb T r, 5 m c. Pres. O. W. Aldrich, V. Pres. J. M. Milue, Sec. R. M. Weaver, Treas. H. C. Cooke. Capital, $40,000.

CONNERSVILLE, IND.—Connersville St. Ry. Co. Elec. 5 m. Pres. J. B. McFarlan. 5 3

CORAOPOLIS, PA.—Pittsburgh, Neville Island & Coraopolis Ry. Co. Elec. 8 m, 5-2 g, 60 lb T & girder r, 8 m c. Pres. J. W. Arras, Sec. M. D. Rowland, Treas. J. D. Shanks. 5 2

D

DEDHAM, MASS.—Norfolk Suburban St. Ry. Co. Elec. 8 m, 4-8½ g, 50 lb T r, 5 c. Gen. Elec. system. Morse cars. Pres. J. R. Bullard, Sec. Treas. & Supt. T. T. Robinson, Engr. E. Worthington, Jr. Capital, $75.000. To be opened May, 1894 9 3

DUNDEE, ILL.—Dundee Rapid Transit Co. Pres. E. C. Hawley. n 11 3

E

ELDORADO SPRINGS, MO. — Eldorado Springs & Nevada Dummy R. R. 22 m, 4-8½ g, 40 lb r, 8 c, 2 motors. To be built soon as possible. 8 2

EVERETT, WASH.—Everett Electric Ry. Co. 7 m. Engr. Leo Daft.

F

FONDA, N. Y.—Fonda & Fultonville Electric R. R. Co. (Extension of Cayadutta Elec. R. R.) 1 m. Pres. J. Shanahan, Sec. C. Rickard. Capital, $100.-000. 2 3

G

GALT, ONT.—Galt & Preston St. Ry. Co., Ltd. Pres. T. Todd, V. Pres. R. G. Cox, Sec. & Treas. W. Lutz.

GREENCASTLE, IND —2½ m, 4-8½ g, 40-50 lb T r, 3 m. c. Pres. J. W. Welk. Sec. & Treas. F. G. Gilmore. 7 3

H

HAMILTON, ONT.—Hamilton Radial Electric Ry. Co. 130m, 4-8½ g, 60 lb r, 80 c, of which 30 will be m. c. Officers C. M. Counsell, W. J. Copp, J. Patterson, J. H. Tilden, N. Dyment, A. Zimmerman, W. A. Wood, T. Patterson, Jr. Capital $2,000,000. Commenced December 1892, to be finished in fall, 1893. Power to be obtained from Niagara Falls. 11 2

Hamilton, Grimbsy & Beamsville Elec. Ry. Co. Pres. C. J. Myles, V. Pres. J. T. Middleton, Sec. A. Rutherford.

HAVERHILL, MASS.—Haverhill, Georgetown & Danvers R. R. Co. Address Hamilton L. Perkins. 9 3

HAZLETON, PA.—Hazleton & Suburban Street Ry. Co. Elec. 20 m, 4-8½ g, 60 lb r. Westinghouse system. Pres. A. Markle, Supt. & Engr. J. E. Giles. Capital $100,000. Under construction. 3 3

HOOPESTON, ILL.—Hoopeston St. Ry. Co. 5 m 4-8½ g, 8 c, 20 h. Pres. & Man. D. Wallace, V. Pres. W. R. Clark, Sec & Treas. J. H. Dyer. Capital, $50,-000. To be finished January 1, 1894. 9 3

HOOSICK FALLS, N. Y.—Hoosick Ry. Co. Elec. 5 m, 4-8½ g, 50 lb. T r. Pres. W. M. Holmes, V. Pres. J. Buckley, Sec. & Gen. Man. C. B. Story, Treas. G. C. Moses. Capital authorized $60,000. Office, 60 Classic St. 12 3

HOUSTON, TEX.—Houston Rapid Transit Co Elec. 17 m, 4-8½ g, 56 lb girder and T r, 20 c. V. Pres & Gen. Man. H. T. D. Wilson. Capital, $300,000. 7 2

HULL, MASS.—Hull St. Ry. Co. 4 m c. T-H system. 12 2

I

INDIANAPOLIS, IND.—Indianopolis & Martinsville Electric Ry. Co. 30 m, 4-8½ g, 60 lb. r, 40 c. Pres. J. Stevenson, V. Pres. O. Matthews, Sec. E. F. Branch, Gen. Man. H. A. Smock. Capital, $500,000. Address Lock Box 522. 5 3

J

JUNCTION CITY KAN.—Junction City & Fort Riley St. Ry. Co. Elec. 6 m. Pres. J. Eddy, Gen Man. G. W. Harris. Capital, $200,000. 7 2

K

KEENE, N. H.—Keene Electric Ry. Co. Pres. E. F. Lane, Treas. A. Litchfield, Audr. D. R. Cole. n 5 3

KINGSTON, N. Y.—Colonial City Electric Ry. Co. 6 m, 4-8½ g, 62 lb r, 6 m. Pres. E. H. Loughran, V. Pres. W. Goodwin, Sec. N. C. Powelson, Treas. F Swift. Capital, $175,000. 6 3

L

LANCASTER, PA.—Lancaster & Lititz Ry. Co. Elec. 8 m, 5-2½ g, Pres. J. A. Coyle, Sec. & Treas. J. E. Ackley. 8 2

M

McKEESPORT, PA.—The Dravosburgh, Mendelssohn & Elizabeth Electric St. Ry. Co. 7⅛ m 5-2½ g, 56 lb girder r, 16 m c. Pres. H. H. Saraney Sec. J. A. Skelley. Capital, $100,000. Office, 510 Locust st. 10 2

MAUCH CHUNK, PA.—Carbon County Electric Ry. Co. Pres. A. B. Clemmer. Office 14 Chamber of Commerce 33 S. 2d St. Philadelphia. 11 2

MIDDLETOWN, DEL.—Odessa & Middletown Elec. Ry. Co. 4 m. Pres. W. Taylor, Sec. & Gen. Man. W. R. Polk, Treas. J. T. Corbitt. Capital, $100,000. 9 3

MIDDLETOWN, N. Y.—Middletown - Goshen Traction Co. 10 m, 4-8½ g, 50, 90 lb T & girder r. Pres. J. C. Hinchcliff, Vice-Pres. M. J. Wightman, Sec. E. G. Wightman, Treas. & Gen. Man. W. B. Rockwell. Capital, $100,000. To be operated about June 1, 1894. 9 3

MIDDLETOWN, O.—Middletown Electric Power & Ry. Co. 5½ m, 4-8½ g, 35, 45 lo T & girder r, 6 m c Pres. C. T. Goldman, V. Pres. G. C. Jacoby, Sec. J. M. Iseminger, Treas. W. O. Banutz. Gen. Man. W. P. Noble. Capital, $100,000. To be built in 1894. 9 3

N

NEW ALBANY, IND.—Glen View Park Ry. Co Elec. 3½ m, 4-8½ g, 45, 56 lb. T & girder r. Pres. J Peters Jr. Sec. E. B. Stotsenburg. Office 120 Pearl St. 10 2

NEW GLASGOW, N. S.—New Glasgow Electric Co. Ltd. 8¼ m. 4-8½ g, 60 lb T r, 8 c, of which 4 are m c and 4 t c. Pres. J. L. Jennison, Sec. & Treas. H. V. Jennison. Gen. Man., Supt. & Elec'n. F. A. Bowman. Capital $50,000. 9 2

O

OCEAN CITY, N. J.—Ocean City Electric Ry Co. 2 m, 4-8½ g, 53 lb girder r, 4 m c. T-H system Ball and Westinghouse engines. Pres. E. B. Lake, V. Pres. W. Lake, Sec. H B. Adams, Treas. G. E. Palen, Supt. H. Kalbach. Capital, $100,000. 9 3

P

PATERSON, N. J.—Paterson, Passaic & Rutherford Electric Ry. Co. Pres. C. A. Johnson, V. Pres. J. A. Morisse, Sec. J. J. Scanlan, Treas. L. Fitzgerald. n 11 3

PEKIN, ILL.—Pekin Rapid Transit Co. Elec. 6½ m, 4-8½ g, 45 lb r. Pres. J. Patterson, Sec. Gen. Man. & Supt. H. Patterson. Capital, $100,000. To be built in spring of 1894 9 3

PERU, IND.—Peru Ry. Co. Elec. 4 m, 4-8½ g, 40 or 50 lb r, 6 m c. Pres. R. A. Edwards, V. Pres. W. S. Mercer, Sec. R. H. Bousloy, Treas. C. H. Brownell. Capital, $50,000. 3 3

PHILADELPHIA, PA. — North Philadelphia Pass. Ry. Co. Pres. H. A. Stiles, Sec. & Treas. G. C. Stiles. Capital, $300,000. Office, 209 S. Third st. 7 2

PHŒNIX, ARIZ.—Phœnix, Mt. Olive & Mesa Ry. Co. Elec. 25 m, 4-8½ g, 50 lb T r, 16 c. Pres. B. E. Lower, Sec. W. Scott, Treas. T. W. Hine. Capital, $1,500,000. To be finished in 1893. 12 2

PITTSBURGH, PA.—Grandview Traction Co 6½ m, of which ¾ m is cable and 5¾ elec, 5-2½ g, 10 c. Pres. W. B. Lupton, V. Pres. C. H. Humbert, Sec. F. W. Gordon, Treas. W. T. Brown. Capital $250,000 Office, 155 4th Ave. 10 2

PONTIAC MICH.—Pontiac & Sylvan Lake St. Ry. Co. 5 m. Pres. M. B. Mills, Detroit; Sec. D. D. Jayne, 416 Hammond Bldg., Detroit; Treas. J. D. Norton. Pontiac. Capital, $150.000. 8 2

PORTSMOUTH, O.—Portsmouth St. R. R & Lt. Co. 5 m, 4-8½ g, 45, 67 lb r, 7 c, of which 5 are m c and 2 t c. Pres. G. Davis, V. Pres. F. Z. Smith, Sec. & Treas. S. B. Emmonds. Capital $125,000.

POTTSTOWN, PA.—Citizens' Passenger Ry. Co 12½, 4-8½ g, 70 lb. r, 6 m. c. Pres. J. A. Weber, Sec & Treas. J. C. Heilig. Office 227½ High St. 11 2

POTTSVILLE, PA. — Pottsville, Cressona, Schuylkill Haven & Orwigsburg Electric Ry. Co. 12 m, 4-8½ g, T r. Pres. J. T. Shoener, V. Pres. G. F. Dengler, Sec. & Gen. Man. L. K. Hannum. 9 3

S

ST. LOUIS, MO.—Kirkwood, Webster & St. Louis R. R. Co. Elec. 8 m, 4-8½ g, 60 lb r, 7 m c. Capital, $350,000. 11 2

Clayton & Forest Park Ry. Co. Elec. 4½ m. 4-8½ g 60 lb. T & girder r. Pres. T. K. Skinker, V. Pres. T. L. Boland, Sec. & Treas. B. F. Thomas. Capital, $68,000; authorized $100,000. Office 220 N. High st., Room 522. 9 3

SALEM, ORE.—Capital City Ry. Co. Elec. 7 m, 4-8½ g, 30, 40 lb T r, 8 m. c. Edison system. Pres. D. Simpson, Sec. & Treas. T. H. Barnes. Capital &100,000. 8 2

SCOTTDALE, PA.—Scottdale, Everson & Broadford St. Ry. Co. Elec 5 m, 5-2 g, 45 lb girder r, 4 m c Pres. N. Miles, Sec. J. R. Byrne, Treas. W. N. Porter To be built in 1894 9 3

SCRANTON, PA.—Scranton Rapid Transit Co. Elec. 10 m, 4-8½ g, 56, 80 lb T & girder r. 20 c. Wightman system. Pres. P. J. Horan, Sec. A. Frothingham Treas. M. J. Wightman. 1 3

Shamokin & Elysburg Electric Ry. Co. 6 m, 4-8½ T r, 5 m c. Pres. E. C. Hamilton, Sec. J. I. Higbee, Treas. C. M. Clement. Capital, $100,000. 2 3

SPARTANBURG, S. C.—Spartanburg, Clifton & Glendale R. R. Co. 2½ m. Steam. 4-8½ g, 40 lb T r, 3 c. 1 engine. Pres. A. H. Leftwich, V. Pres. J. W. Fowler, Sec. & Treas. W. D. Fowler, Gen. Man. & Supt. W. E. Fowler 9 3

SPOKANE FALLS, WASH.—Spokane & University Heights St. Ry. Co. 7 m elec. 4-8½ g, 35 lb T r 3 c. Pres. & Gen. Man. Allan V. Garratt, V. Pres Robert Abernethy, Sec. L. B. Cornell. Capital, $100,-000, 4 2

Spokane & Cœur d'Alene Ry. & Navigation Co. Elec. 32 m, 4-8½ g, 56 lb T r, 4 m c. Gen. Elec. system. Pres. A. A. Newberry. Sec. W. S. Norman, Treas. D. M. Drumhilbur, Ch. Eng. B. C. Riblet. Capital, $500,000. 8 2

SUNBURY, PA.—Sunbury & Selins Grove Elec. Ry. Co. 6 m, 4-8½ g, T r, 8 m c. Pres. E. C. Hamilton, Sec. J. I. Higbee, Treas. C. M. Clement. Capital, $100,000. 9 3

SYRACUSE, N. Y.—Syracuse, Fayetteville & Manlius Ry. Co. Elec. 12 m, 4-8½ g, 60 lb T r, 10 to 14 m c. Pres. R. R. Spaulding, V. Pres. & Gen. Man. E. W. Emmons, Sec. C. A. Spaulding. Capital $250,-000. Office, New York. 7 3

T

TAMPA, FLA.—Consumers' Elec. Lt. & St. R. R Co. 9 m, 4-8½ g, 45, 56 lb T & girder r, 9 c, of which 7 are m c and 2 t c. T-H system. Brill and Brownell cars. Pres, W. B. Henderson, V. Pres. & Treas, E. S. Douglass, Sec. & Supt J. T. Douglass. Capital $50,-000. Bonds $200,000 9 3

TAMAQUA, PA.—Tamaqua & Lansford St. Ry Co. Elec. 9 m, T r, 8 c Pres, F. P. Spiese, V. Pres. R. Harris, Sec. A. P. Blakeslee, Treas. P. J. Ferguson. Capital, $100,000. Office, 43 45 W. Broad St. 9 3

V

VELASCO, TEX.—Bryan Heights Ry. Co. Dummy. 5 m, 4-8½ g, 25 lb T r. Pres. J. P. Bryan, V. Pres. G. M. Bryan, Jr., Sec. & Treas. F. S. Robbins. Capital, $25,000. 4 2

W

WASHINGTON, D. C.—District of Columbia Suburban Ry. Co. Elec. 13 m, 4-8½ g, T & girder r. Pres. G. Moyers, V. Pres. & Supt. G. P. Davis Sec. H. Barton, Treas. L. C. Loomis. 9 2

WATERTOWN, N Y.—Watertown & Brownville St. Ry. Co. Pres. A. H. Sawyer, V. Pres. S. Cooper, Sec. & Treas. G. F. Clark. n 6 3

WAVERLY, N. Y.—Waverly, Sayre & Athens Electric Traction Co. 7 m, 4-8½ g, 45, 52 lb T & girder r, 6 m c. Pres. A. N. Broadhead, V. Pres. W. L. Watrous, Sec. A. C. Wade, Treas. C. M. Dow. Capital, $75,000. 2 3

WELLSTON, O.—Wellston Electric Belt R. R. Co. Elec and Steam. 35 m, 4-8½ g, 60 lb T r, 10 motors with t c. Capital, $1,000,000. Address Harvey Wells. 3 3

WEST CHESTER, PA.—Suburban Ry. Co. of West Chester. 25 m. 4-8½ g, 5 m c. Pres. W. J. Fell Engr. W. S. Kirk. Office, 402 N. Church St. 8 3

WEST NEWBURY, MASS.—People's St. Ry. Co. Pres. F. S. Carr, Sec. F. W. Noyes, Treas. H. O. Delano, n 6 3

WORCESTER, MASS.—State Central Ry. Co. Elec. 4-8½ g. Pres. S. Winslow, Treas. T. Robinson. Capital, $650.000. 5 3

Y

YORK, PA.—York & Dallastown Electric Ry. Co. 6 m, 4-8½ g, Pres. W. H. Lanius, Sec. F. Geise, Treas. G. Hersh. Capital $40,000. 7 3



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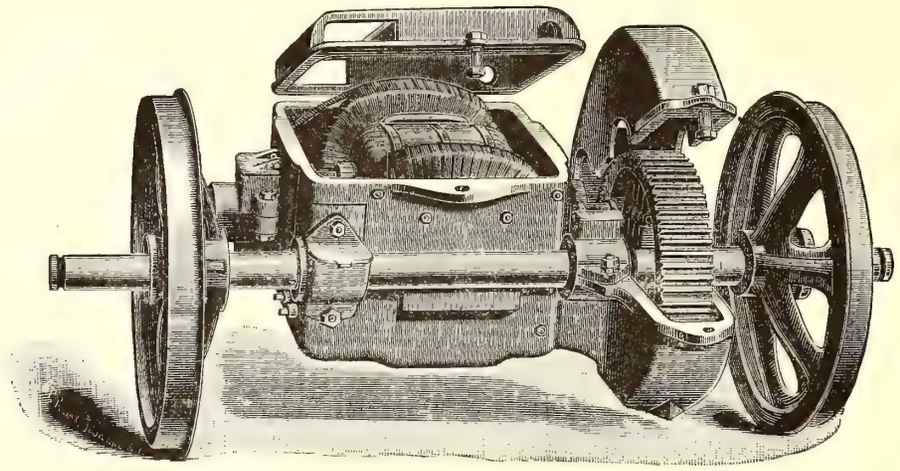
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CURTIS STANDARD (30 H. P.) MOTOR.

No Curtis Armature or Controller Has Ever Burned Out or Grounded in Service.

These Motors, and the Curtis Series Multiple Platform Controllers have been in constant service on many street railroads, and have invariably given perfect satisfaction. We refer, among others, to

Brooklyn City Railroad Co.,	**Brooklyn, N. Y.**
Consolidated Traction Co.,	**Jersey City, N. J.**
Citizens' Passenger Railway Co.,	**Norristown, Pa.**
Reading & Southwestern Railway Co.,	**Reading, Pa.**
Portsmouth Street Railroad & Light Co.,	**Portsmouth, O.**
Oil City Street Railway Co.,	**Oil City, Pa.**

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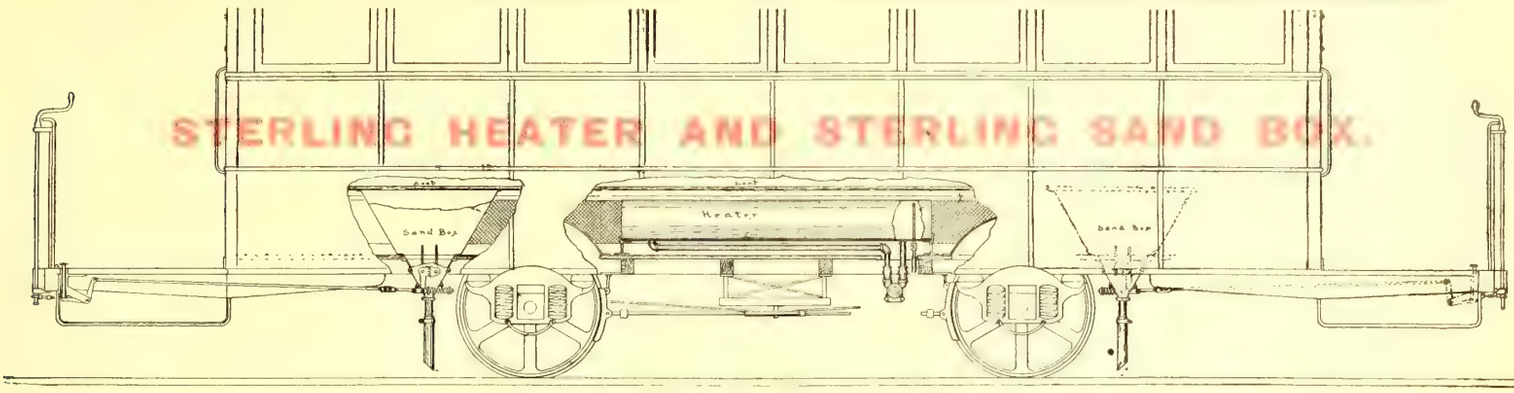
CONTROLLERS.—These are of the series multiple type, and do not ground, arc, tit, or burn out. They are simple in design, and require little or no attention.

RHEOSTATS.—These are suspended by insulated supports within an iron case and are waterproof.

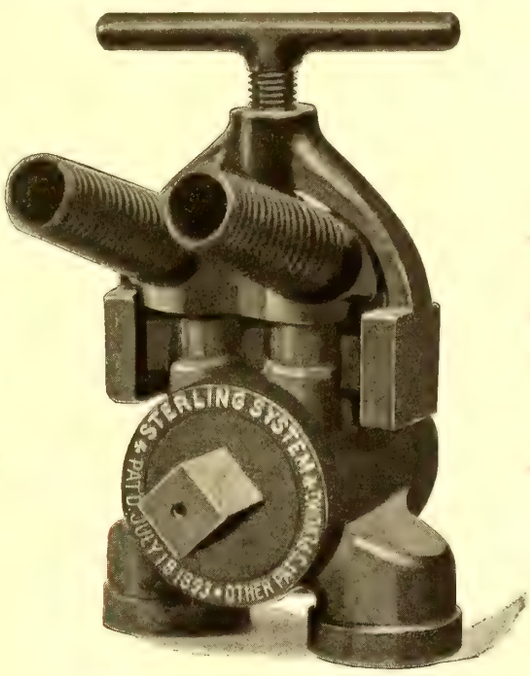
LIGHTNING ARRESTERS AND OVERHEAD CUT-OUTS.—These are of approved design and workmanship.

SEND FOR DESCRIPTIVE CATALOGUE.

CURTIS ELECTRIC MFG. CO., Pacific Ave., Jersey City, N. J.



STERLING HEATER AND STERLING SAND BOX.



STERLING FOUR-WAY COCK AND QUICK COUPLER FOR HEATERS.

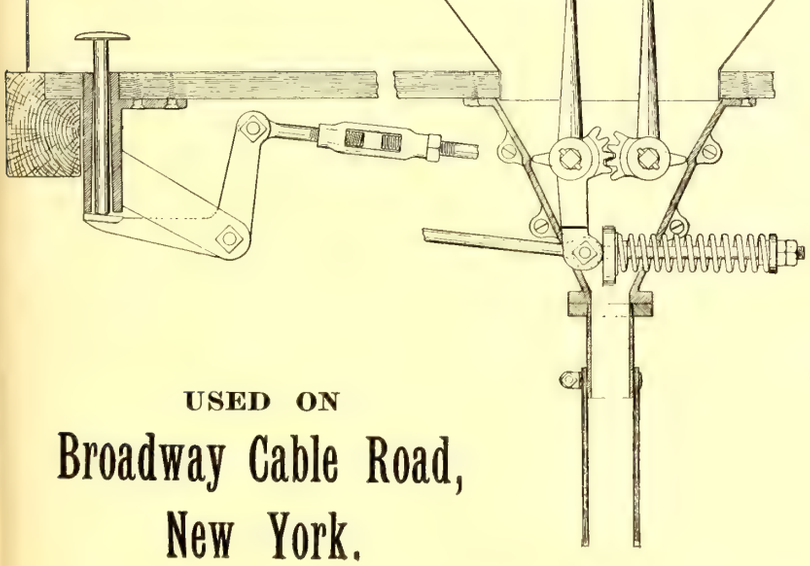
STYLE Nº 1

STERLING SAND BOX

FOR STREET CARS.

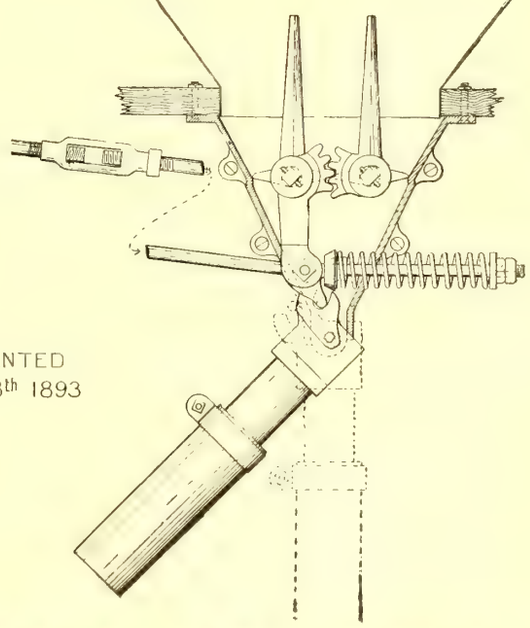
STERLING SUPPLY COMPANY.

47 Cedar Street, New York.



STYLE Nº 2

SHOWING LIFTING ATTACHMENT



PATENTED
JULY 18th 1893

USED ON

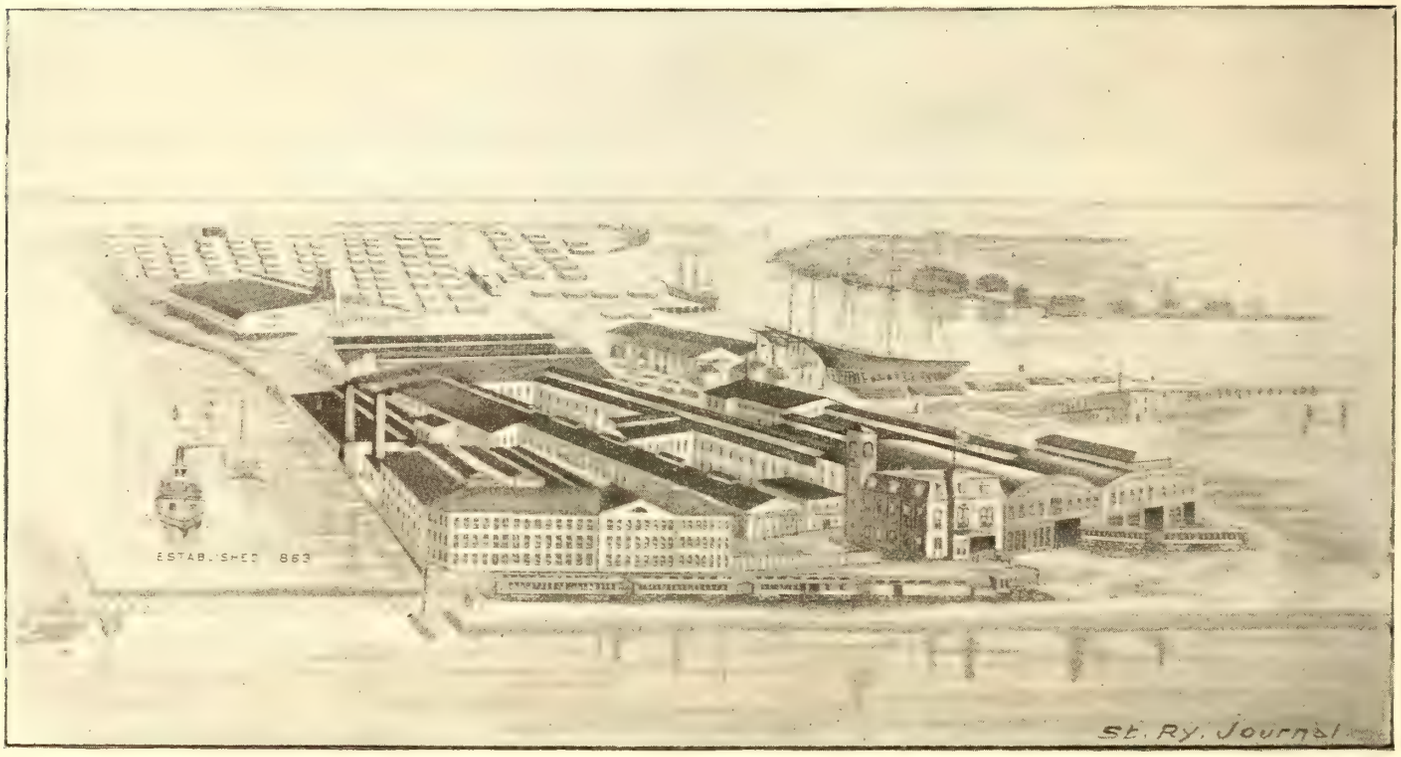
Broadway Cable Road, New York.

STERLING SUPPLY CO.

Jackson & Sharp Co.

DELAWARE CAR WORKS,

WILMINGTON, - DELAWARE,



BUILDERS OF

STREET RAILWAY CARS

OF ALL KINDS.

Between 6,000,000 and 7,000,000 feet of thoroughly dry and seasoned lumber of all kinds constantly on hand, and 2,000,000 feet under cover. Extraordinary facilities and large experience give us many advantages.

WRITE FOR DRAWINGS AND PRICES.

DIRECTORY
OF
MANUFACTURERS AND DEALERS IN STREET RAILWAY SUPPLIES.

NOTE.—For reference to the advertisements, see alphabetical index on page V.

ADVERTISING RACKS.

U.S. Steam & Street Ry. Advertising Co., Boston, New York, etc.
Veneer Seating & Church Furniture Co., Brooklyn, N. Y.

AIR PUMPS.

Philadelphia Engineering Works (Ltd.), Phila., Pa.

AUTOMATIC SWITCHES.

Dorner & Dutton Mfg. Co., Cleveland, O.
Fulton Truck & Foundry Co., Cleveland, O.
Johnson Co., Johnstown, Pa.
Jonson Engineering & Foundry Co., New York.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Pennsylvania Steel Works, Philadelphia, Pa.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.
White Manufacturing Co., The, New York.

AXLES.

Brill, J. G. Co., Philadelphia, Pa.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fulton Truck & Foundry Co., Cleveland, O.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Peckham Motor Truck & Wheel Co., Kingston, N.Y
Stephenson, Jno., Co. Ld., New York.
White Manufacturing Co., The, New York.
Whitney, A., & Sons, Philadelphia, Pa.

BEARINGS.

Bemis Car Box Co., Springfield, Mass.
Brill, J. G. Co., Philadelphia, Pa.
Dorner & Dutton Mfg. Co., Cleveland, O.
Electric Railway Equipment Co., Cincinnati, O.
Fulton Truck & Foundry Co., Cleveland, O.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Nuttall, R. D., Co., Allegheny, Pa.
Peckham Motor Truck & Wheel Co., Kingston, N. Y
Stephenson, John, Co., Ld., New York.
Taylor Electric Truck Co., Troy, N. Y.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.
White Manufacturing Co., The, New York.

BELL CORD.

McClure, Chas. L., New York.

BELLS, CAR.

Brill, J. G., Co., Philadelphia, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Pittsburgh Steel Hollow Ware Co., Allegheny City, Pa.

BELTING.

Green, H. N., New York.
Link-Belt Engineering Co., Nicetown, Pa.
Munson, Charles, Belting Co., Chicago, Ill.
Shultz Belting Co., St. Louis, Mo.

BELTING, COTTON AND LEATHER.

Green, H. N., New York.

BELTING, LEATHER LINK.

Shultz Belting Co., St. Louis, Mo.

BENDING MACHINES.

Barbour, Stockwell Co., Cambridgeport, Mass.
Johnson Co., Johnstown, Pa.
Jonson Engineering & Foundry Co., New York.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.

BLINDS.

Brill, J. G., Co., Philadelphia, Pa.
Frost Veneer Seating Co., New York.
Sjoberg, J. P., & Co., New York,
Trimble, Jas. A., New York.

BOILER & PIPE COVERINGS.

Johns, H. W., Manufacturing Co., New York.

BOILERS.

Babcock & Wilcox, New York.
Dickson Manufacturing Co., Scranton, Pa.
Field Engineering Co., New York.
Fleming, W. R. & Co., New York.
Heine Safety Boiler Co., St. Louis, Mo.
Jarvis Engineering Co., Boston, Mass.
Parker, J. W. & Co., Philadelphia, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Southwark Foundry & Machine Co., Philadelph a, Pa.
Stearns Manufacturing Co., Erie, Pa,
Stirling Co., The, Chicago, Ill.
Wetherill, Robert, & Co., Chester, Pa.

BOILERS, ECONOMIZERS.

The Fuel Economizer Co., Matteawan, N. Y.

BOLTS, FISH PLATES, ETC.

Barbour, Stockwell Co., Cambridgeport, Mass.
Belleville Steel Co., St. Louis, Mo.
Cambria Iron Co., Philadelphia, Pa.
Craig, Wm. P., New York.
Dick, Kerr & Co., London, Eng.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass.
Johnson Co., Johnstown, Pa.
Lewis & Fowler Mfg. Co, Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Steel Co., Philadelphia, Pa.
Ralston & Henry, Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
Wharton, Wm., Jr. & Co., Philadelphia, Pa.

BOOKS.

Street Railway Publishing Co., The, New York.

BOXES, JOURNAL.

Bemis Car Box Co., Springfield, Mass.
Brill, J. G. Co., Philadelphia, Pa.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fowler, J. W., Car Co., Elizabethport, N. J.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass,
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Peckham Motor Truck & Wheel Co., Kingston, N. Y
Stephenson, Jno., Co. Ld., New York.
Taylor Electric Truck Co., Troy, N. Y;
White, Manufacturing Co., The, New York.
Whitney, A., & Sons, Philadelphia, Pa.

BRAKE HANDLES.

Brill, J. G. Co., Philadelphia, Pa.
Fowler, J. W., Car Co., Elizabethport, N. J.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Reliable Manufacturing Co., The, Boston, Mass.
Stephenson, Jno. Co., Ld., New York.
White Manufacturing Co., New York.

BRAKE RODS.

Fowler, J. W., Car Co., Elizabethport, N. J.
Brill, J. G. Co., Philadelphia, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Peckham Motor Truck & Wheel Co., Kingston, N. Y
Stephenson, Jno., Co. Ld., New York.
Taylor Electric Truck Co., Troy, N. Y.

BRAKE SHOES.

Brill, J. G. Co., Philadelphia, Pa.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fowler, J. W., Car Co., Elizabethport, N. J.
Fulton Truck & Foundry Co., Cleveland, O.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Peckham Motor Truck & Wheel Co., Kingston, N. Y
Pennsylvania Iron Works Co., Philadelphia, Pa.
Stephenson, Jno., Co., Ld., New York.
Taylor Electric Truck Co., Troy, N. Y.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.
White Manufacturing Co., The, New York.

BRAKES.

Brill, J. G. Co., Philadelphia, Pa.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fowler, J. W., Car Co., Elizabethport, N. J.
Genett Air Brake Co., Chicago, Ill.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Peckham Motor Truck & Wheel Co., Kingston, N. Y
Reliable Manufacturing Co., The, Boston, Mass.
Stephenson, Jno. Co. Ld., New York.
Taylor Electric Truck Co., Troy, N. Y.

BRAKES, RATCHET.

Brill J. G., Co., Philadelphia, Pa.
Reliable Manufacturing Co., The, Boston, Mass.

BRAKES, TRACK.

Brill, J. G. Co., Philadelphia Pa.
Stephenson, Jno., Co. Ld., New York.

BRIDGES, IRON.

Berlin Iron Bridge Co., East Berlin, Conn.
Wrought Iron Bridge Co., Canton, O.

BUILDINGS, IRON.

Berlin Iron Bridge Co., East Berlin, Conn.
Wrought Iron Bridge Co., Canton, O.

BUSHINGS, GRAPHITE.

Walker Manufacturing Co., The, Cleveland, O.

CABLE DRIVING MACHINERY.

Dickson Manufacturing Co., Scranton, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.

CAR LIGHTING.

Safety Car Heating & Lighting Co., New York.
Sterling Supply Co., New York.

CABLE GRIPS.

Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.

CABLE RAILWAY PLANTS.

Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.

CABLE ROADS AND MATERIALS.

Barry & McTighe, New York.
Conway, M. W., Brooklyn, N. Y.
Dick, Kerr & Co., London, Eng.
Fowler, Geo. L., New York.
Jonson Engineering & Foundry Co., New York.
McCarthy, F. E., & Co., Boston, Mass.
New York Equipment Co., New York.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.
Washburn & Moen, Mfg. Co., Worcester, Mass.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

CABLE YOKES,

Johnson Co., Johnstown, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.
Wharton, Wm., Jr., & Co., Philadelphia, Pa..

CABLES, ELECTRIC LIGHT & POWER

Allen Electric & Supply Co., Philadelphia, Pa.
Brown Electric Co., Boston, Mass.
Eastern Electric Cable Co., Boston, Mass.
Habirshaw Wire, Yonkers, N. Y.
Moore, Alfred F., Philadelphia, Pa.
New York Electrical Works, New York.
New York Insulated Wire Co., New York.
Okonite Co. (Ltd.), The, New York.
Roebling's, John A., Sons Co., Trenton, N. J.
Simplex Electrical Co., Boston, Mass.
Washburn & Moen Mfg. Co., Worcester, Mass.

CABLES, ROPES.

California Wire Works, San Francisco, Cal.
Cradock, George, & Co, Wakefield, England.
Hazard Manufacturing Co., Wilkesbarre, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Smith, Thos. & Wm., Newcastle-on-Tyne, England.
Trenton Iron Company, Trenton, N. J.
Walker Manufacturing Co., Cleveland, O.
Washburn & Moen Mfg. Co., Worcester, Mass.

CABLES, TELEPHONE & TELEGRAPH

Brown Electric Co., Boston, Mass.
Eastern Electric Cable Co., Boston, Mass.
Habirshaw Wire, Yonkers, N. Y.
Moore, Alfred F. Philadelphia, Pa.
New York Electrical Works, New York.
Okonite Co. (Ltd.), The, New York.
Roebling's, John A., Sons Co., Trenton, N. J.
Simplex Electrical Co., Boston, Mass.
Washburn & Moen Mfg. Co., Worcester, Mass.

CAR CEILINGS.

Brill, J. G. Co., Philadelphia, Pa.
Fowler, J. W., Car Co., Elizabethport, N. J.
Frost Veneer Seating Co., N. Y.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Stephenson, Jno., Co. Ld., New York.

CAR CHANNELS.

Cambria Iron Co., Philadelphia, Pa.
Johnson Co., Johnstown, Pa.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

CAR COUPLERS.

Fitzgerald-Van Dorn Co., The, Lincoln, Neb.

CAR CURTAINS.

Burrowes, E. T., Co., The, Portland, Me.
Davis Car Shade Co., Portland, Me.
Brill, J. G., Co., Philadelphia, Pa.

CAR GATES & GUARDS.

Brill, J. G., Co., Philadelphia, Pa.
Pitt, Wm. R., Composite Iron Works, New York.

EDWARD SMITH & CO., COLORS AND VARNISHES, TIMES BUILDING, NEW YORK.

CAR LININGS.
Brill, J. G., Co., Philadelphia, Pa.
Woodman, Joel H., Hoboken, N. J.

CAR LUMBER.
Jackson & Sharp Co., Wilmington, Del.
Wetmore, A. B., New York.

CAR PANELS.
Brill, J. G. Co., Philadelphia. Pa.
Fowler, J. W., Car Co., Elizabethport, N. J.
Lewis & Fowler Mfg. Co , Brooklyn, N. Y.
Stephenson, Jno., Co., New York.
Trimble, Jas. A., New York.
Woodman, Joel H., Hoboken, N. J.

CAR ROOFS.
Frost Veneer Seating Co., New York.
Sjoberg, J. P., & Co., New York.
Trimble, Jas. A., New York.
Woodman, Joel H., Hoboken, N. J.

CAR SEATS.
Brill, J. G. Co., Philadelphia, Pa.
Frost Veneer Seating Co., New York.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Scarritt Furniture Co., St. Louis, Mo.
Sjoberg, J. P., & Co., New York.
Stephenson, Jno., Co. Ld., New York.
Trimble, Jas. A., New York.
Veneer Seating & Church Furniture Co., Brooklyn, N. Y.
Woodman, Joel H., Hoboken, N. J.

CAR SHADES.
Burrowes, E. T., Co., The, Portland, Me.
Davis Car Shade Co., Portland, Me.

CAR SIDES AND ENDS.
Brill, J. G., Co., Philadelphia, Pa.
Frost Veneer Seating Co., New York.
Sjoberg, J. P., & Co., New York.
Trimble, Jas. A., New York.
Woodman, Joel H., Hoboken, N. J.

CAR STOVES.
Brill, J. G., Co., Philadelphia, Pa.
Fowler, J. W., Car Co., Elizabethport, N. J.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Standard Railway Supply Co., Chicago, Ill.

CAR TRIMMINGS.
Brill, J. G., Co., Philadelphia, Pa.
Fowler, J. W., Car Co., Elizabethport, N. J.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Stephenson, Jno., Co., Ld., New York.

CARRIAGES.
Briggs Carriage Co., Amesbury, Mass.

CARS, NEW.
American Car Co., St. Louis, Mo.
Barney & Smith Car Co., Dayton, O.
Briggs Carriage Co., Amesbury, Mass.
Brill, J. G., Co., Philadelphia, Pa.
Brownell Car Co., St. Louis, Mo.
Ellis Car Co. Amesbury, Mass.
Fowler, J. W., Car Co., Elizabethport, N. J.
Gilbert Car Co., Troy, N. Y.
Jackson & Sharp Co., Wilmington, Del.
Jones, J. M., Sons, West Troy, N. Y.
Kuhlman, G. C., Co., Cleveland, O.
Laclede Car Co., St. Louis, Mo.
Lamokin Car Works, Philadelphia and Chester, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y
Morse, C. D., Car Mfg. Co., Millbury, Mass.
New Castle Car Manufacturing Co., New Castle, Pa.
New York Equipment Co., New York.
Newburyport Car Mfg. Co., Newburyport, Mass.
Pullman's Palace Car Co., Chicago, Ill.
Ralston & Henry, Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
Stephenson, John, Co., Ld., New York.
St. Louis Car Co., St. Louis, Mo.
Trimble, James A., New York.

CARS, SECOND HAND.
New York Equipment Co., New York.
Ralston & Henry, Philadelphia, Pa.
Steel Rail Supply Co., The, New York.

CASTINGS.
Chester Steel Castings Co., Philadelphia, Pa.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fulton Foundry Co., Cleveland, O.
Jonson Engineering & Foundry Co., New York.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Ralston & Henry, Philadelphia, Pa.
Shriver, T., & Co., New York.
Wharton, Wm., Jr., & Co., Philadelphia, Pa
White, Edward C., New York.
Whitney, A., & Sons, Philadelphia, Pa.

CASTINGS (SPECIAL), FOR WATER AND GAS.
Floyd, James R. & Sons, New York.

CHAIRS.
Barbour, Stockwell Co., Cambridgeport, Mass.
Johnson Co., Johnstown, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Iron Works, Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
Wharton, Wm., Jr. & Co., Philadelphia, Pa.

CHANNEL PLATES.
Craig, Wm. P., East Orange, N. J.

CHIMNEYS, STEEL PLATE.
Philadelphia Engineering Works (Ltd.), Phila., Pa.

COAL SAVER.
North Western Land & Coal Co., Boston, Mass.

COMMUTATOR BARS.
Billings & Spencer Co., Hartford, Conn.
Williams, J. H., & Co., Brooklyn, N. Y.

COMPRESSORS.
Philadelphia Engineering Works (Ltd.), Phila., Pa

CONDENSERS.
Philadelphia Engineering Works (Ltd.), Phila., Pa

CONDUCTORS' CAPS.
Brill J. G., Co., Philadelphia, Pa.
Wales Manufacturing Co., Syracuse, N. Y

CONVEYORS, COAL AND ASHES.
Hunt, C. W., Co., New York.
Link-Belt Engineering Co., Nicetown, Pa.

COPPER WIRE
Benedict & Burnham Mfg. Co., Waterbury, Conn.
Ralston & Henry, Philadelphia, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

CRANES, TRAVELING.
Harrington, Edwin, Son & Co., Incorporated, Philadelphia, Pa.
Phœnix Iron Works, Cleveland, O.
Sellers, Wm. & Co., Incorp., Philadelphia, Pa.
Shriver, T., & Co., New York.

CROSSINGS, FROGS AND SWITCHES.
Barbour, Stockwell Co., Cambridgeport, Mass.
Dick, Kerr & Co., London, Eng.
Dorner & Dutton Mfg. Co., Cleveland, O.
Floyd, James R., & Sons, New York.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass.
Jonson Engineering & Foundry Co., New York.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
Price Railway Appliance Co., Philadelphia, Pa.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
White Manufacturing Co., The, New York.

CURVED RAILS.
Barbour, Stockwell Co., Cambridgeport, Mass.
Craig, Wm. P., East Orange, N. J.
Floyd, James R., & Sons, New York.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass.
Johnson Co., Johnstown, Pa.
Jonson Engineering & Foundry Co., New York.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Steel Rail Supply Co., The, New York.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.

DETECTIVE SERVICE.
Mowatt's Detective Service, Cleveland, O.
National Railroad Detective Agency, Newark, N. J.
Reliable Detective Agency, The, New York.

DERMAGLUTINE.
Groetzinger, A., & Sons, Allegheny, Pa.

DIFFERENTIAL CABLE DRUMS.
Walker Manufacturing Co., The, Cleveland, O.

DROP FORGINGS.
Billings & Spencer Co., Hartford, Conn.
Williams, J. H., & Co., Brooklyn, N. Y.

DUMMY ENGINES.
Porter, H. K., & Co., Pittsburgh, Pa.

DYNAMOS.
Brown Electric Co., Boston, Mass.
Complete Electric Construction Co., New York.
Curtis Electric Mfg. Co., Jersey City, N. J.
Edison General Electric Co., New York.
Eddy Electric Mfg Co., Windsor, Conn.
General Electric Co., Boston and New York.
New York Equipment Co., New York.
Railway Equipment Co., Chicago, Ill.
Siemens & Halske Electric Co. of America, Chicago
Steel Motor Co., The, Cleveland, O.
United Columbian Electric Co., New York.
Waddell-Entz Co., New York.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Woodbridge & Turner Engineering Co., New York.

ECONOMIZERS, "GREEN'S"
Fuel Economizer Co., The, Matteawan, N. Y.

ELECTRIC PUMPS.
Otis Brothers & Co., New York.

ELECTRIC RAILWAYS.
Bickford, J. H., Salem, Mass.
Complete Electric Construction Co., New York.
Dick, Kerr & Co., London, Eng.
Field Engineering Co., New York.
General Electric Co., Boston and New York.
Jonson Engineering & Foundry Co., New York.
McCarthy, F. E., & Co., Boston, Mass.
Murray, J. D., New Brunswick, N. J.
Neftel, O'Connor & Co., Incorporated, New York.
Pepper & Register, Philadelphia, Pa.
Pierce & Miller Engineering Co., New York.
Ralston & Henry, Philadelphia, Pa.
Reed & McKibbin, New York.
Wakefield Electrical Engineering Co., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
White, J. G., & Co., New York.
Woodbridge & Turner Engineering Co., New York.

ELECTRICAL INSTRUMENTS.
Weston Electrical Instrument Co., Newark, N.J.

ELECTRICAL SLATE AND MARBLE.
Murphy, T. J., New York.

ELECTRICAL SUPPLIES
Adams, W. L., & Co., Chicago, Ill.
Allen Electric & Supply Co., Philadelphia, Pa.
Anderson, A. & J. M., Boston, Mass.
Billings & Spencer Co., Hartford, Conn.
Brown Electric Co., Boston, Mass.
Curtis Electric Mfg. Co., Jersey City, N. J.
Cutter Electrical & Mfg. Co., Philadelphia, Pa.
Dick, Kerr & Co., London, Eng.
Eastern Electric Cable Co., Boston, Mass.
Eddy Electric Manufacturing Co., Windsor, Conn.
Electric Railway Equipment Co., Cincinnati, O.
Fiberite Co., The, Mechanicville, N. Y.
General Electric Co., Boston and New York.
Glenwood Works, Yonkers, N. Y.
Groetzinger, A. & Sons, Allegheny, Pa.
Johns, H. W., Manufacturing Co., New York.
Johns-Pratt Co., Hartford, Conn.
Moore, Alfred F., Philadelphia, Pa.
Neftel, O'Connor & Co., Incorporated, New York.
New York Electrical Works, New York.
New York Equipment Co., New York.
New York Insulated Wire Co., New York
Okonite Co. (Ltd.), The, New York.
Railway Equipment Co., Chicago, Ill.
Ralston & Henry, Philadelphia, Pa.
Simplex Electrical Co., Boston, Mass.
Standard Paint Co., New York.
Standard Railway Supply Co., Chicago, Ill.
Steel Motor Co., The, Cleveland, O.
United Columbian Electric Co., New York.
Van Nuis, C. S., New York,
Waddell-Entz Co., New York.
Wales Manufacturing Co., Syracuse, N. Y.
Washburn & Moen Mfg. Co., Worcester, Mass.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Weston Electrical Instrument Co., Newark, N.J.

ELECTROTYPING.
Field & Beattie, New York.

ELEVATORS.
Link-Belt Engineering Co., Nicetown, Pa.
Morse, Williams & Co., Philadelphia, Pa.
Otis Brothers & Co., New York.

ENGINEERS, CONSULTING.
Bickford, J. H., Salem, Mass.
Complete Electric Construction Co., New York.
Dick, Kerr & Co., London, Eng.
Field, C. J., New York.
Fowler, Geo. L., New York.
Hampson, Edw. P., & Co., New York.
Higgins, Edward E., New York.
Jonson Engineering & Foundry Co., New York.
Mailloux, C. O., New York.
Meyer, Julius, New York.
Neftel, O'Connor & Co., Incorporated, New York.
Parker, J. W., & Co., Philadelphia, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa.
Ralston & Henry, Philadelphia, Pa.
Reed & McKibbin, New York.
Wakefield Electrical Engineering Co., Philadelphia, Pa.
White, J. G. & Co., New York.
Woodbridge & Turner Engineering Co., New York.

ENGINEERS, ELECTRICAL.
Bickford, J. H., Salem, Mass.
Colburn, Ralph D., Holliston, Mass.
Complete Electric Construction Co., New York.
Dick, Kerr & Co., London, Eng.
Field, C. J., New York.
Field Engineering Co., New York.
General Electric Co., Boston and New York.
Higgins, Edward E., New York.
Jonson Engineering & Foundry Co., New York.
McCarthy, F. E., & Co., Boston, Mass.
Mailloux, C. O., Liberty St., New York.
Meyer, Julius, New York.
Murray, J. D., New Brunswick, N. J.
Neftel, O'Connor & Co., Incorporated, New York.
Parker, J. W., & Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa.
Ralston & Henry, Philadelphia, Pa.
Reed & McKibbin, New York.
Siemens & Halske Electric Co. of America, Chicago
Sperry Electric Railway Co., Cleveland, O.
Van Nuis, C. S., New York.
Wakefield Electrical Engineering Co., Philadelphia, Pa.
Woodbridge & Turner Engineering Co., New York.

ENGINEERS, MECHANICAL.
Bickford, J. H., Salem, Mass.
Dick, Kerr & Co., London, Eng.
Falls Rivet & Machine Co., Cuyahoga Falls, O.
Field Engineering Co., New York.
Fowler, Geo. L., New York
Hampson, Edw. P., & Co., New York.
Jarvis Engineering Co., Boston, Mass.
Jonson Engineering & Foundry Co , New York.
Lane & Bodley Co., The, Cincinnati, O.
McCarthy, F. E., & Co., Boston, Mass.
Meyer, Julius, New York.
Parker, J. W., & Co., Philadelphia, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa
Shook, Anderson Mfg. Co., Pittsburgh, Pa.
Walker Manufacturing Co., The, Cleveland, O.
Woodbridge & Turner Engineering Co., New York.

ENGINEERS' SETS.
Wilmot & Hobbs, New York, and Bridgeport, Conn

ENGINES.
Allis, The Edward P. Co., Milwaukee. Wis.
Altoona Manufacturing Co., Altoona, Pa.
Ames Iron Works, Oswego, N. Y.
Ball & Wood Co., The, New York.
Ball Engine Co., Erie, Pa.

HABIRSHAW Insulated Wires and Cables, GLENWOOD WORKS, YONKERS, N. Y.

Bates Machine Co., Joliet, Ill.
Buckeye Engine Co., Salem, O.
Clark Brothers, Belmont, N. Y.
Cooper, C. & G., & Co., Mt. Vernon, O.
Dickson Manufacturing Co., Scranton, Pa.
Field Engineering Co., New York.
Fishkill Landing Machine Co., Fishkill-on-Hudson
Fleming, W. R. & Co., New York.
Grant, J. A., & Co., Boston, Mass.
Hampson, Edw. P. & Co., New York.
Harrisburg Foundry & Machine Co., Harrisb'g, Pa.
Hoffman & Billings Mfg. Co., Milwaukee, Wis.
Hooven, Owens & Rentschler, Hamilton, O.
Ide, A. L., & Son, Springfield, Ill.
Jarvis Engineering Co., Boston, Mass
"L. P. & D." Transmitter Co., Montpelier, Vt.
Lake Erie Engineering Co., Buffalo, N. Y.
Lane & Bodley Co., The, Cincinnati, O.
McEwen, J. H., Mfg. Co., Ridgway, Pa.
McIntosh, Seymour & Co., Auburn, N. Y.
New York Equipment Co., New York.
Otto Gas Engine Works, Philadelphia, Pa.
Parker, J. W., & Co., Philadelphia, Pa.
Payne, B. W. & Sons, Elmira, N. Y.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Philadelphia Engineering Works (Ltd.), Phila., Pa.
Phœnix Iron Works, Cleveland, O.
Pierce & Miller Engineering Co., New York.
Southwark Foundry & Machine Co., Phila., Pa.
Stearns Manufacturing Co., Erie, Pa.
Walker Manufacturing Co., The, Cleveland, O.
Wetherill, Robert, & Co., Chester, Pa.

ENGINES, BLOWING.

Philadelphia Engineering Works (Ltd.), Phila., Pa

ENGINES, HOISTING.

Dickson Manufacturing Co., Scranton, Pa.
Walker Manufacturing Co., The, Cleveland, O.

ENGRAVING.

Field & Beattie, New York.

EYE BOLTS.

Billings & Spencer Co., Hartford, Conn.

FANS, STEAM.

Sturtevant, B. F., & Co., Boston, Mass.

FARE BOXES.

Brill, J. G. Co., Philadelphia, Pa.
Brownell Car Co., St. Louis, Mo.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Stephenson, John, Co., Ld., New York.
Wales Manufacturing Co., Syracuse, N. Y.

FARE COLLECTORS.

Lewis & Fowler Mfg. Co., Brooklyn, N. Y.

FARE REGISTERS.

Brill, J. G. Co., Philadelphia, Pa.
Fowler, J. W., Car Co., Elizabethport, N. J.
International Register Co., The, Chicago, Ill.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Meaker Mfg. Co., Chicago, Ill.
New Haven Car Register Co., New Haven, Conn.
Railway Register Mfg. Co., New York.
St. Louis Car Co., St. Louis, Mo.
St. Louis Register Co., St. Louis, Mo.
Standard Index & Register Co., New York.
Sterling Supply Co., New York.
Wales Manufacturing Co., Syracuse, N. Y.

FEED WATER HEATERS.

Davis, I. B. & Son, Hartford, Conn.
Fuel Economizer Co., The, New York.
Goubert Manufacturing Co., The, New York.
Hoppes Manufacturing Co., Springfield, O.
Jarvis Engineering Co., Boston, Mass,
Philadelphia Engineering Works (Ltd.), Phila., Pa

FEED WATER PURIFIERS (Live Steam).

Davis, I. B., & Son, Hartford, Conn.
Goubert Manufacturing Co., New York.
Hoppes Manufacturing Co., Springfield, O.

FENDERS AND GUARDS.

Clarke, F. H., Springfield, O.
Crawford, R. A., Mfg. Co., Pittsburgh, Pa.
Euphrat Life Saving Car Fender Co., New York.
Field Electric Car Life Guard Co., Boston, Mass.
Pfingst, Louis, Boston, Mass.
Robins Life Guard & Mfg. Co., Philadelphia, Pa.

FORGINGS.

Dorner & Dutton Mfg. Co., Cleveland, O.

FRICTION CLUTCHES AND COUPLINGS.

Falls Rivet & Machine Co., Cuyahoga Falls, O.
Lake, J. H. & D., Co., Massillon, O.
Walker Manufacturing Co., Cleveland, O.

FURNACES.

Fleming, W. R., & Co., New York.
Jarvis Engineering Co., Boston, Mass,
Philadelphia Engineering Works (Ltd.), Phila., Pa

GEARING.

Chester Steel Castings Co., Philadelphia, Pa.
Dickson Manufacturing Co., Scranton, Pa.
Dorner & Dutton Mfg. Co., Cleveland, O.
Electric Railway Equipment Co., Cincinnati, O.
Fulton Truck & Foundry Co., Cleveland, O.
General Electric Co., Boston and New York.
Groetzinger, A. & Sons, Allegheny, Pa.
Mertes, A., Manufacturing Co., Allegheny, Pa.
New Process Raw Hide Co., The, Syracuse, N. Y.
Nuttall, R. D. Co., Allegheny, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Shriver, T., & Co. New York.
Steel Motor Co., The, Cleveland, O.
Walker Manufacturing Co., The, Cleveland, O.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
Woodbridge & Turner Engineering Co., New York.

GONGS, CABLE AND CAR.

Bevin Bros. Manufacturing Co., East Hampton, Conn.
Brill, J. G., Co., Philadelphia, Pa.
Fowler, J. W., Car Co., Elizabethport, N. J.
Johnson Electric Co., Cleveland, O.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Pittsburgh Steel Hollow Ware Co., Allegheny, Pa.
Standard Railway Supply Co., Chicago, Ill.

GRATE BARS, SECTIONAL.

Tupper, W. W., & Co., New York.

GRATES, SECTIONAL.

Tupper, W. W., & Co., New York.

GRIP DIES.

Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.

GRIPS.

Pennsylvania Iron Works Co., Philadelphia, Pa.

GUTTERS.

Barbour, Stockwell Co., Cambridgeport, Mass.
Dorner & Dutton Mfg. Co., Cleveland, O.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

HEADLIGHTS.

Brill, J. G., Co., Philadelphia, Pa.
New York Equipment Co., New York.
Smith, J. D., New York.
Steam Gauge & Lantern Co., Syracuse, N. Y.
Wales Manufacturing Co., Syracuse, N. Y.
Wheeler Reflector Co., Boston, Mass.

HEATERS, CAR.

Adams, W. L., & Co., Chicago, Ill.
Baker, Wm. C., New York.
Brill, J. G. Co., Philadelphia, Pa.
Consolidated Car Heating Co., Albany, N. Y.
Fowler, J. W., Car Co., Elizabethport, N. J.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Safety Car Heating & Lighting Co., New York.
Standard Railway Supply Co., Chicago, Ill.
Sterling Supply Co., New York.

HEATERS, ELECTRIC.

Central Electric Heating Co., New York.
Brill, J. G., Co., Philadelphia, Pa.
Burton Electric Co., Richmond, Va.
Consolidated Car Heating Co., Albany, N. Y.
Reliable Manufacturing Co., Boston, Mass.
Taylor, Dee & Mack, Chicago, Ill.
Western Electric Heating Co., Chicago, Ill.

HYDRAULIC JACKS.

Schaffer, The J. T., Mfg. Co., Rochester, N. Y.
Walker Manufacturing Co., The, Cleveland, O.
Watson & Stillman, New York.

INSULATORS.

Allen Electric & Supply Co., Philadelphia, Pa.
Brown Electric Co., Boston, Mass.
Curtis Electric Mfg. Co., Jersey City, N. J.
Delaware Hard Fibre Co., Wilmington, Del.
Electric Railway Equipment Co., Cincinnati, O.
Fiberite Co., The, Mechanicville, N. Y.
Johns, H. W., Manufacturing Co., New York.
Railway Equipment Co., Chicago, Ill.
Standard Paint Co., New York.
Steel Motor Co., The, Cleveland, O.
Wales Manufacturing Co., Syracuse, N. Y.
Walworth Mfg. Co., Boston, Mass.

INSULATORS, MICA.

Johns, H. W., Manufacturing Co., New York.

IRON STRUCTURAL WORK.

Berlin Iron Bridge Co., East Berlin, Conn.
Johnson Co., Johnstown, Pa.
Wrought Iron Bridge Co., Canton, O.

KNEES AND OTHER TRACK CASTINGS.

Barbour, Stockwell Co., Cambridgeport, Mass.
Craig, Wm. P., New York.
Dorner & Dutton Mfg. Co., Cleveland, O.
Floyd, James R., & Sons, New York.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Steel Works, Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

LAMPS.

Brill, J. G. Co., Philadelphia, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Smith, J. D., New York.
Steam Gauge & Lantern Co., Syracuse, N. Y.
Stephenson, John, Co., Ltd., New York.
Wheeler Reflector Co., Washington, D. C.
Wilmot & Hobbs, New York, and Bridgeport, Conn.

LAMPS, ELECTRIC.

Brown Electric Co., Boston, Mass.
General Electric Co., Boston and New York.
General Incandescent Arc Light Co., New York.
Wheeler Reflector Co., Boston, Mass.

LAW.

Eppley, Francis M., New York.
McKinney, William M., New York.

LIGHTNING ARRESTERS.

Van Nuis, C. S., New York.

LOCK NUTS.

Young Lock Nut Co., New York.

LOCOMOTIVES.

Dickson Manufacturing Co., Scranton, Pa.
Porter, H. K., & Co., Pittsburgh, Pa.
Steel Rail Supply Co., The, New York.

LUBRICANTS.

Dixon, Joseph, Crucible Co., Jersey City, N. J.

LUMBER, CAR BUILDERS'.

Wetmore, A. B., New York.

MACHINE TOOLS

Harrington, Edwin, Son & Co., Incorporated, Philadelphia, Pa.
Ralston & Henry, Philadelphia, Pa.
Schaffer, The J. T., Mfg. Co., Rochester, N. Y.
Sellers, Wm., & Co., Incorp., Philadelphia, Pa.

MAGNESIA SECTIONAL COVERINGS.

Keasbey, Robert A., New York.

MAGNETIC CUT-OUTS.

Cutter Electrical & Mfg. Co., Philadelphia, Pa.

MATTING, WIRE.

U. S. Wire Mat Co., Decatur, Ill.

MATTING, WOOD.

Brill, J. G. Co., Philadelphia, Pa.
Lewis, Samuel, Brooklyn, N. Y.

MEDBERY INSULATION.

Fiberite Co., The, Mechanicville, N. Y.

MICA.

Belden, F. E., Mica Mining Co., Boston, Mass.

MOTORS, ELECTRIC.

Brown Electric Co., Boston, Mass.
Complete Electric Construction Co., New York.
Curtis Electric Mfg. Co., Jersey City, N. J.
Edison General Electric Co., Broad St., New York.
Eddy Electric Manufacturing Co., Windsor, Conn.
General Electric Co., Boston and New York.
New York Equipment Co., New York.
Railway Equipment Co., Chicago, Ill.
Siemens & Halske Electric Co. of America, Chicago
Steel Motor Co., The, Cleveland, O.
United Columbian Electric Co., New York.
Waddell-Entz Co., New York.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Woodbridge & Turner Engineering Co., New York.

MOTORS GAS, STEAM, ETC.

Baldwin Locomotive Works, Philadelphia, Pa.
Porter, H. K. & Co., Pittsburgh, Pa.

NUMBER BADGES.

Wales Manufacturing Co., Syracuse, N. Y.

OILERS.

Wilmot & Hobbs, New York, and Bridgeport, Conn.

PAINT, GRAPHITE.

Dixon, Joseph, Crucible Co., Jersey City, N. J.

PAINT, PRESERVATIVE, FOR IRON.

Standard Paint Co., New York.

PAINTS.

Johns, H. W., Manufacturing Co., New York.
Valentine & Co., New York.

PATENT SOLICITORS, ETC.

Rosenbaum, Wm. A., New York.

PEDESTALS.

Brill, J. G. Co., Philadelphia, Pa.
Fowler, J. W., & Co., Elizabethport, N. J.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.,
Stephenson, John, Co., Ld., New York
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
White Manufacturing Co., The, New York.

PERFORATED METALS.

Mundt & Sons, New York.

Wm. A. Rosenbaum, Electrical Expert and Patent Solicitor, Times Building, NEW YORK.

PHOSPHOR BRONZE.
Phosphor Bronze Smelting Co., Philadelphia, Pa

PINIONS, METALLIC.
Chester Steel Castings Co., Philadelphia, Pa.
Dickson Manufacturing Co., Scranton, Pa.
Dorner & Dutton Manufacturing Co., Cleveland, O.
Electric Railway Equipment Co. Cincinnati, O.
General Electric Co., Boston and New York.
Mertes, A., Manufacturing Co., Allegheny, Pa,
Nuttall, R. D., Co., Allegheny, Pa.
Pennsylvania Iron Works. Philadelphia. Pa.
Steel Motor Co., The, Cleveland, O.
Walker Manufacturing Co., Cleveland, O.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
Woodbridge & Turner Engineering Co., New York.

PIPES.
Shook, Anderson Mfg. Co., Pittsburgh, Pa.

POLES, METAL.
Adams, W. L., & Co., Chicago, Ill.
Allen Electric & Supply Co., Philadelphia, Pa.
Berlin Iron Bridge Co., East Berlin, Conn.
Electric Railway Equipment Co., Cincinnati, O.
Neftel, O'Connor & Co., Incorporated, New York.
New York Electrical Works, New York.
New York Equipment Co., New York.
Nuttall, R. D., Co., Allegheny, Pa.
Railway Equipment Co., Chicago, Ill.
Ralston & Henry, Philadelphia, Pa.
Standard Railway Supply Co., Chicago, Ill.
Walworth Mfg. Co., Boston, Mass.
Wrought Iron Bridge Co., Canton, O.

POLES, WOODEN.
Hallowell, Eli B. & Co., Philadelphia, Pa.
New York Equipment Co., New York.
Nuttall, R. D., Co., Allegheny, Pa.
Ralston & Henry, Philadelphia, Pa.

POWER TRANSMISSION.
"L. P. & D." Transmitter Co., Montpelier, Vt.
Lake, J. H. & D., Co., Massillon, O.
Link-Belt Engineering Co., Nicetown, Pa.
Washburn & Moen, Mfg. Co., Worcester, Mass.

PRESSES, COPYING.
Shriver, T. & Co., New York.

PRESSES, LEVER, HYDRAULIC, ETC.
Schaffer, J. T., Manuacturing Co., Rochester, N. Y.
Walker Manufacturing Co., The, Cleveland, O.
Watson & Stillman, New York.

PRESSES, WHEEL.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fulton Truck & Foundry Co., Cleveland, O.
Hathaway, Alfred G., Cleveland, O.
Schaffer, J. T., Manufacturing Co., Rochester, N.Y.
Watson & Stillman, New York.

PULLEY BOXES.
Walker Manufacturing Co., The, Cleveland, O.

PULLEYS.
Falls Rivet & Machine Co., Cuyahoga Falls, O.
Friction Pulley & Mach. Works, Sandy Hill, N. Y.
"L. P. & D." Transmitter Co., Montpelier, Vt.
Lake, J. H. & D., Co., Massillon, O.
Lane & Bodley Co., The, Cincinnati, O.
Sellers, Wm., & Co., Incorp., Philadelphia, Pa.
Shriver, T., & Co., New York.
Walker Manufacturing Co., The, Cleveland, O.

PULLEYS, CABLE.
Jonson Engineering & Foundry Co., New York.
Walker Manufacturing Co., The, Cleveland, O.
Wharton, Wm., Jr. & Co., Philadelphia, Pa.

PUMPS.
Dickson Manufacturing Co., Scranton, Pa.
Schaffer, J. T., Manufacturing Co., Rochester, N.Y.
Shook, Anderson Mfg. Co., Pittsburgh, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.

RAIL BONDS.
Keithley, H. R., Chicago, Ill.
New York Electrical Works, New York.
New York Equipment Co., New York.

RAIL JOINTS.
American Rail Joint Co., Marion, Ind.
Cambria Iron Co., Philadelphia, Pa.
Harrington, Robinson & Co., Boston, Mass.
Johnson Co., Johnstown, Pa.
New York Equipment Co., New York.
Pennsylvania Steel Co., Philadelphia, Pa.
Wharton, Wm Jr. & Co., Philadelphia, Pa.

RAILS, GIRDER.
Barbour, Stockwell Co., Cambridgeport, Mass.
Dick, Kerr & Co., London, Eng.
Harrington, Robinson & Co., Boston, Mass.
Johnson Co., Johnstown, Pa.
Lewis & Fowler Girder Rail Co. Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Iron Works, Philadelphia, Pa.
Ralston & Henry, Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

RAILS, SECOND HAND.
New York Equipment Co., New York.
Ralston & Henry, Philadelphia, Pa.

RAILS, TURNOUTS, CURVES, ETC.
Barbour, Stockwell Co., Cambridgeport, Mass.
Cambria Iron Co., Philadelphia, Pa.
Craig, Wm. P., East Orange, N. Y.
Dick, Kerr & Co., London, Eng.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass.
Johnson Co., Johnstown, Pa.
Jonson Engineering Co., New York.
Lewis & Fowler Girder Rail Co., Brooklyn, N. Y.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Ralston & Henry, Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

RAILWAY ADVERTISING.
U. S. Steam & Street Railway Advertising Co. New York and Boston.

RAILWAY FEED WIRES.
Adams, W. L., & Co., Chicago, Ill.
Allen Electric & Supply Co., Philadelphia, Pa.
Brown Electric Co., Boston, Mass.
Curtis Electric Mfg. Co., Jersey City, N. J.
Eastern Electric Cable Co., Boston, Mass.
Electric Railway Equipment Co., Cincinnati, O.
Habirshaw Wire, Yonkers, N. Y.
New York Equipment Co., New York.
Okonite Co., The, Ltd., New York.
Railway Equipment Co., Chicago, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Simplex Electrical Co., Boston, Mass.
Standard Railway Supply Co., Chicago, Ill.
Washburn & Moen Mfg. Co., Worcester, Mass.

RAW HIDE PINIONS.
Groetzinger, A. & Sons, Allegheny, Pa.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall, R. D. Co., Allegheny, Pa.
Steel Motor Co., The, Cleveland, O.

REFLECTORS.
Smith, Josephine D., New York.
Steam Gauge & Lantern Co, Syracuse, N, Y
Wheeler Reflector Co., Boston, Mass.

ROOFING.
Johns, H. W., Manufacturing Co., New York.

ROOFS, IRON.
Berlin Iron Bridge Co., East Berlin, Conn.
Wrought Iron Bridge Co., Canton, O.

ROPE WHEELS.
Philadelphia Engineering Works (Ltd.), Phila., Pa

ROPES, COTTON.
Walker Manufacturing Co., The, Cleveland, O

ROTATING SIGNS.
Wheeler Reflector Co., Washington, D. C.

RUNNING GEAR.
Barney & Smith Car Co., Dayton, O.
Bemis Car Box Co., Springfield, Mass.
Brill, J. G., Co., Philadelphia, Pa.
Brownell Car Co., St. Louis, Mo.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fowler, J. W., Car Co., Elizabethport, N. J.
Fulton Truck & Foundry Co., Cleveland, O.
General Electric Co., Boston and New York.
Laclede Car Co., St. Louis, Mo.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
McGuire Manufacturing Co., Chicago, Ill.
Peckham Motor Truck & Wheel Co., Kingston, N. Y
Robinson Electric Truck & Supply Co., Boston, Mass.
St. Louis Car Co., St. Louis, Mo.
Sheppard Manufacturing Co., Louisville, Ky.
Stephenson, John, Co., Ld., New York.
Taylor Electric Truck Co., Troy, N. Y.
Wharton, Wm., Jr., & Co. Philadelphia, Pa.

SALT DISTRIBUTORS.
Brill, J. G., Co., Philadelphia, Pa.
Dewitt, E. F. & Co., Lansingburgh. N. Y.
Reliable Manufacturing Co., The, Boston, Mass.

SAND BOXES.
Adams, W. L., & Co., Chicago, Ill.
Brill, J. G., Co., Philadelphia, Pa.
Crawford, R. A., Manufacturing Co., Pittsburgh, Pa.
Dewitt, E. F., & Co., Lansingburgh, N. Y.
Fulton Truck & Foundry Co., Cleveland, O.
Peckham Motor Truck & Wheel Co., Kingston, N. Y
Reliable Manufacturing Co., The, Boston, Mass.
Sterling Supply Co., New York.

SASHES.
Frost Veneer Seating Co., New York.
Sjoberg, J. P., New York.
Trimble, Jas. A., New York
Woodman, Joel H., Hoboken, N. J.

SCHOOLS.
Correspondence School of Technology, Cleveland, O

SEATING, RAILROAD.
Woodman, Joel H., Hoboken, N. J.

SECURITIES.
Eppley, Francis M., New York.
Hutchinson, A. J., New York.
McKinney, William M., New York.
New York Equipment Co., New York.

SEPARATORS.
Goubert Mfg. Co., (Stratton Separator) The, New York.

SHAFTING.
Lane & Bodley Co., The, Cincinnati, O.
Sellers, Wm. & Co., Incorp., Philadelphia, Pa.

SIGNAL LIGHTS.
Brill, J. G. Co., Philadelphia, Pa.
Stephenson, Jno., Co. Ld., New York.

SILICON BRONZE WIRE.
Roebling's, John A., Sons Co., New York.

SNOW PLOWS.
Adams, W. L., & Co., Chicago, Ill.
Brill, J. G., Co., Philadelphia, Pa.
Brooklyn Railway Supply Co., Stamford, Conn.
Dorner & Dutton Mfg. Co., Cleveland, O.
Floyd, James R., & Sons, New York.
Fowler, J. W., Car Co., Elizabethport, N. J.
General Electric Co., Boston and New York.
Lewis & Fowler Manufacturing Co., Brooklyn, N. Y
Morse, C. D., Car Mfg. Co., Millbury, Mass.
New York Equipment Co., New York.
Standard Railway Supply Co., Chicago, Ill.
Wales Manufacturing Co., Syracuse, N. Y.
White Manufacturing Co., The, New York

SPIKES AND FASTENINGS.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass.
New York Equipment Co., New York.
Steel Rail Supply Co., The, New York.

SPRINKLERS, TRACK AND ROAD.
Brill, J. G., Co., Philadelphia, Pa.
Day, Josiah F., New York.

SPRINGS, CAR.
Brill, J. G. Co., Philadelphia, Pa.
Fowler, J. W., Car Co., Elizabethport, N. J.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Railway Equipment Co., Chicago, Ill.
Scott, Charles, Spring Co., Philadelphia, Pa.
Stephenson, Jno., Co. Ld., New York.
Vose Spring Co., The, New York.

STEAM PLANTS.
Altoona Manufacturing Co., Altoona, Pa.
Bates Machine Co., Joliet, Ill.
Brightman Stoker Co., Cleveland, O.
Clark Brothers, Belmont, N. Y.
Dickson Manufacturing Co., Scranton, Pa.
Field Engineering Co., New York.
Grant, J. A., & Co., New York.
Hampson, Edw. P., & Co., New York.
Jarvis Engineering Co., Boston, Mass.
Lane & Bodley Co., The, Cincinnati, O.
McIntosh, Seymour & Co., Auburn, N. Y.
Neftel, O'Connor & Co., Incorporated, New York.
New York Equipment Co., New York.
Parker, J. W., & Co., Philadelphia, Pa.
Pierce & Miller Engineering Co., New York.
Stearns Manufacturing Co., Erie, Pa.
Wetherill, Robert, & Co., Chester, Pa.

STEEL CASTINGS.
Chester Steel Castings Company, Philadelphia, Pa.

STEEL STEPS.
Stanwood Manufacturing Co., Chicago, Ill.

STOCKS AND BONDS.
Eppley, Francis M., New York.
Higgins, E. E., New York.
McKinney, William M., New York.

STORAGE BATTERIES.
Electric Storage Battery Co., The, Philadelphia, Pa
Waddell-Entz Co., New York.

STORAGE BATTERY CELLS.
Electric Storage Battery Co., The, Philadelphia, Pa

STOKERS, MECHANICAL.
Brightman Stoker Co., Cleveland, O.

STREET RAILWAY BUILDERS.
Bickford, J. H., Salem, Mass.
Complete Electric Construction Co., New York.
Conway, M. W., Brooklyn, N. Y.
Craig, Wm. P., East Orange, N. J.
Dick, Kerr & Co., London, Eng.
Electric Railway Equipment Co., Cincinnati, O.
Field Engineering Co., New York.
General Electric Co., Boston and New York.
Hutchinson, A. J., New York.
Jonson Engineering & Foundry Co., New York.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
McCarthy, F. E., & Co., Boston, Mass.
Murray, J. D., New Brunswick, N. J.
Neftel, O'Connor & Co., Incorporated, New York.
Pennsylvania Iron Works Co., Philadelphia.
Pepper & Register, Philadelphia, Pa.
Wakefield Electrical Engineering Co., Philadelphia, Pa.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
White, J. G. & Co., New York.
Woodbridge & Turner, Engineering Co., New York

STREET RAILWAY SUPPLIES.
Adams, W. L., & Co., Chicago, Ill.
Allen Electric & Supply Co., Philadelphia, Pa.
Barbour, Stockwell Co., Cambridgeport, Mass.
Beadle, Edward, New York City.
Brill, J. G. Co., Philadelphia, Pa.
Brooklyn Railway Supply Co., Stamford, Conn.
Brown Electric Co., Boston, Mass.
Cambria Iron Co., Philadelphia, Pa.
Chester Steel Castings Co., Philadelphia, Pa.
Conway, M. W., Brooklyn, N. Y.
Craig, Wm. P., East Orange, N. J.
Curtis Electric Mfg. Co., Jersey City, N. J.
Dick, Kerr & Co., London, Eng.
Dorner & Dutton Mfg. Co., Cleveland, O.

STEEL & IRON POLES FOR ELECTRIC RAILWAYS. Walworth Mfg. Co. 16 OLIVER ST., BOSTON.

Electric Railway Equipment Co., Cincinnati, O.
Fowler, J. W., Car Co., Elizabethport, N. J.
Fuel Economizer Co., The, New York.
Fulton Truck & Foundry Co., Cleveland, O.
General Electric Co., Boston and New York.
Harrington, Robinson & Co., Boston, Mass.
Hutchinson, A. J., New York.
Johns, H. W., Manufacturing Co., New York.
Johnson Co., Johnstown, Pa.
Jonson Engineering & Foundry Co., New York.
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Wakefield Electrical Engineering Co., Philadelphia, Pa.
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General Electric Co., Broad St., New York.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Morse, C. D., Car Mfg. Co., Millbury, Mass.
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Dorner & Dutton Mfg. Co., Cleveland, O.
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Lewis & Fowler, Brooklyn, N. Y.
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Hathaway, Alfred G., Cleveland, O.
Johnson Co., Johnstown, Pa.
Jonson Engineering & Foundry Co., New York.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Morse, C. D., Car Mfg. Co., Millbury, Mass.
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Steel Motor Co., The, Cleveland, O.

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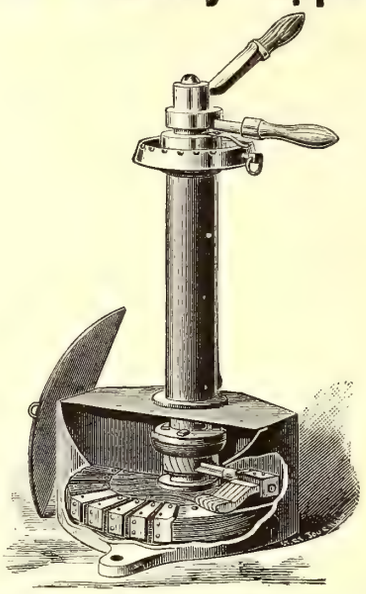
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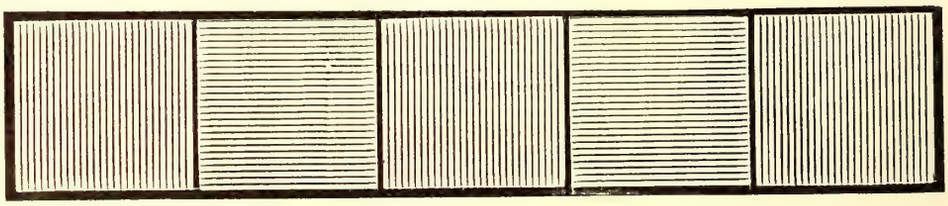
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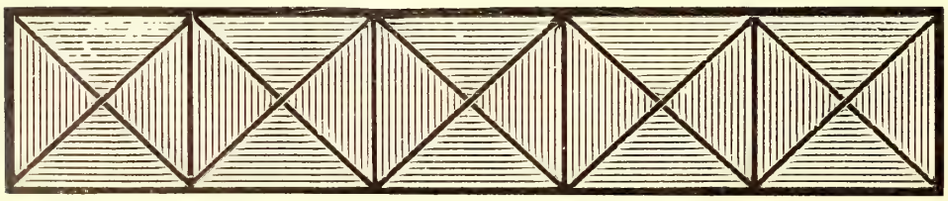
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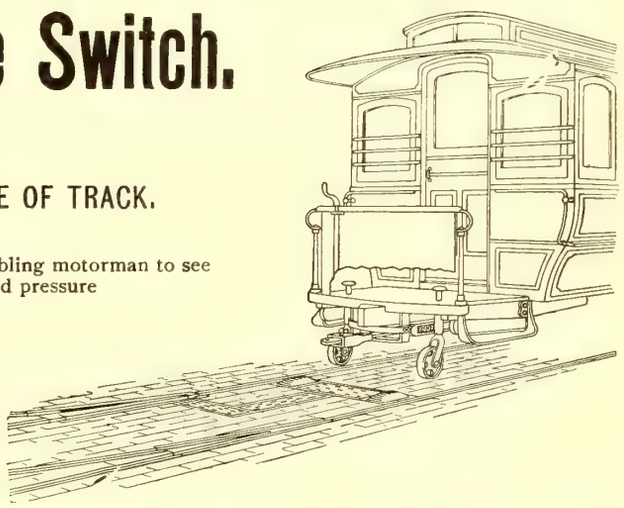
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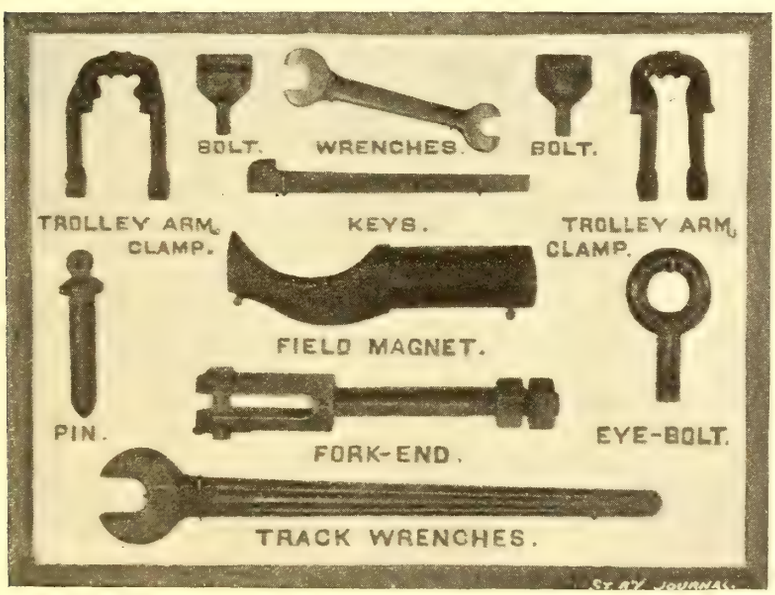


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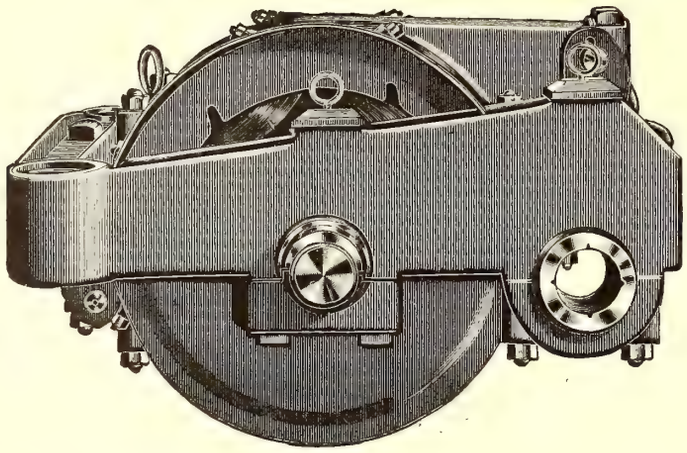
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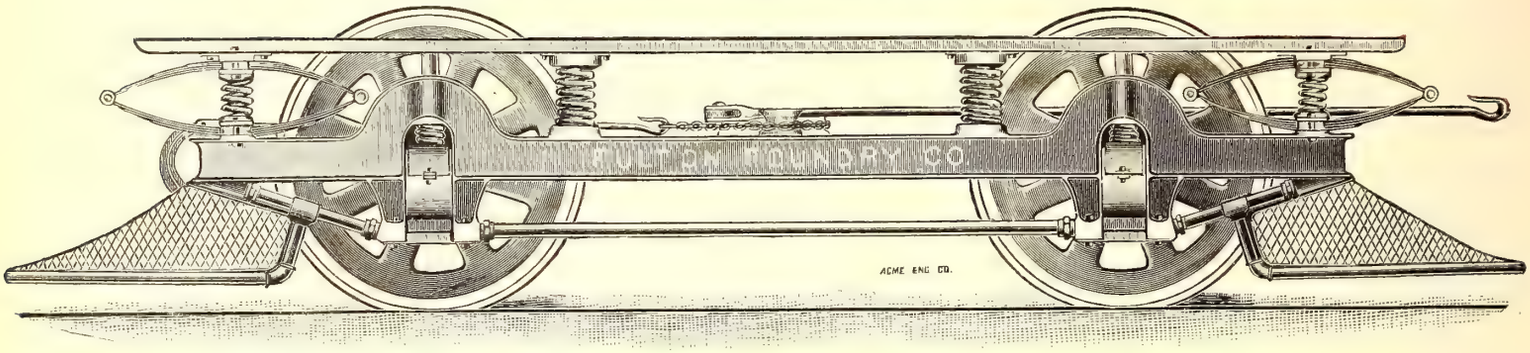
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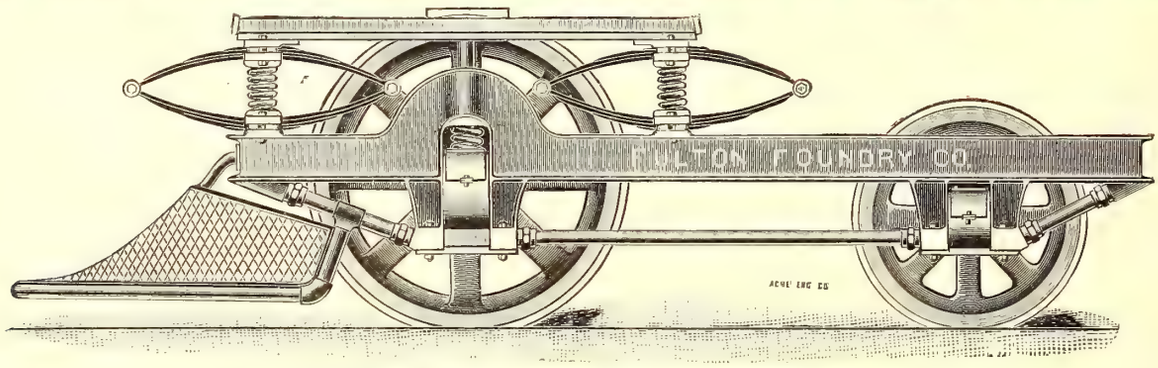
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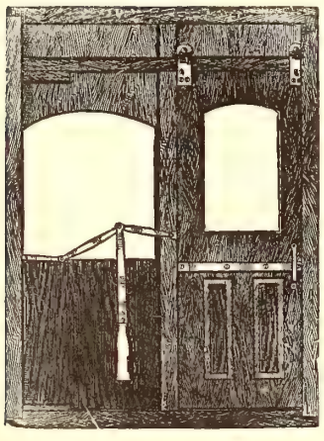


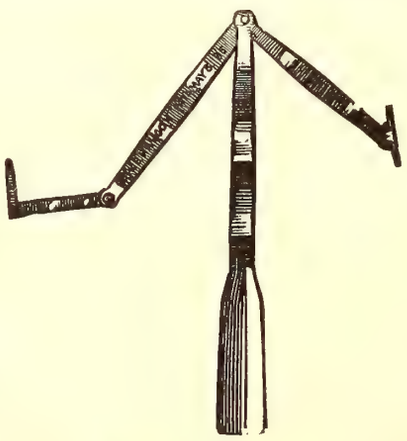
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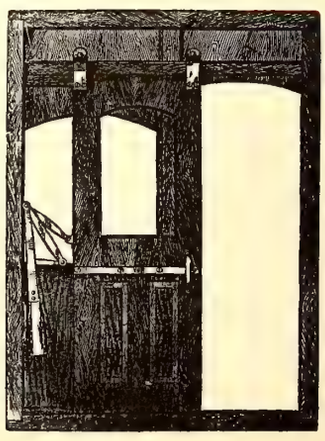
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Yours truly,

(Signed) Harry Scullin, Vice President.

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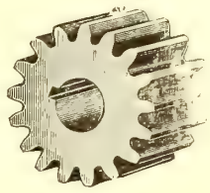
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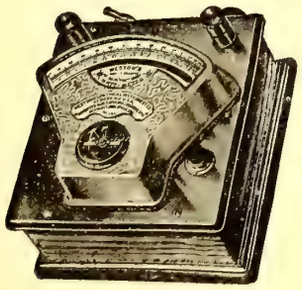
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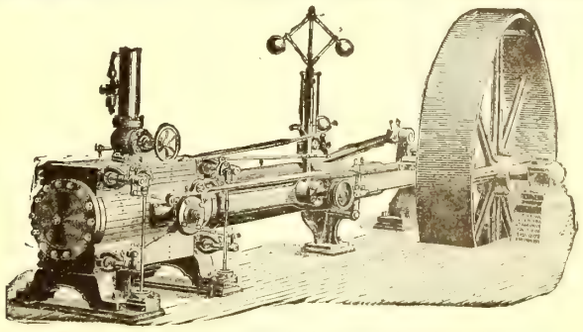
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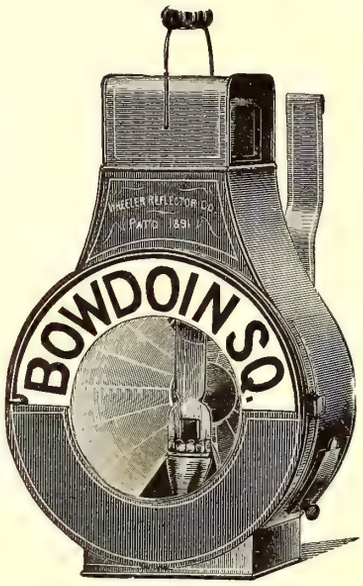
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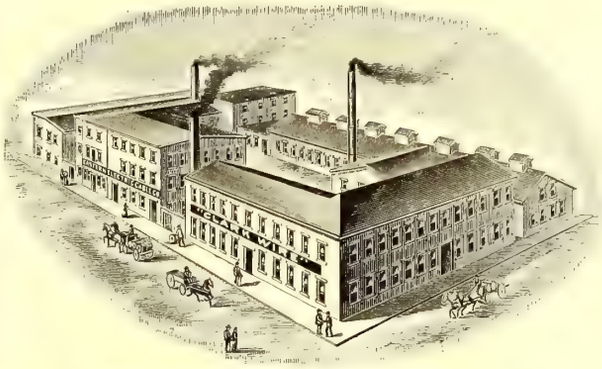
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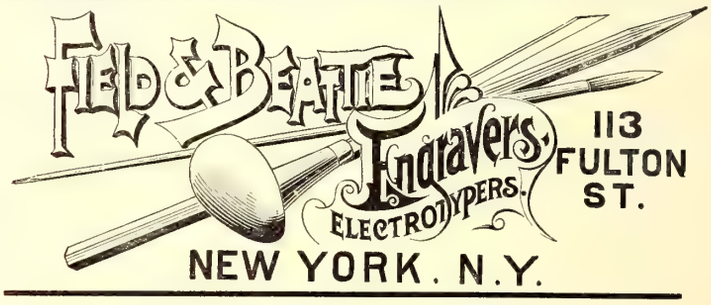
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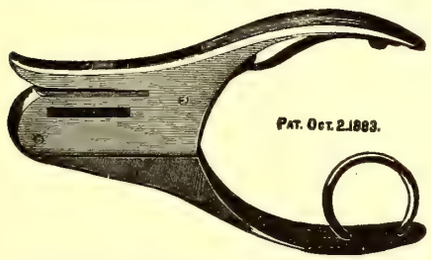
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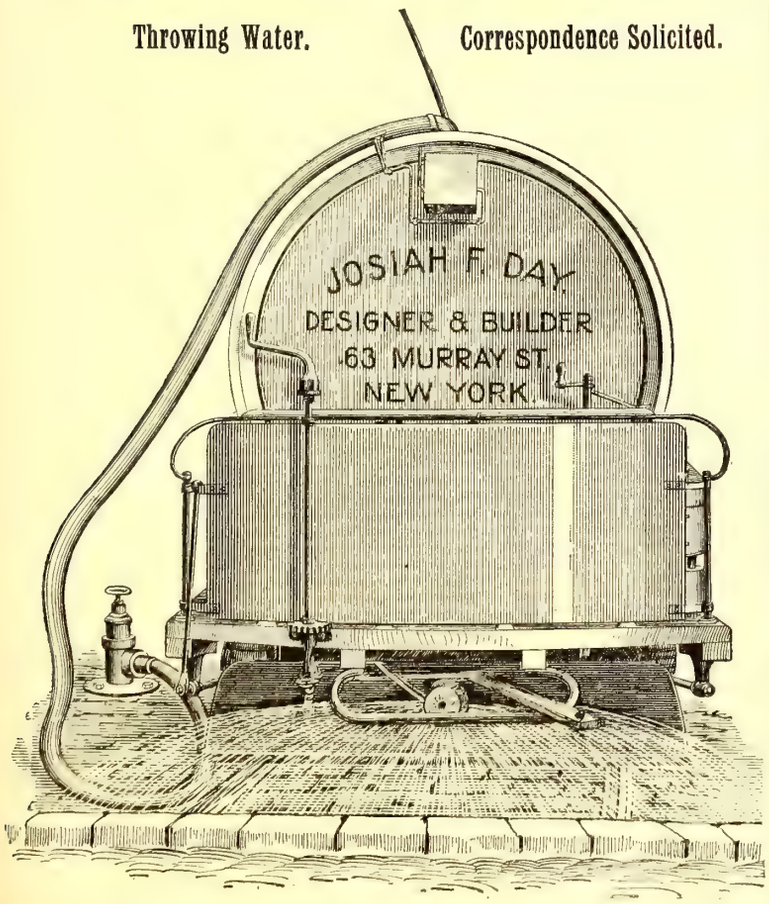
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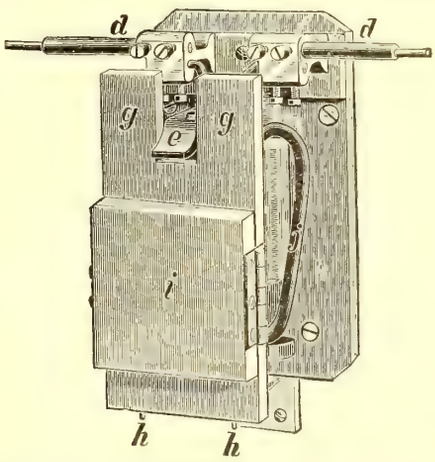
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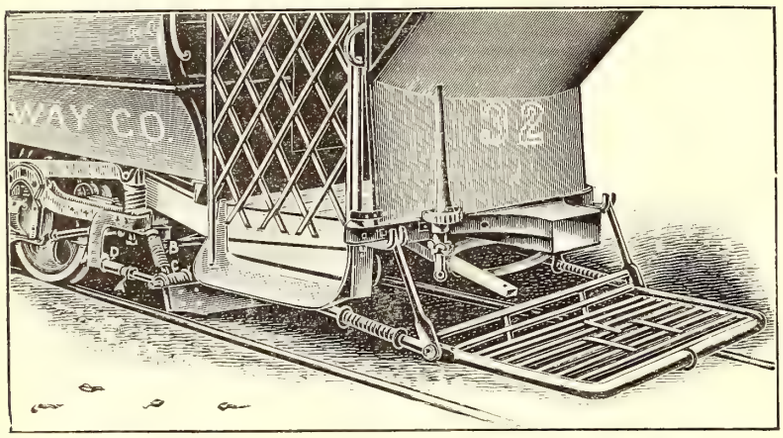
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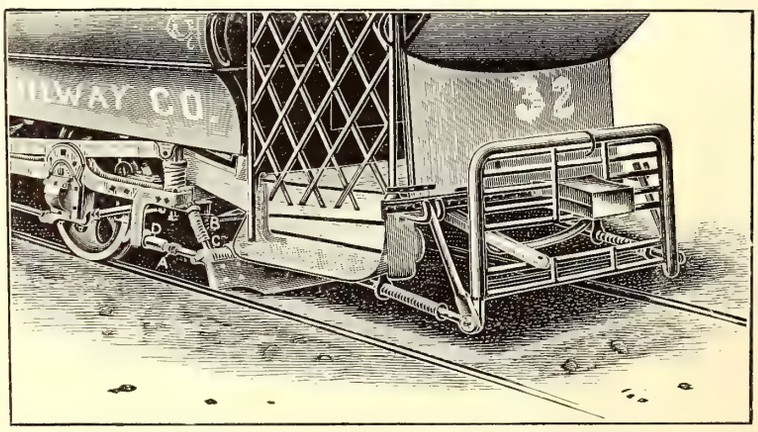
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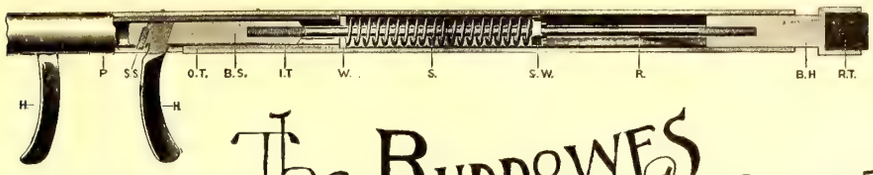
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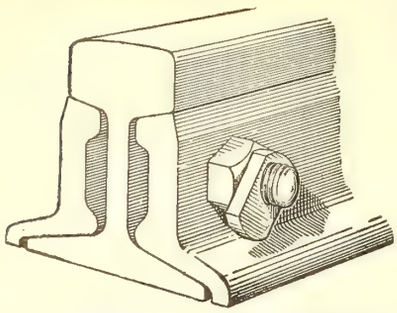
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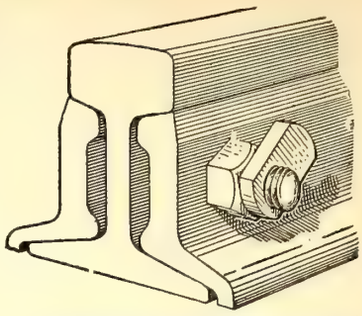
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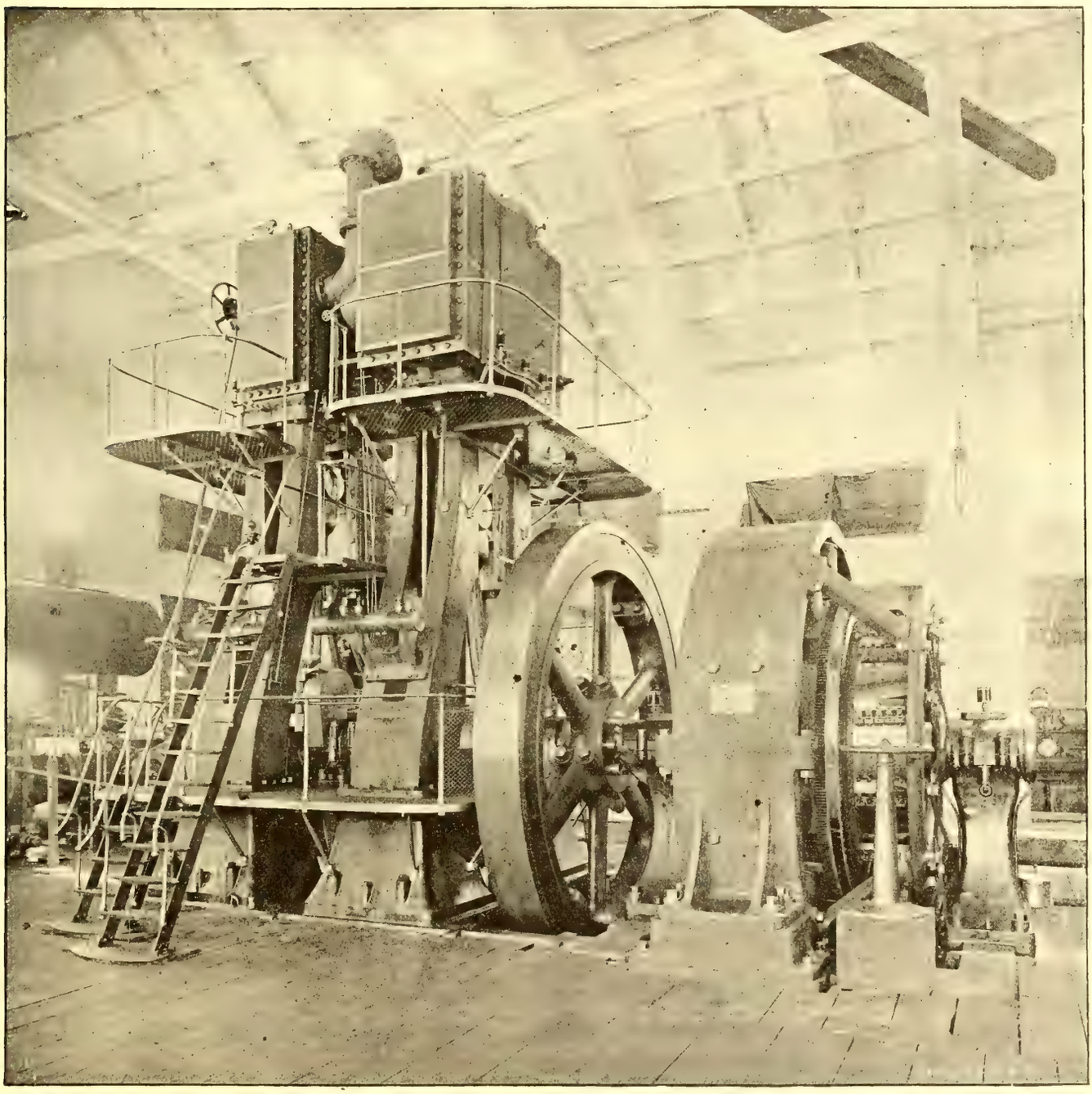
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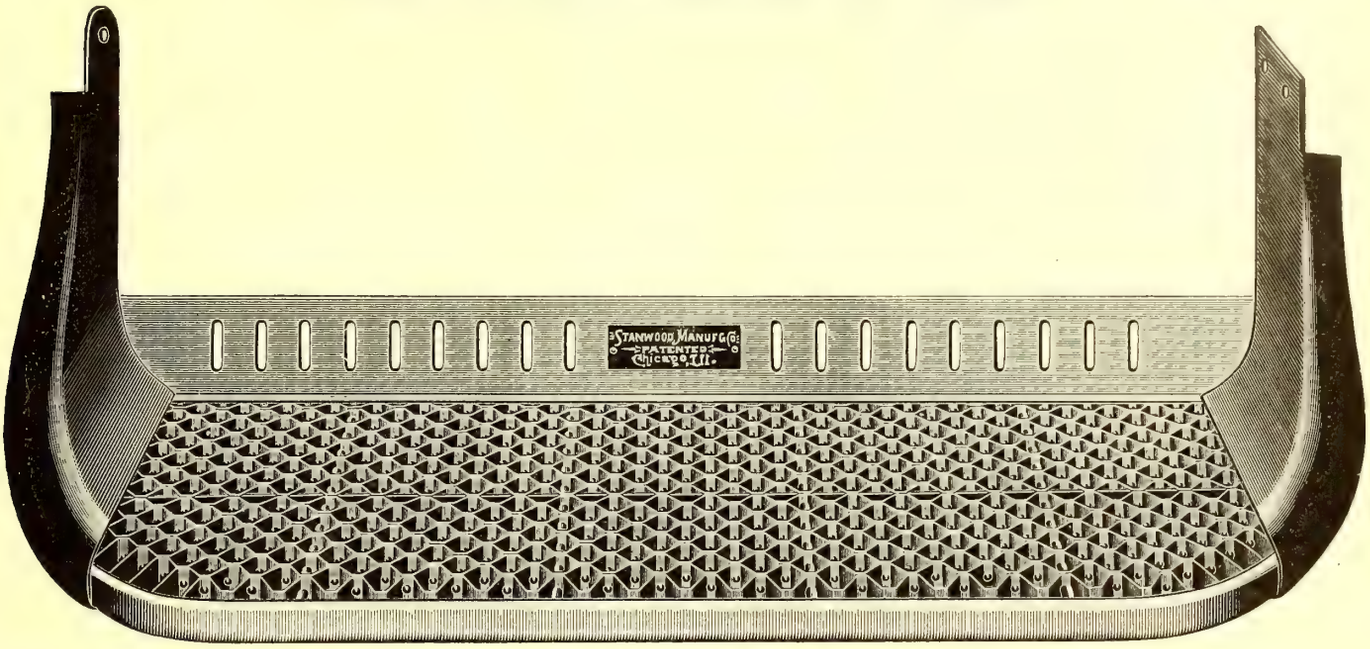
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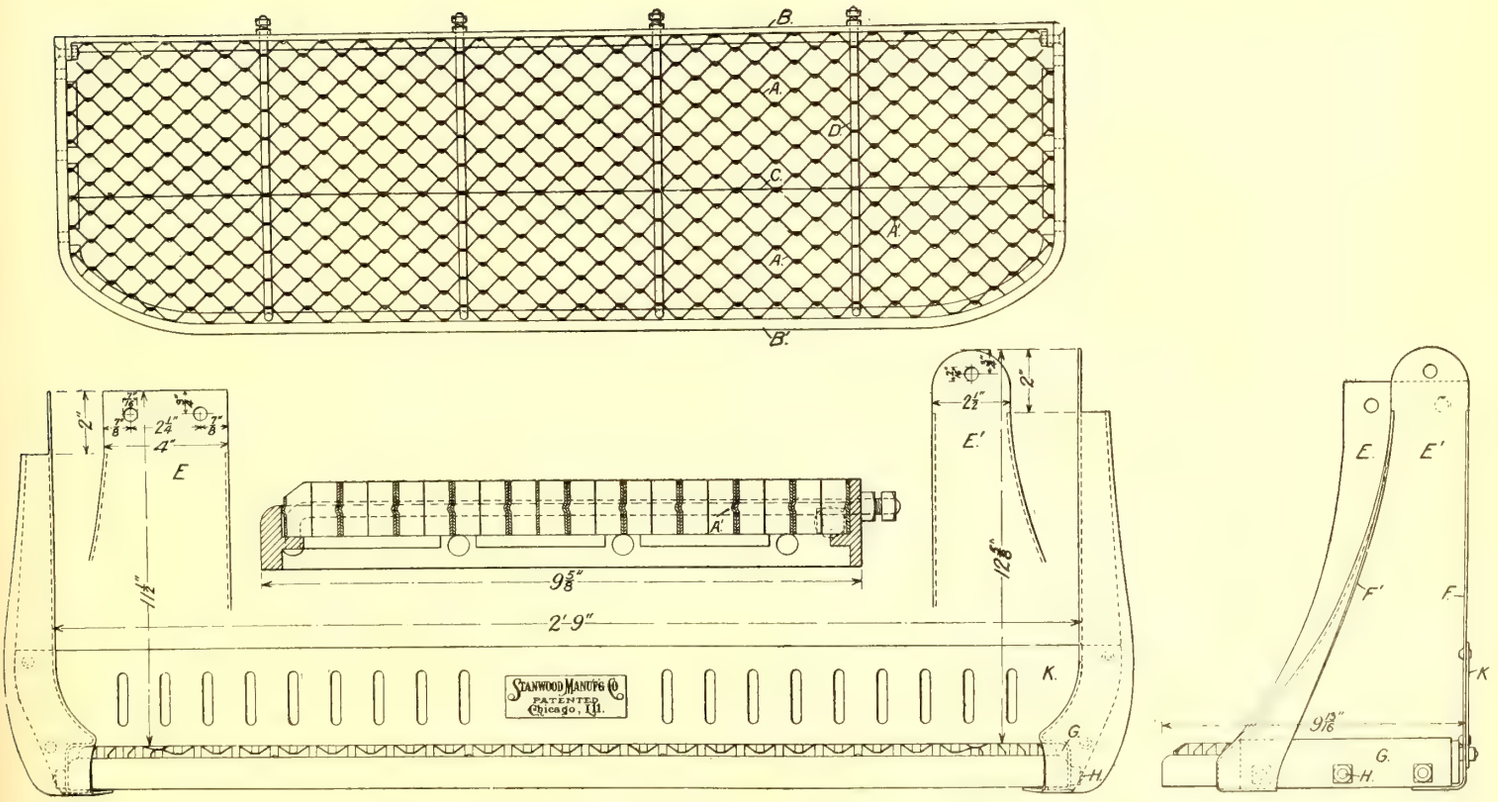
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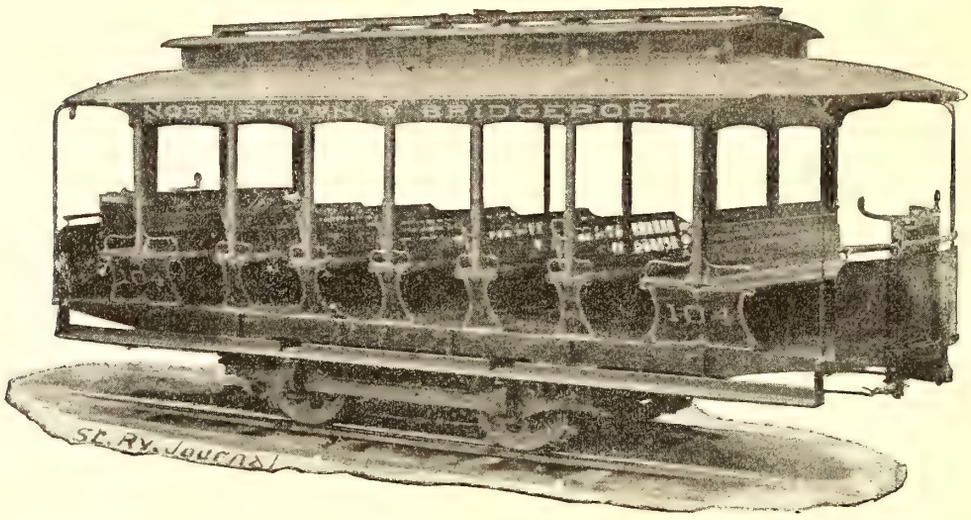
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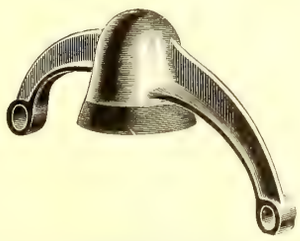
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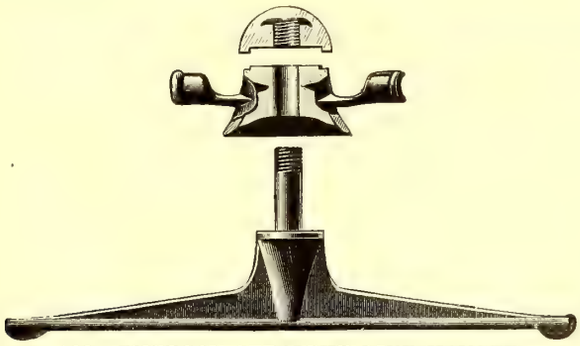


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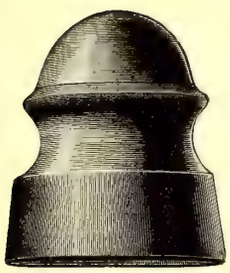


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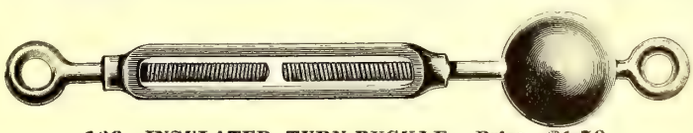


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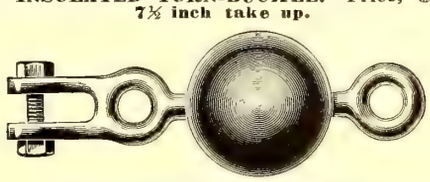
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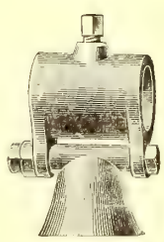
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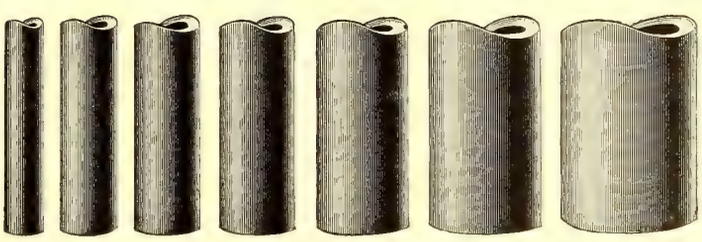
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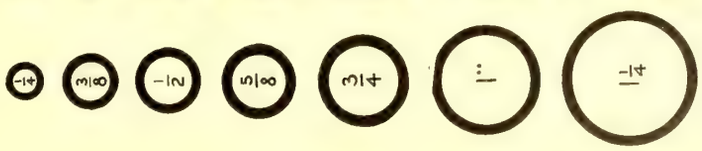
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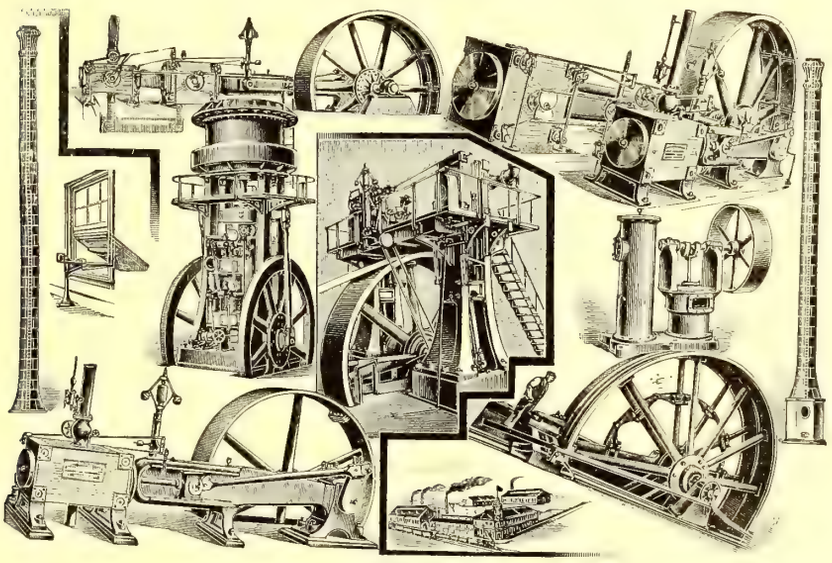
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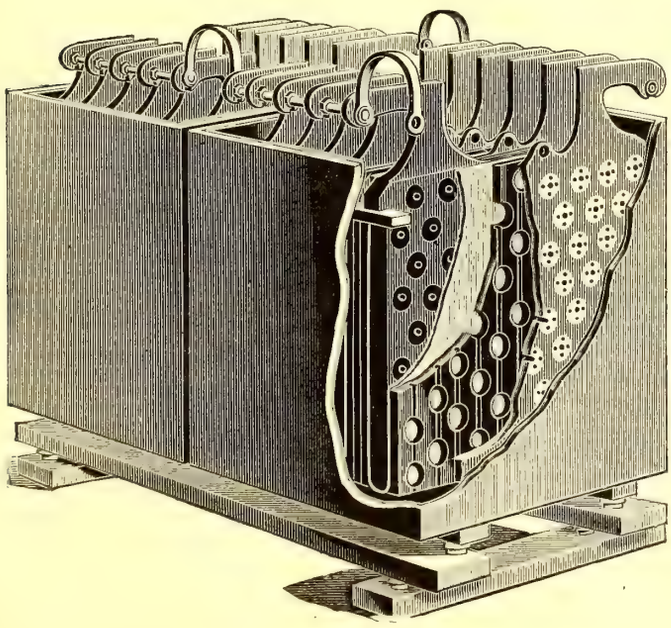
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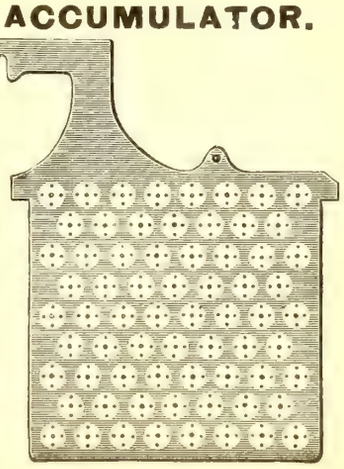


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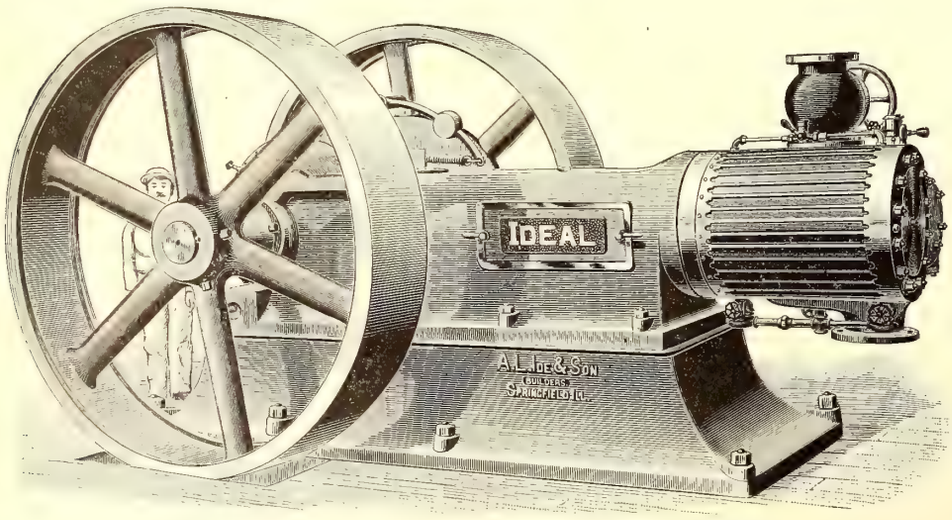
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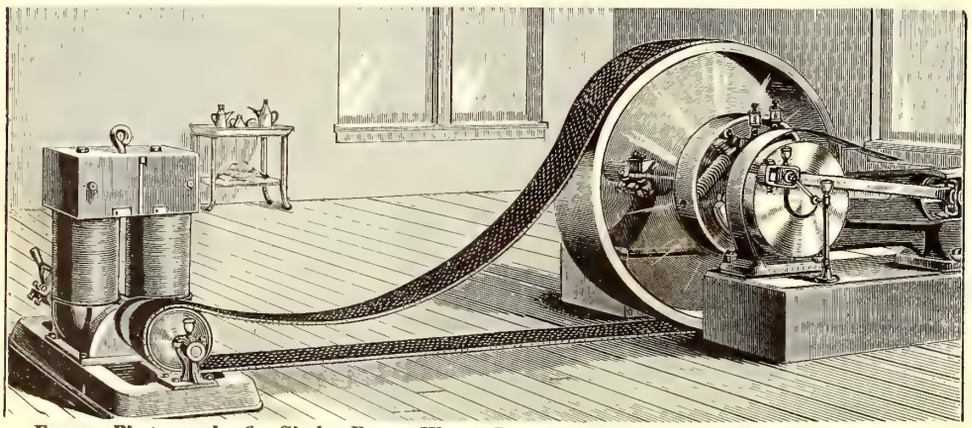
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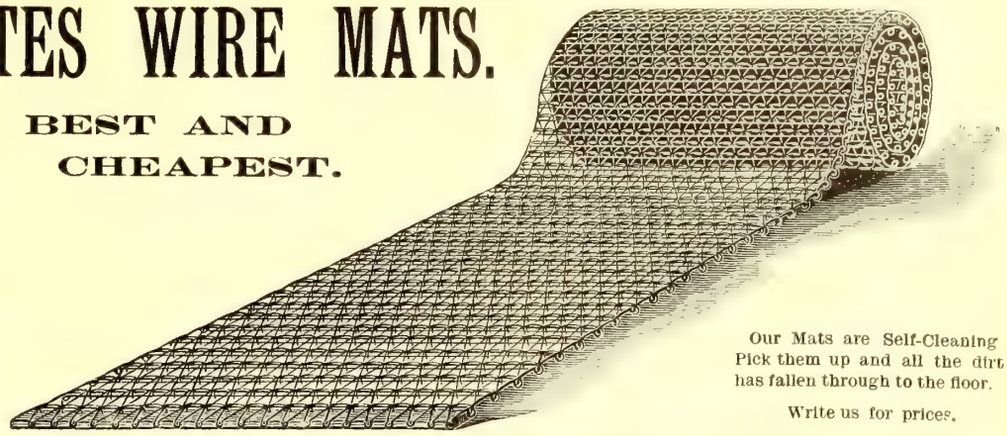
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ANY SIZE AND SHAPE.



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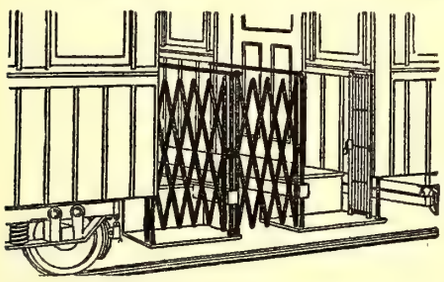
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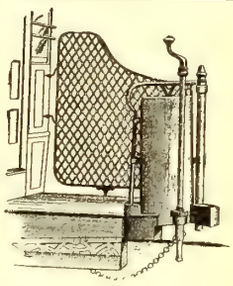
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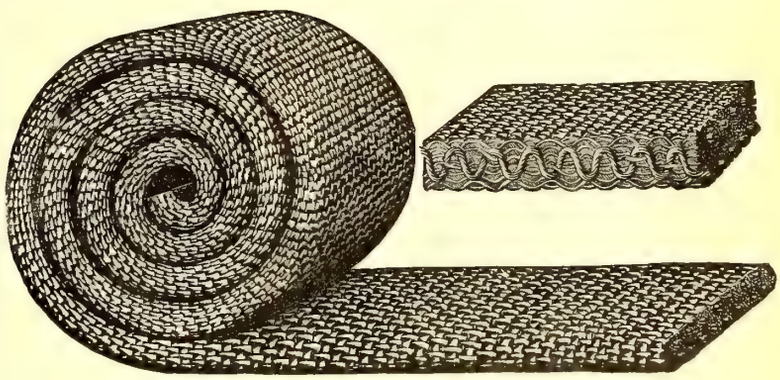
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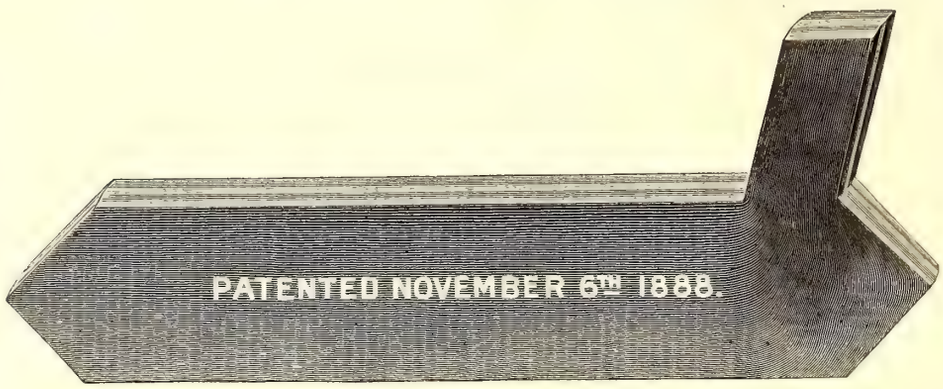


Made of cable steel wire and cotton woven solidly together, absolutely the strongest, toughest, most powerful, flexible, durable and lasting belting made, without any exception whatever. It is stronger, tougher, more durable and will transmit more power than the best oak tanned double leather belting made. It will not stretch or slip even when wet. It is waterproof and is not affected any by water, steam, dampness, moisture, heat, dryness, oils, grease, acids, chemicals, dust, changes of climate or weather. It will not rot, mildew, crack, or get hard or stiff, Does not require any grease or belt composition or special care, but will always keep soft and flexible and in good condition for use. It is cheaper in price than single leather belting, and fifty to seventy-five per cent. cheaper than double leather belting. IT IS ABSOLUTELY SUPERIOR TO ALL OTHER KINDS OF BELTING.

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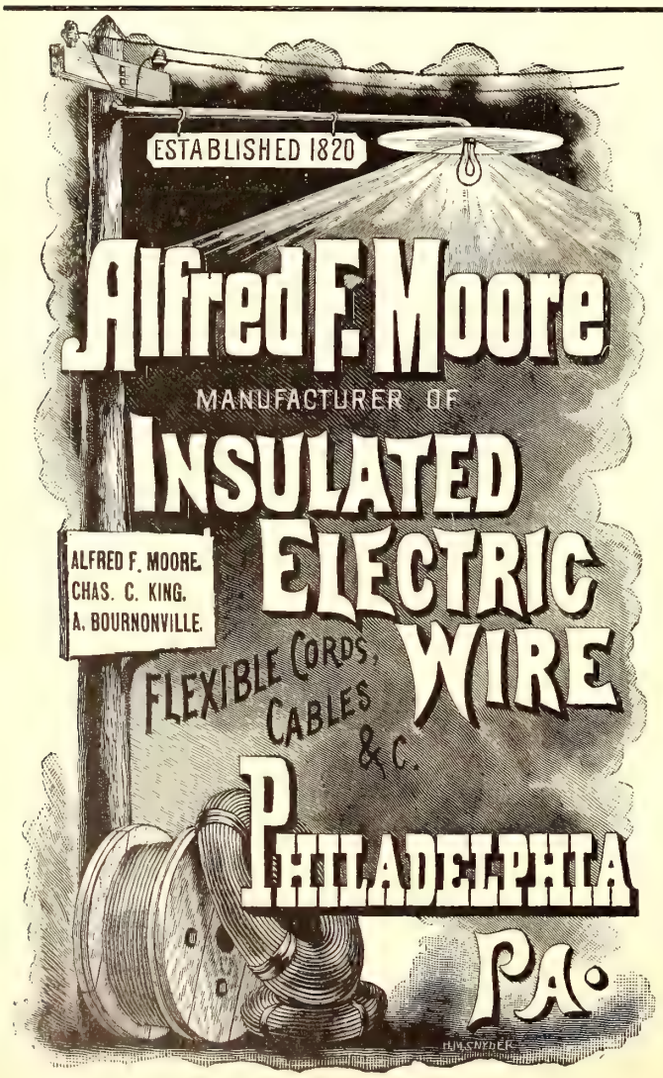
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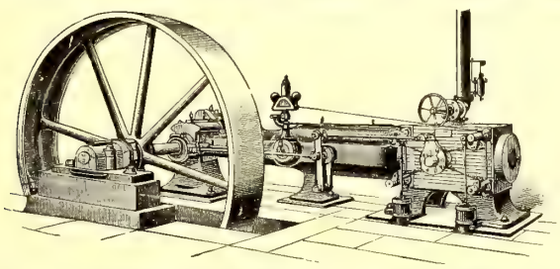
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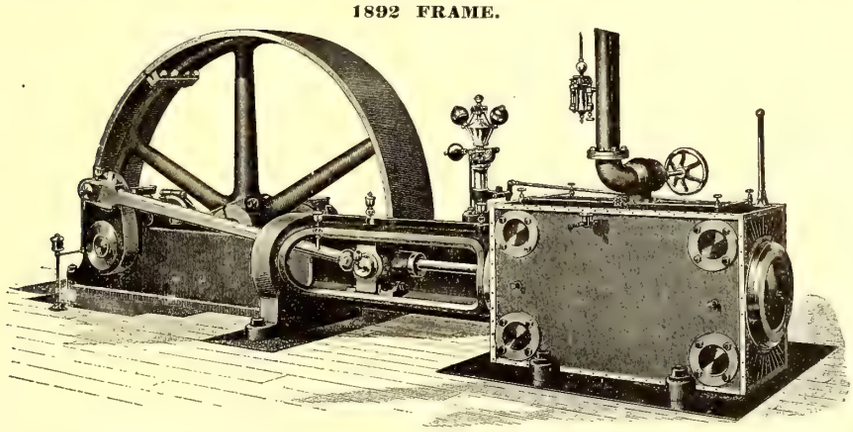
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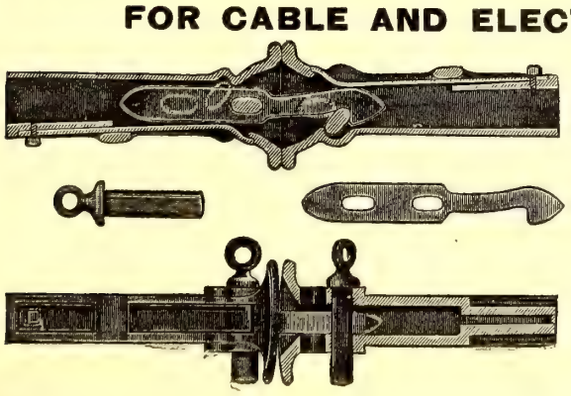
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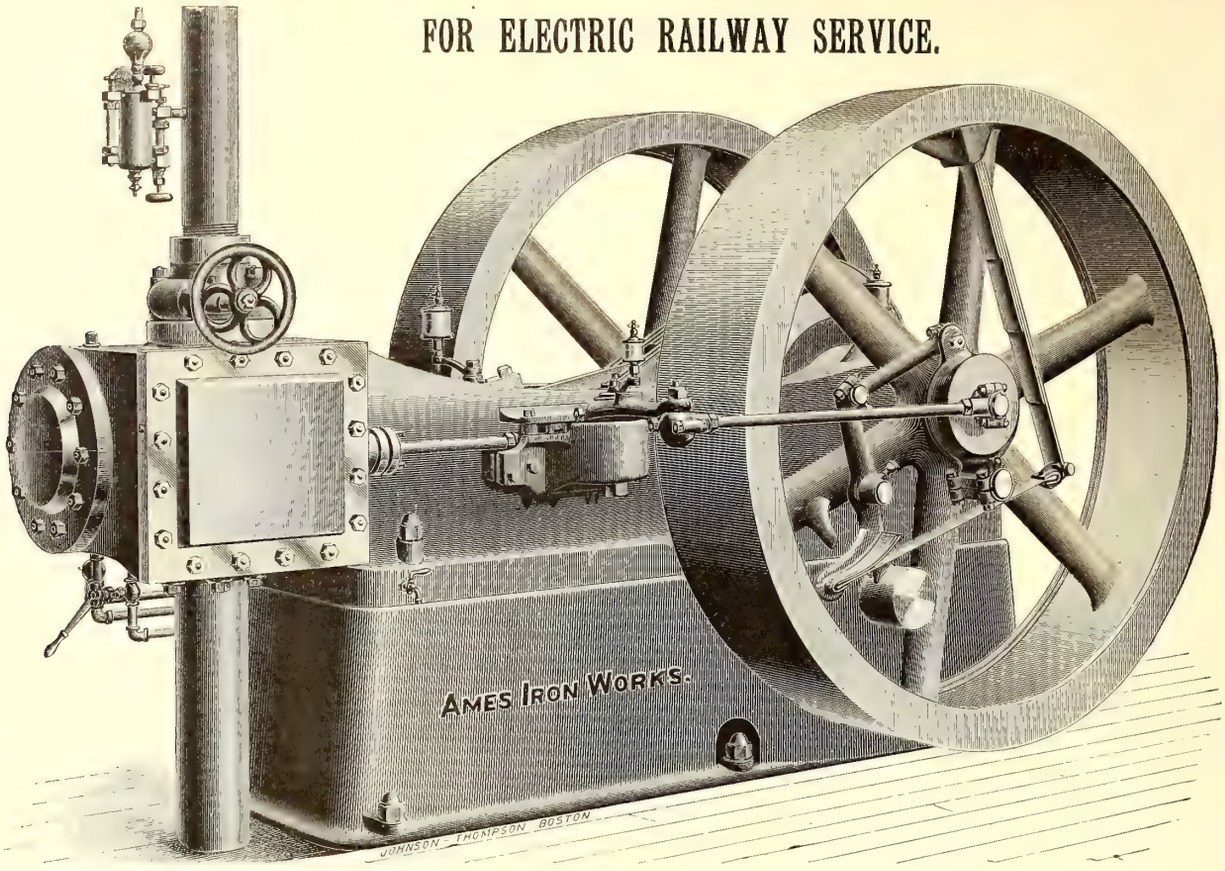
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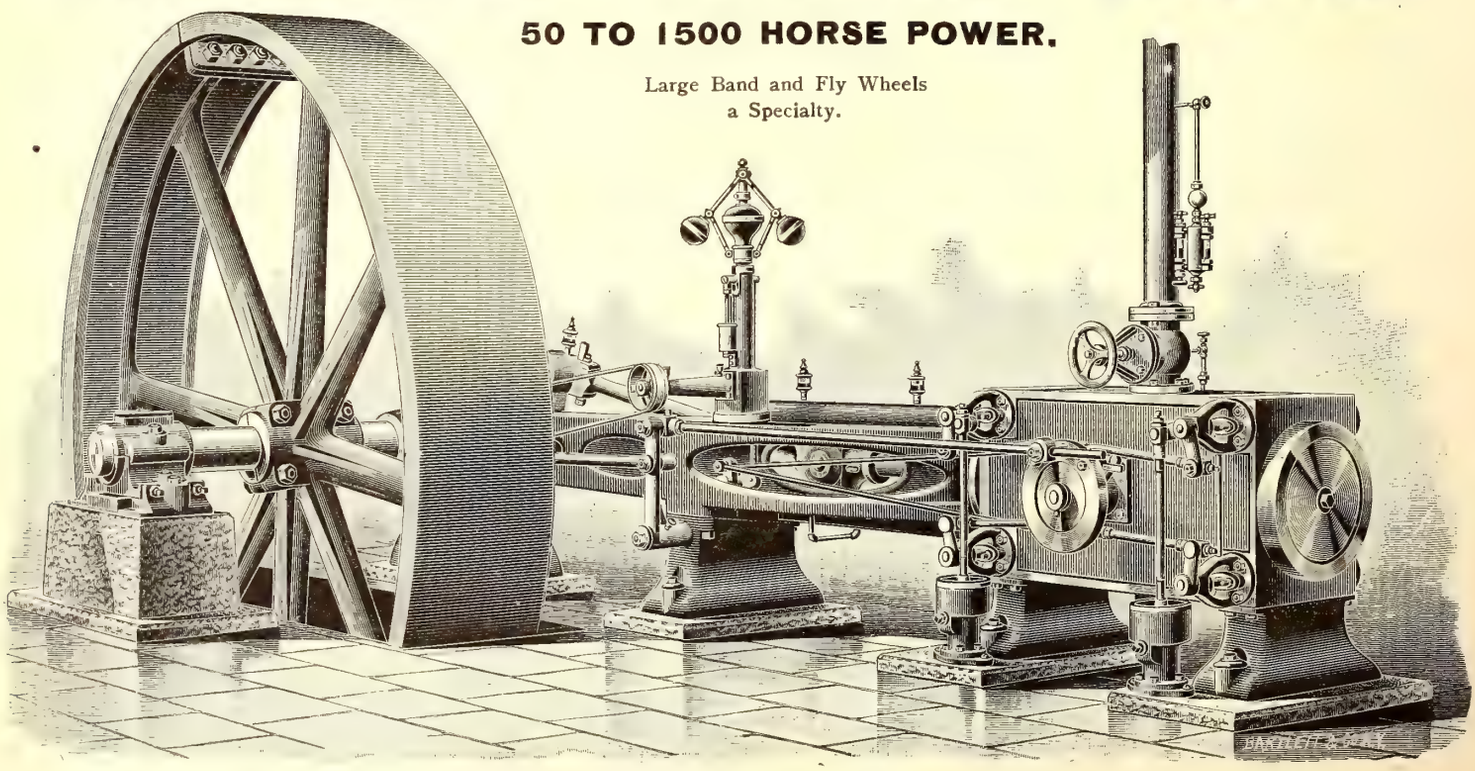
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Large Band and Fly Wheels
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The Only Liberating Valve Gear Without Spring or Hook Block. All Joints have Wrist-Pin Bearings. Special Attention Given to the Construction of Complete Motive Power Plants for Electric Railway and Electric Light Stations. All Patterns of Extra Heavy Design.

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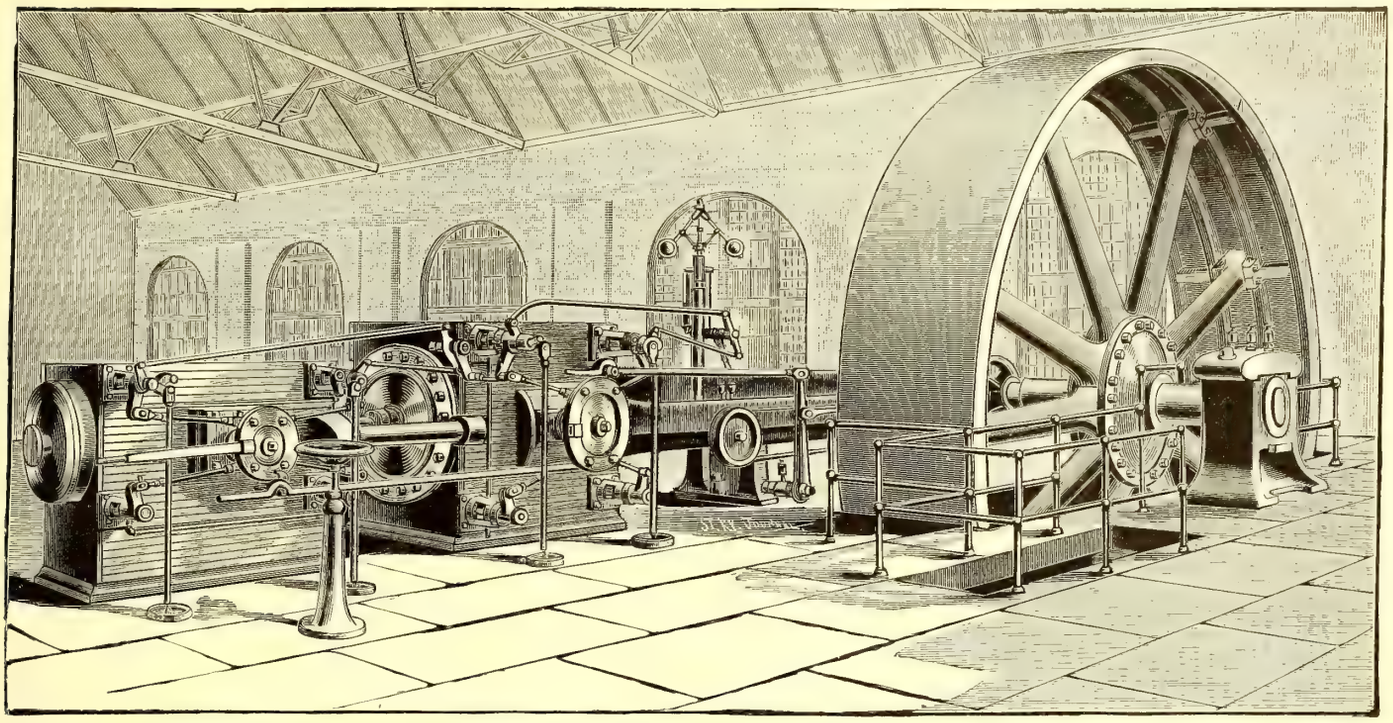
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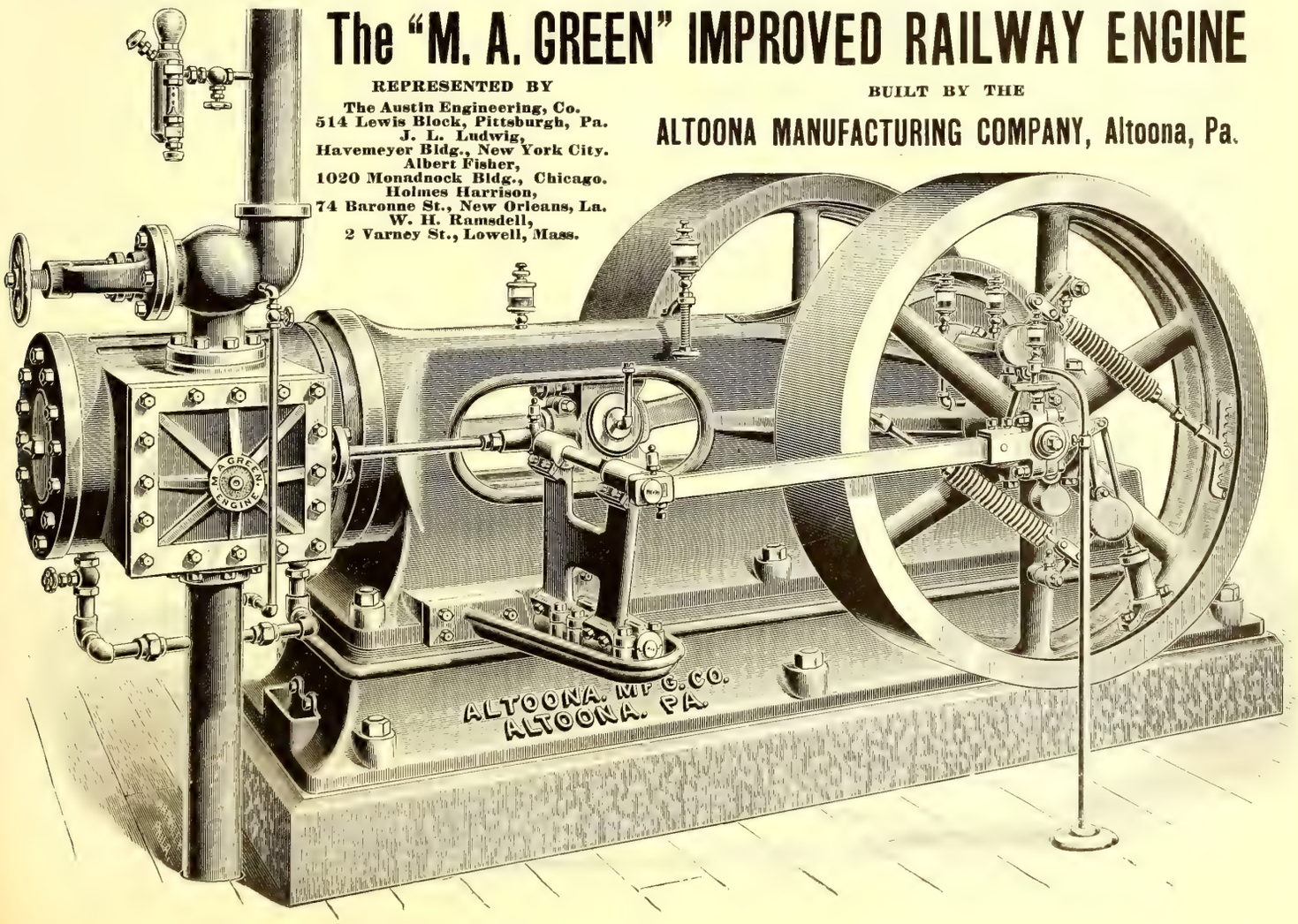
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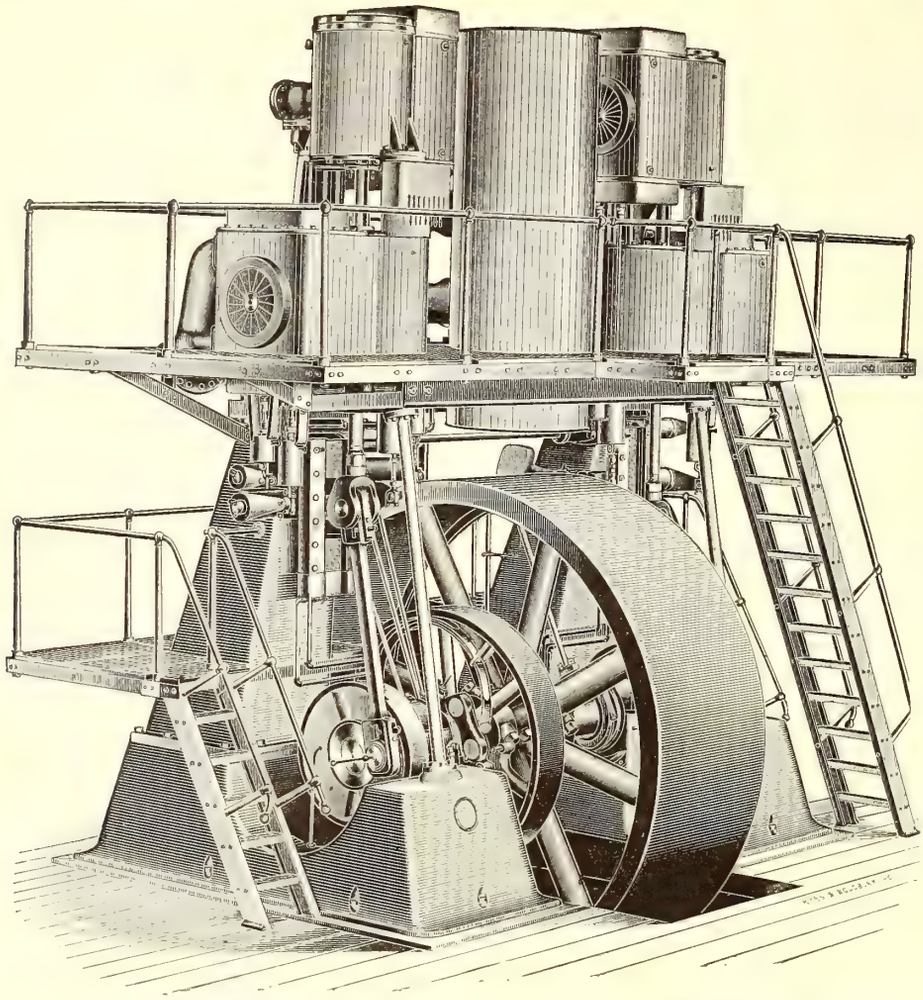
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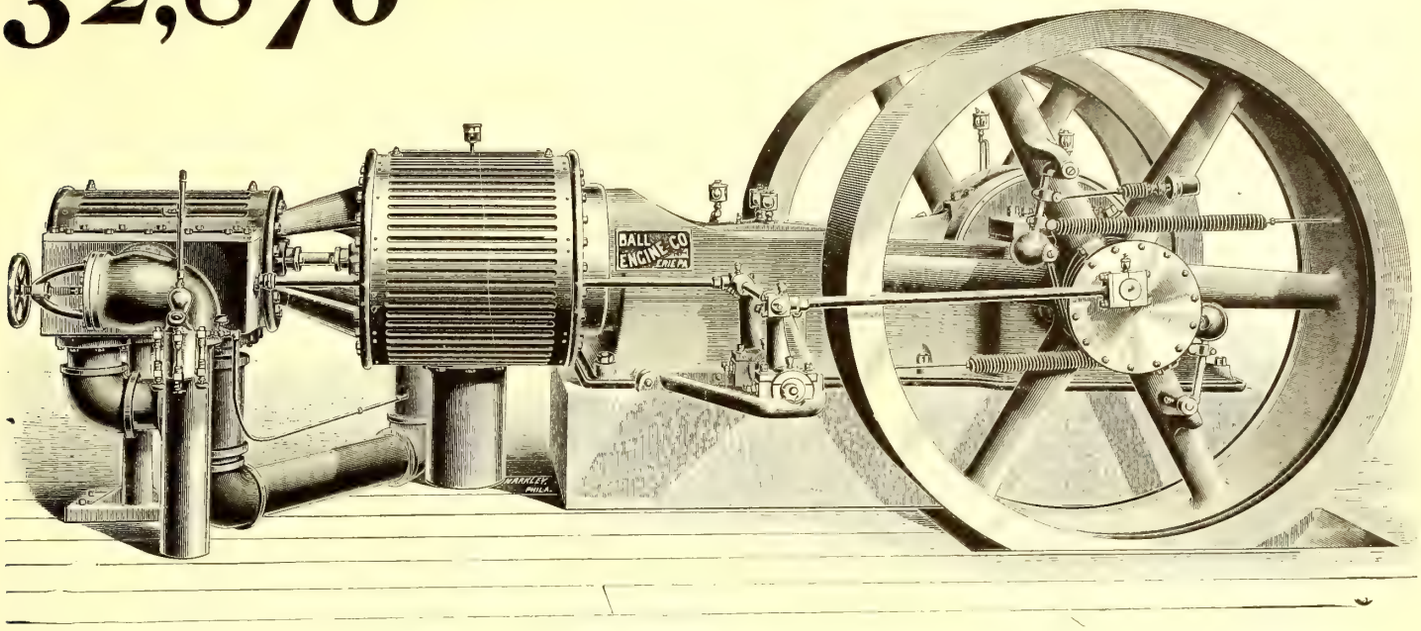
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Complete Power Plants.

32,870 H. P. Sold to Electric Railways.



The Improved Ball Engines

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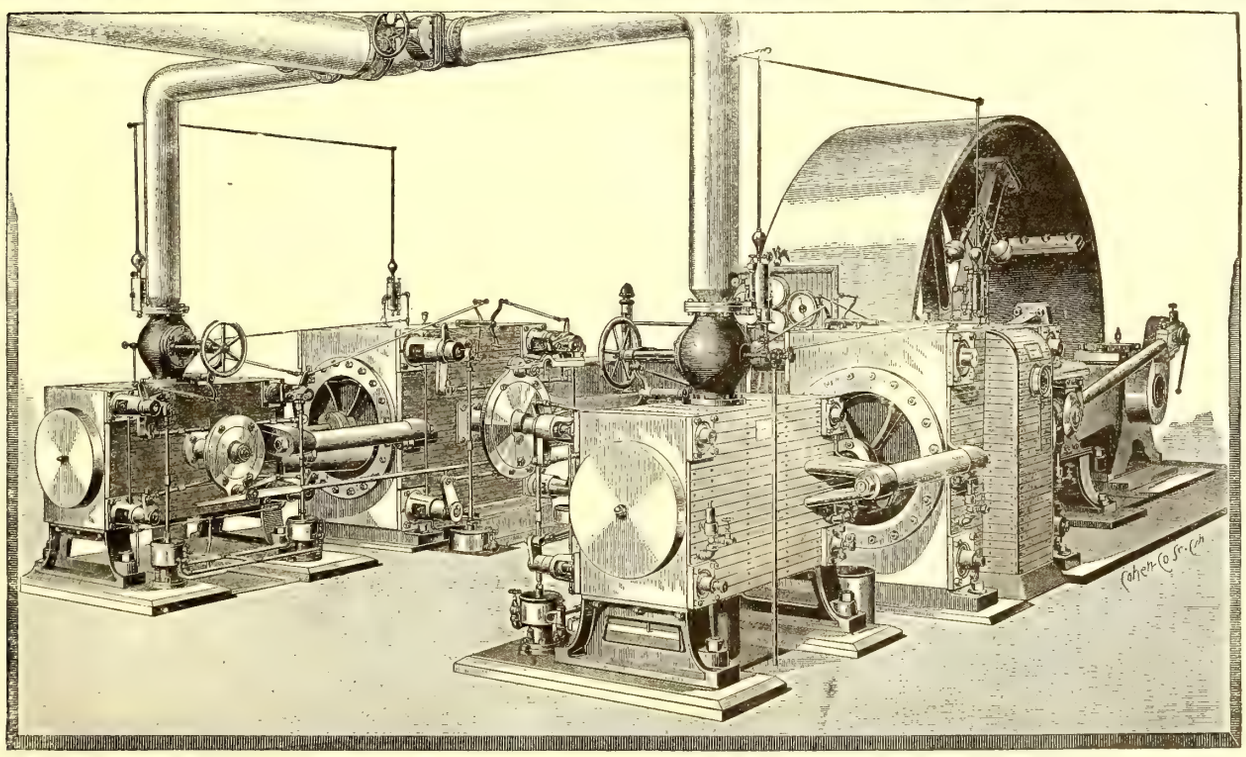
They are correctly designed, beautiful in appearance, thoroughly constructed, heavy and strong. The governor is especially adapted for street railway service, and gives unequalled regulation.

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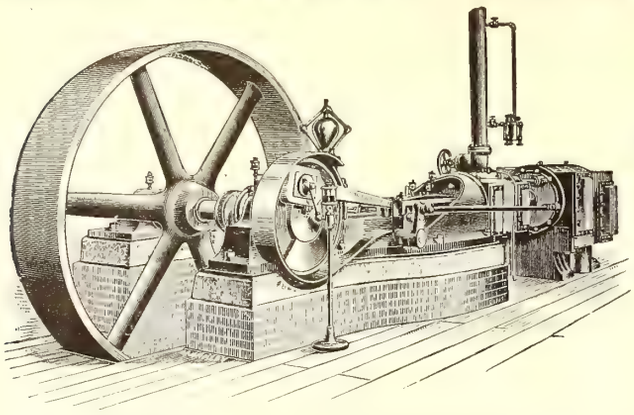
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SOLE MAKERS OF THE

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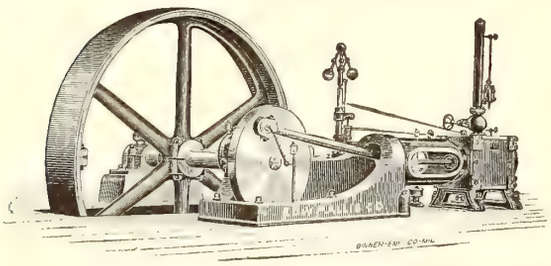
Adapted to Electric Light and Street Railway Service.

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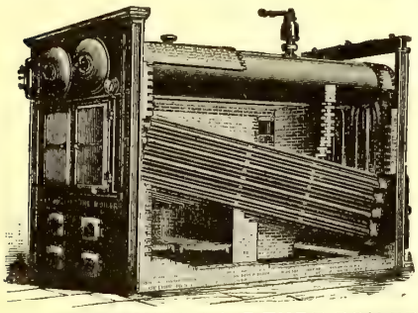
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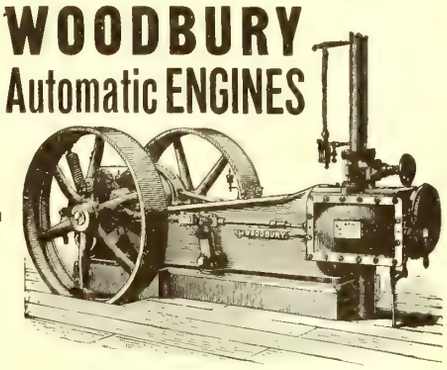


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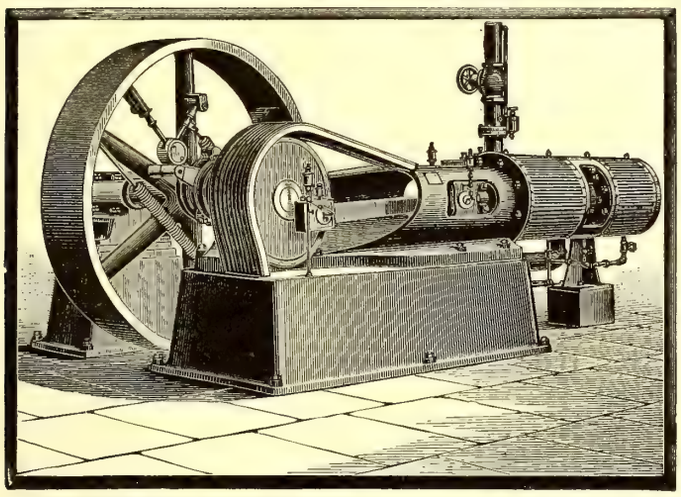
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SIMPLE AND COMPOUND CONDENSING OR NON-CONDENSING.



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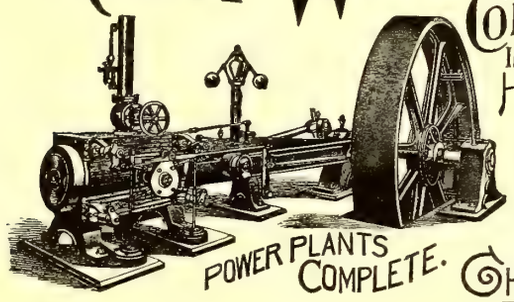
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Our Electric Lighting Engines are sold on a guarantee to equal any engine in use for Uniform Speed under Varying Loads.

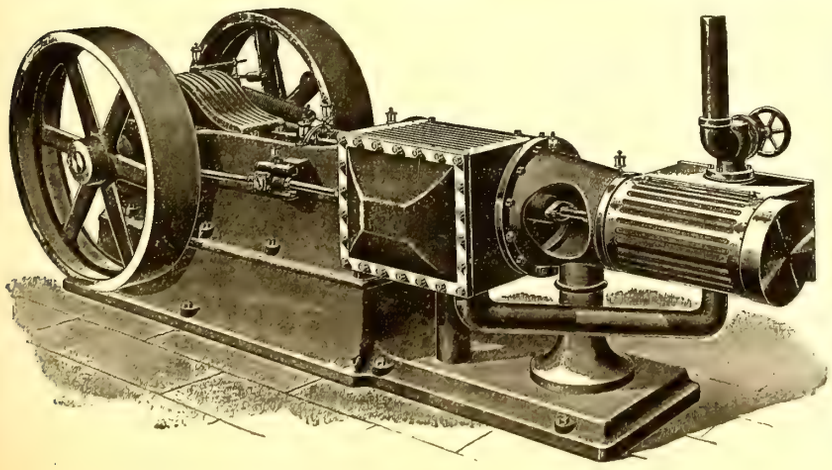
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CONSTRUCTING ENGINEERS
Improved HIGH PRESSURE CONDENSING AND COMPOUND CORLISS ENGINES.
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POWER PLANTS COMPLETE.
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Simple and Compound of the Horizontal Type, from 25 to 600 H. P.

Compound and Triple Expansion of the Vertical Type, from 100 H. P. to any size.

These Engines are especially adapted to any work that requires close regulation, and particularly for Electric Street Railway work where sudden and extreme change of load takes place.

OUR GUARANTEE.

The engine shall not run one revolution slower when fully loaded than when running empty, and a reduction of boiler pressure from the greatest to that necessary to do the work will not reduce the speed of engine one revolution. Any engine failing to meet this guarantee becomes the property of the purchaser upon payment of one dollar.

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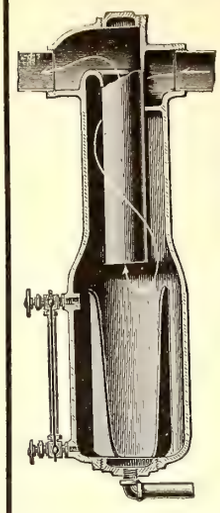
Specially adapted to
CONDENSING ENGINES, and in use in the largest CABLE and ELECTRIC RAILWAY PLANTS in the United States.

ALL SIZES, 50 TO 5,000 H. P.

Meets the requirements of
High Pressure, Free Exhaust, Great Durability.

Agencies in all Principal Cities.

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Means the stoppage of traffic on the entire line.
NINE-TENTHS OF THE BREAKDOWNS are due to Water in the Cylinder.

The Stratton Separator

Removes all Water in the Steam and Delivers

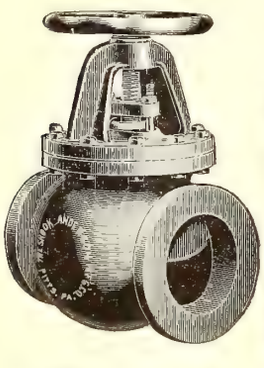
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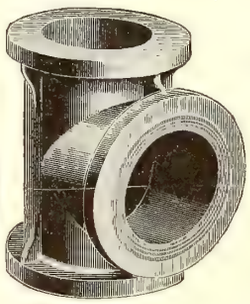
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Engineers, Pipe Fitters AND Machinists.



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PIPE BENDING OF ALL SIZES A SPECIALTY.

Manufacturers of Heavy Valves and Fittings.

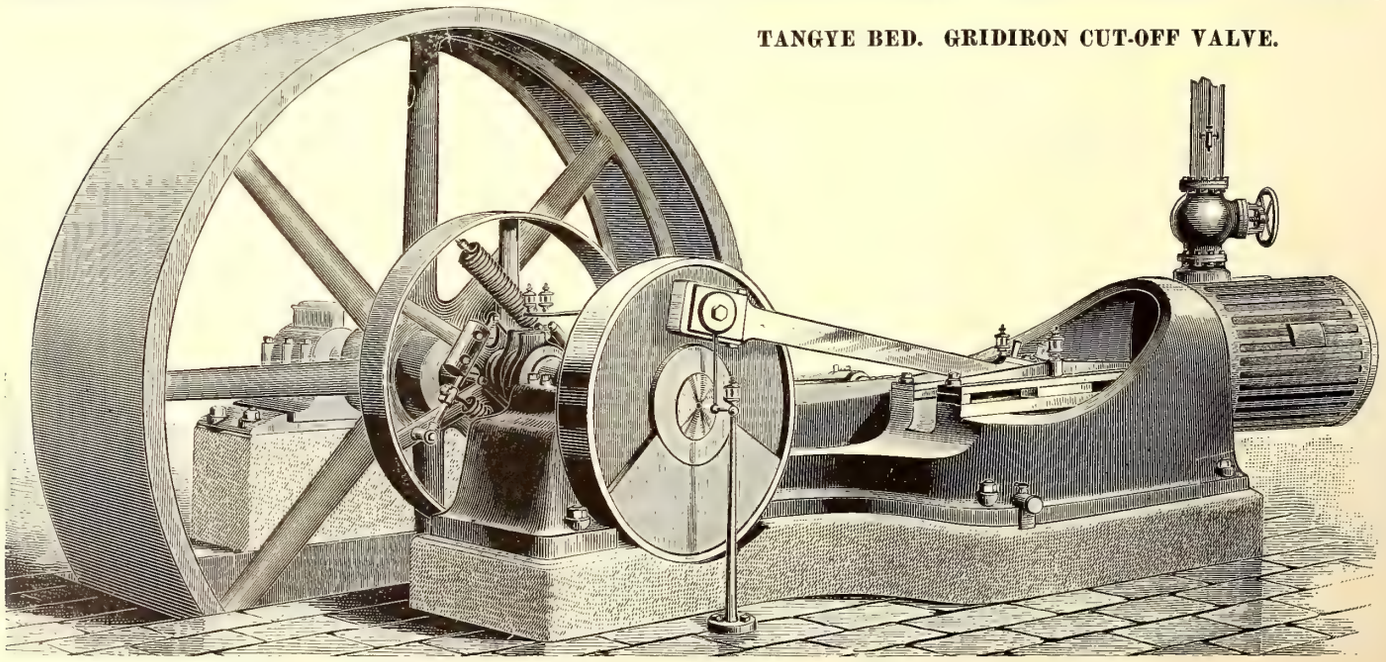
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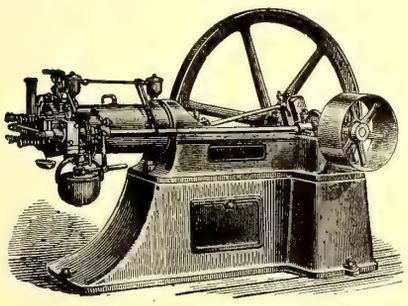
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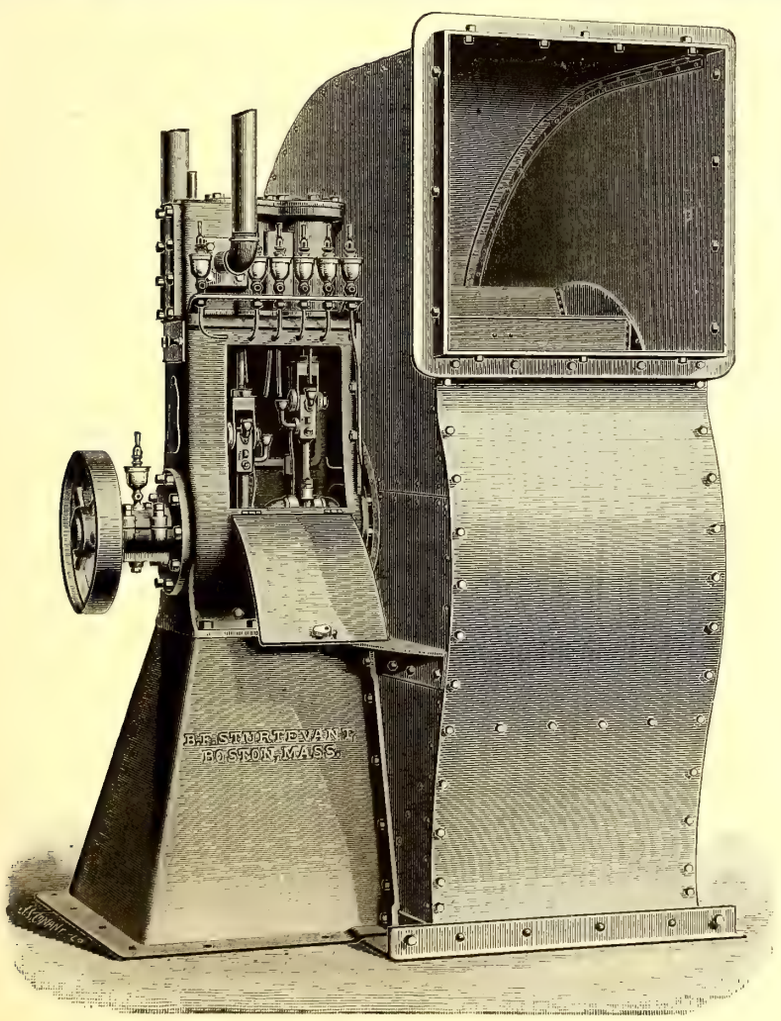
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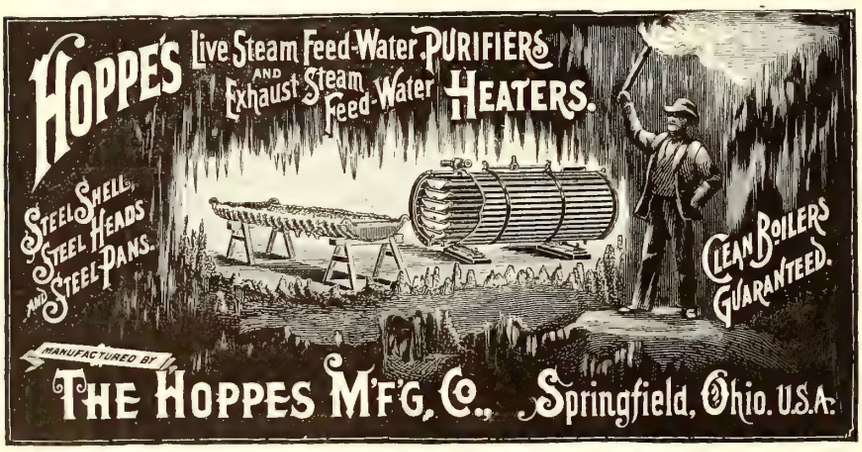
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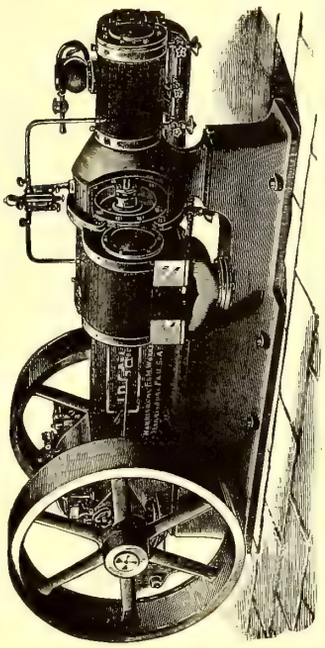
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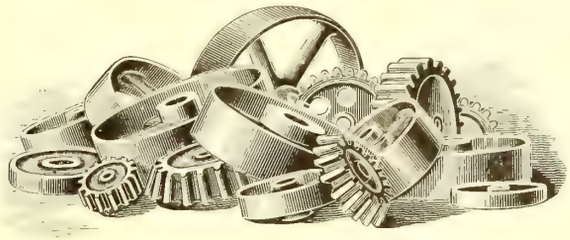
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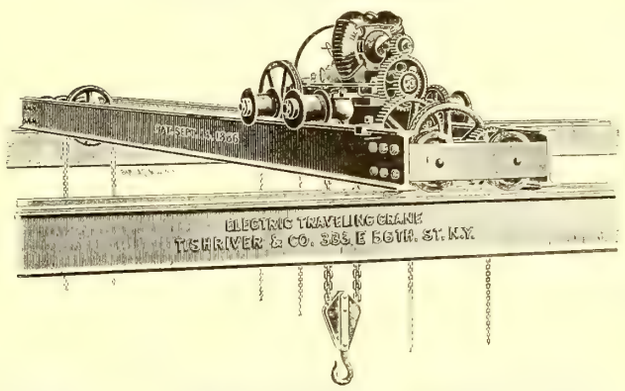


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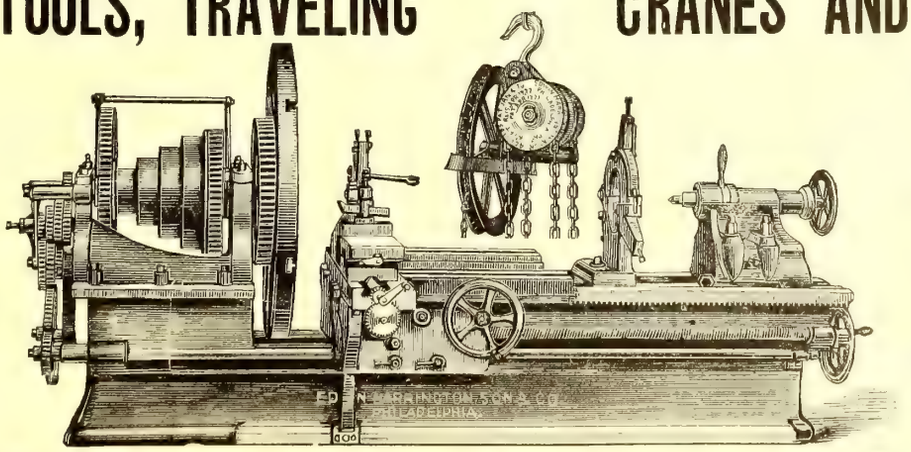
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West End Ry. Co., Boston	4 orders, '89-'92	9,500
The Albany Ry. Albany, N. Y.	3 orders, '89-'92	1,000
The Crosstown St. Ry. Co., Buffalo, N. Y.	3 orders, '90-'93	4,500
Cincinnati St. Ry. Co., Cincinnati, O.	5 orders, '90-'93	3,300
Pittsburgh & Birmingham Traction Co., Pittsburgh, Pa.	July, 1890	1,000
Columbus Elec. St. Ry. Co., Columbus, O.	4 orders	1,807
Aurora St. Ry. Co., Aurora, Ill.	2 orders, '90-'92	832
People's St. Ry. Co., St. Joseph, Mo.	2 orders, '89-'93	1,040
Duluth St. Ry. Co., Duluth, Minn.	4 orders, '90-'93	1,312
Brooklyn City Ry. Co., Brooklyn, N. Y.	6 orders, '91-'93	16,500
Rochester St. Ry. Co., Rochester, N. Y.	2 orders, '91-'92	808
Merrimac Valley R. R. Co., Lawrence, Mass.	3 orders, '91-'93	896
Citizens' Ry. Co., Indianapolis, Ind.	August, 1891	600
Union R. R. Co., New York	2 orders, '91-'92	1,500
Lynn & Boston R. R., Boston, Mass.	3 orders, '91-'92	4,000
Globe St. Ry. Co., Fall River, Mass.	February, 1892	675
Houston City Ry. Co., Houston, Tex.	2 orders, '90-'92	492
City & Suburban Ry. Co., Savannah, Ga.	March, 1892	500
Seashore Elec. Ry., Asbury Park, N. J.	May, 1892	640
Atlantic Ave. Ry. Co., Brooklyn, N. Y.	3 orders, '92-'93	3,000
Carrollton Elec. Ry. Co., New Orleans, La.	May, 1892	624
Intramural Elec. Ry. Co., World's Fair	1892-1893	3,500
Market Street Elec. Ry. Co., San Francisco, Cal.	3 orders	2,208
Cincinnati, Newport & Covington Ry. Newport, Ky.		600
Union Ry. Co., Providence, R. I.	December, 1892	1,500
Atlantic Improvement Co., Long Island City, N. Y.	February, 1893	1,000
Philadelphia Traction Co., Philadelphia	March, 1893	6,000
Camden, Gloucester & Woodbury Elec. Co., Gloucester, N. J.		750
Union Depot Ry. Co., St. Louis, Mo.		1,000
Haverhill & Groveland St. Ry. Co., Haverhill, Mass.	1892	630
Columbus Elec. Ry. Co., Columbus, O.	1890	692
New York & Brooklyn Bridge, Brooklyn	3 orders, '82-'91	1,248
Washington & Georgetown R. R., Washington, D. C.	4 orders	1,923
Cleveland City Cable Ry. Co., Cleveland, O.	March, 1890	1,086
Valley City St. & Cable Ry. Co., Grand Rapids, Mich.		781
Chicago City R. R. Co., Chicago, Ill.	April, 1881	1,000
Grand Ave R. R. Co., Kansas City, Mo.	2 orders, '86-'88	800
Metropolitan St. Ry. Co., Kansas City, Mo.	3 orders, '86-'88	1,800
Denver City Cable Ry. Co., Denver, Colo.	2 orders, '89-'91	1,600
The Melbourne Tramways, Melbourne, Australia	1884-1885	1,040

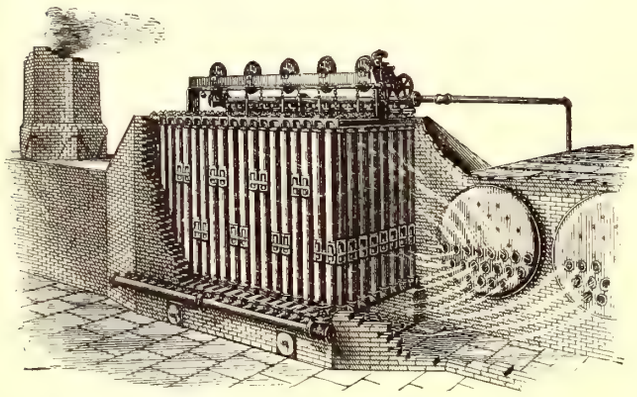
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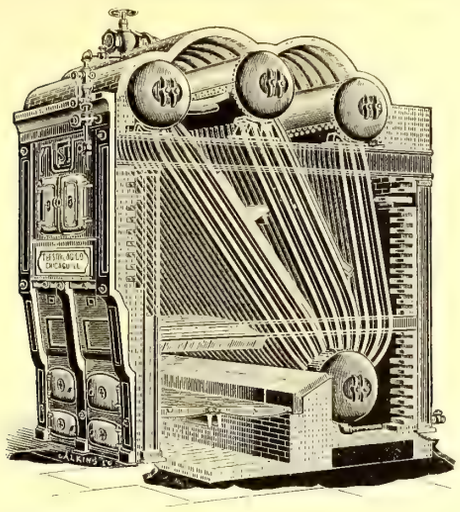
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" " " " "	Second order,	2000
Toledo Consolidated Street Ry., Toledo, O.	First order,	600
" " " " "	Second order,	600
Waco Electric Ry. & Light Co., Waco, Tex.	First order,	300
" " " " " "	Second order,	150
" " " " " "	Third order,	150
Second Avenue Electric Ry., Pittsburgh		200
Jamestown Street Ry., Jamestown, N. Y.		300
San Francisco & San Mateo Railway, San Francisco		1250
Los Angeles Consolidated Electric Ry., Los Angeles, Cal.		1500

	H. P.
Ottumwa Electric Railway, Ottumwa, Ia.	750
Evansville Street Railway, Evansville, Ind.	750
St. Joe & Benton Harbor Street Railway, St. Joseph, Mich.	400
Pittsburgh & West End Electric Railway, Pittsburgh	612
South Chicago City Railway, South Chicago	900
The Lafayette Street Railway, Lafayette, Ind.	500
Union Railway, New York City	1000
The Compton Heights & Union Depot, St. Louis, Mo.	2700
Union Street Railway, Providence, R. I.	500
Portland Street Railway, Portland, Me.	250
Cincinnati, Covington & Newport, Cincinnati, O.	500

Cleveland City Cable Railway.....750

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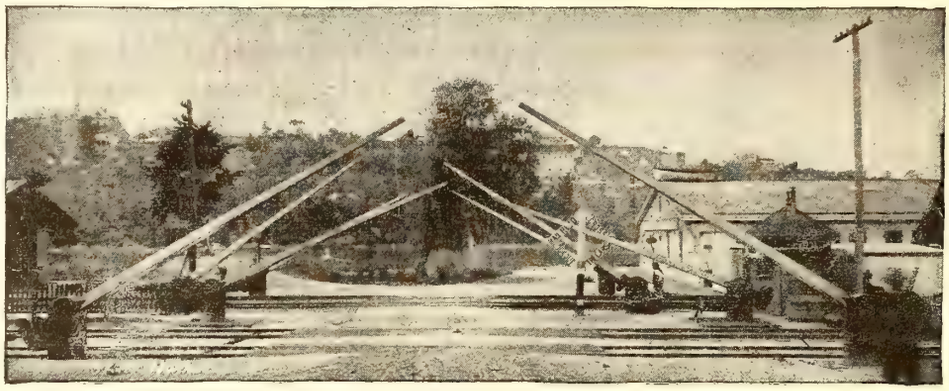
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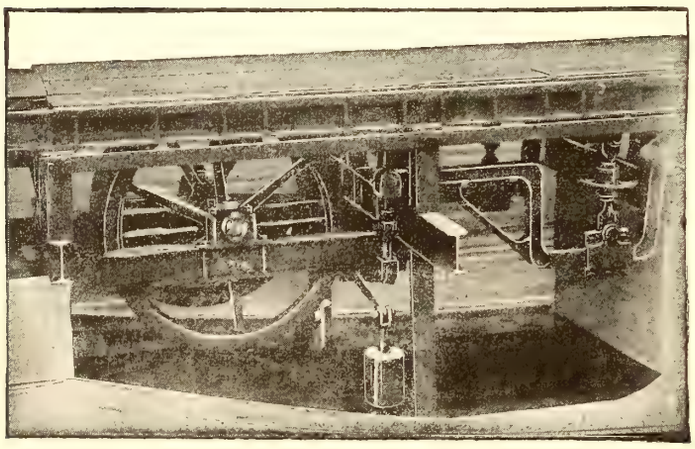
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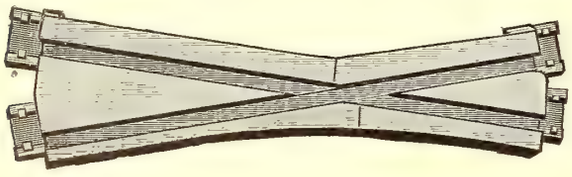


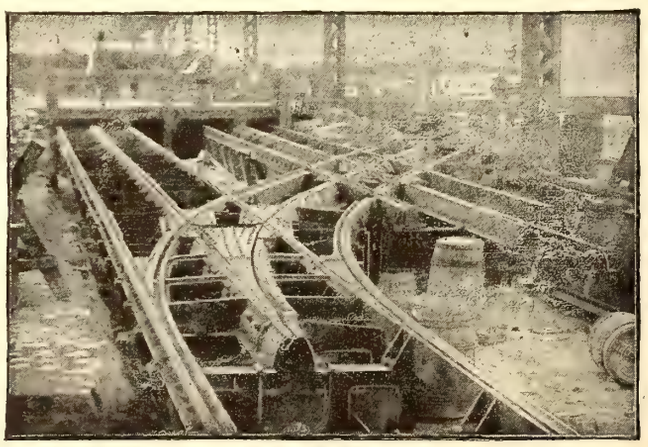
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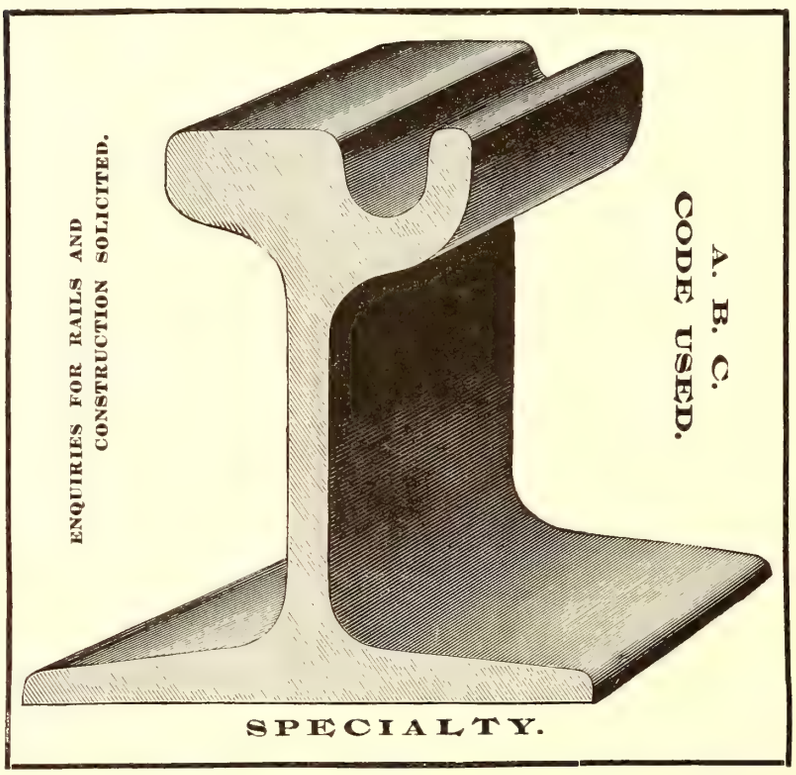
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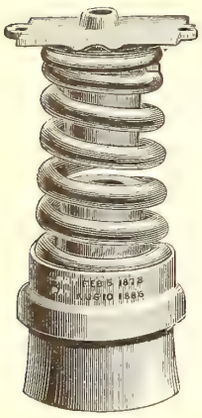
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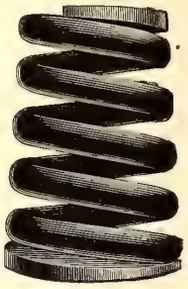
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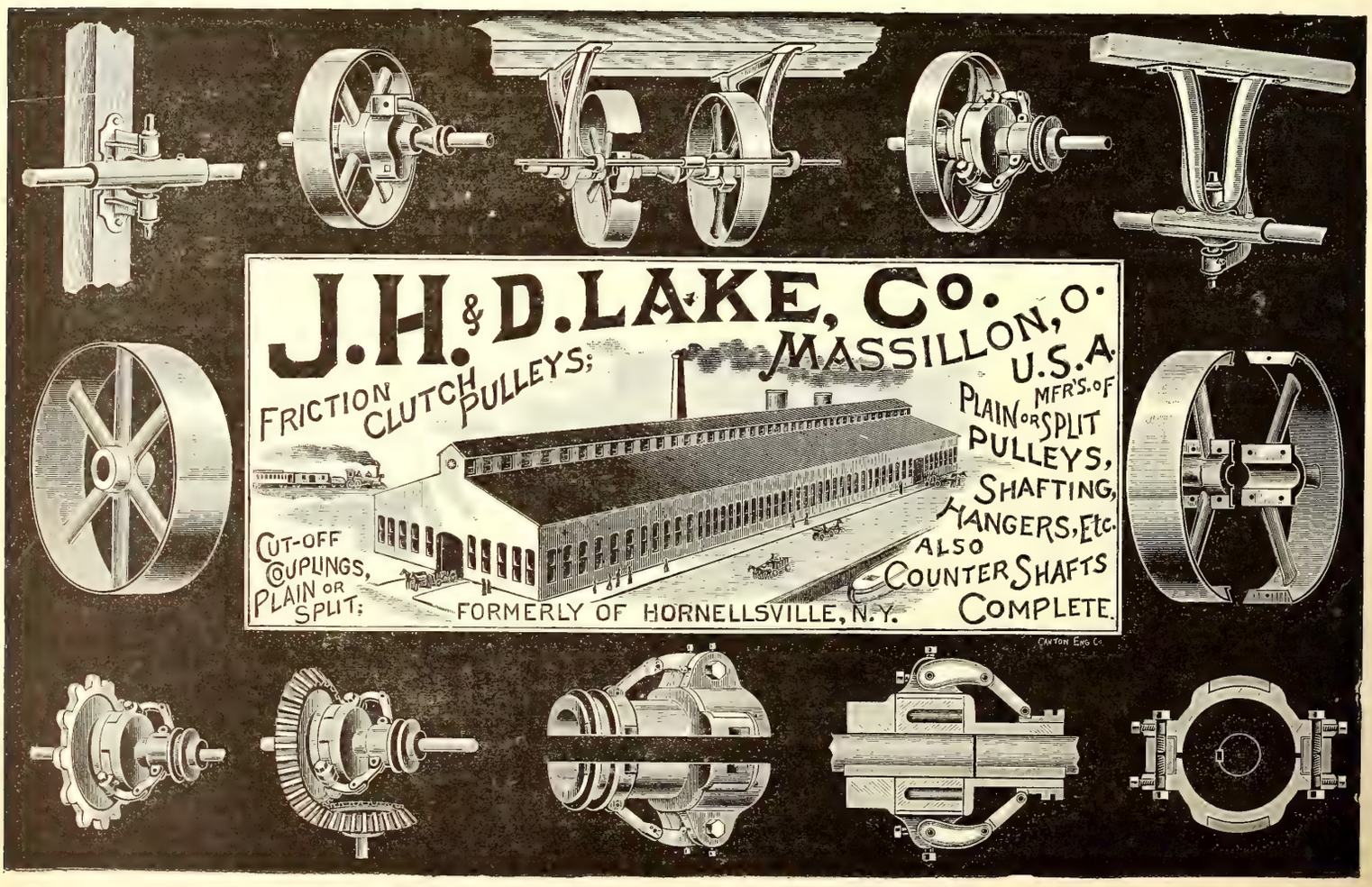
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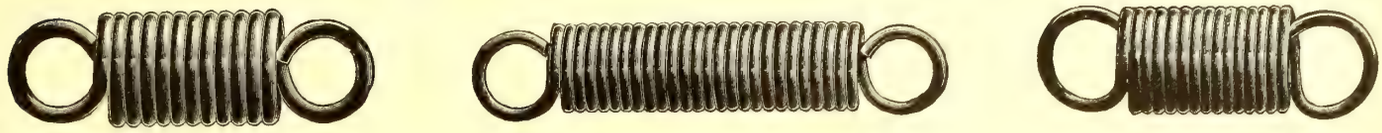
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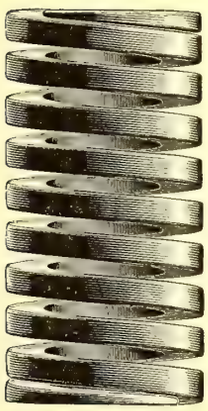




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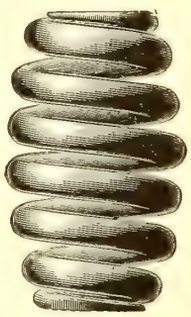
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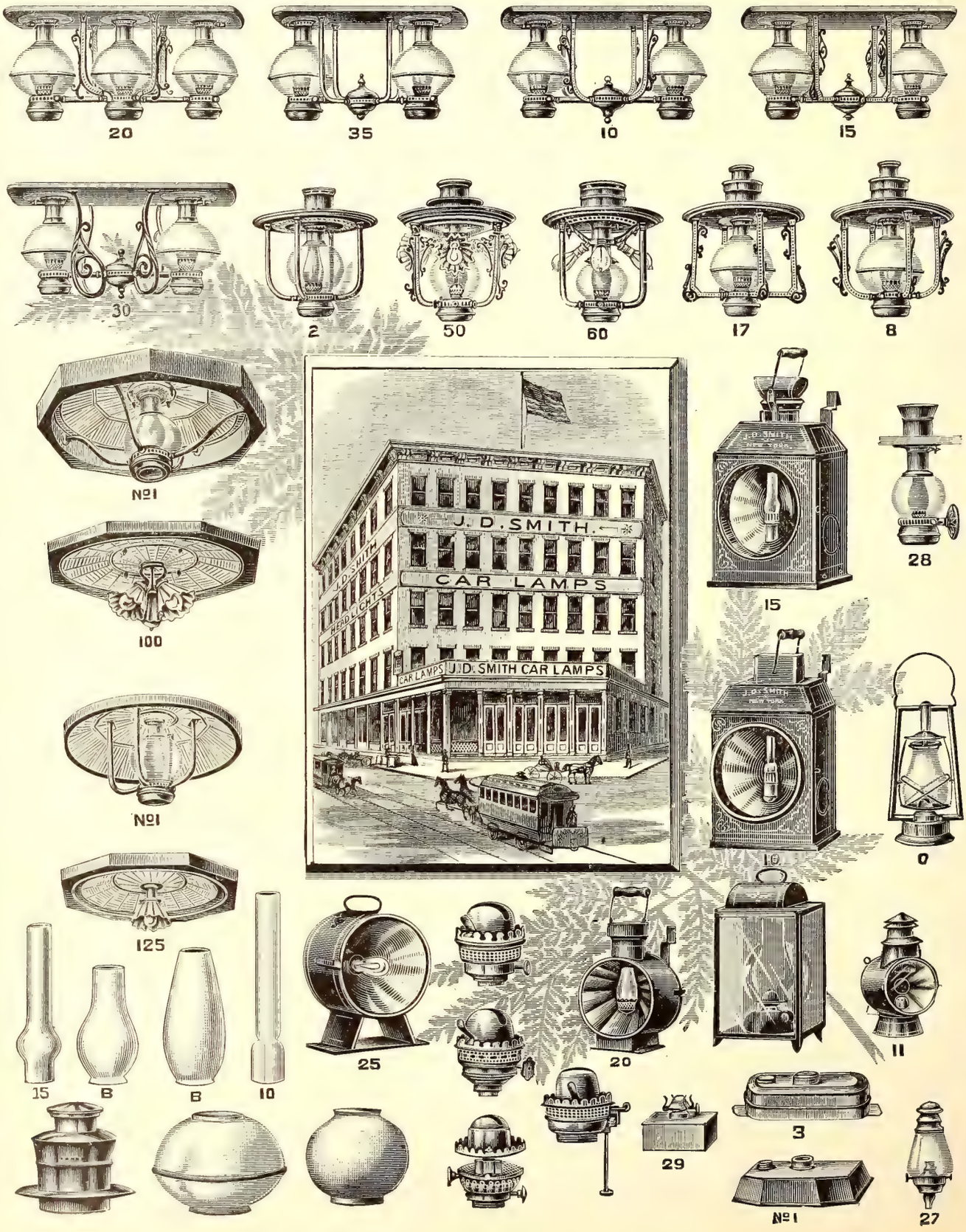
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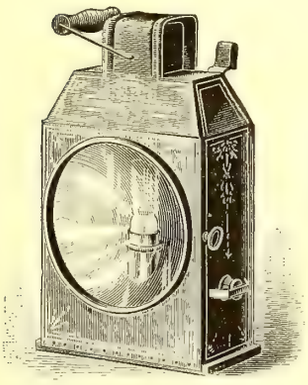
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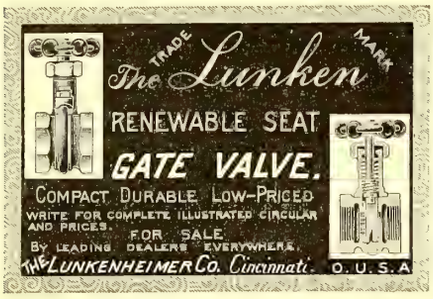
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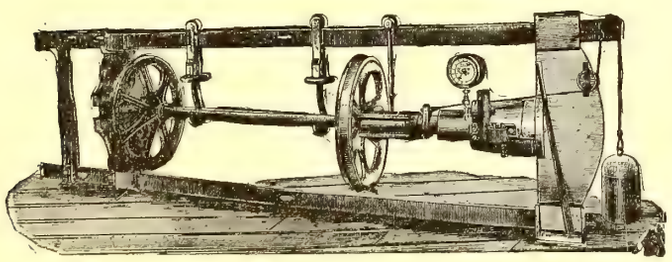
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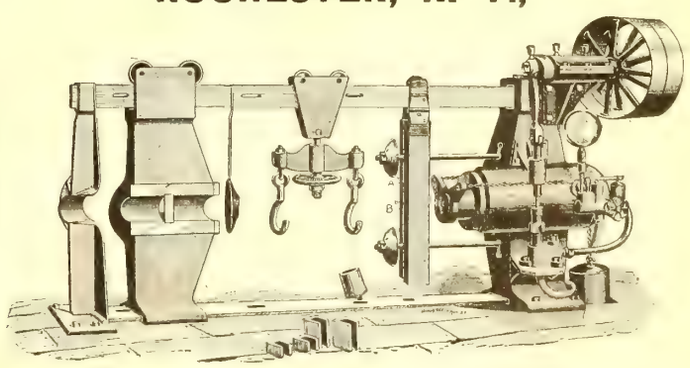
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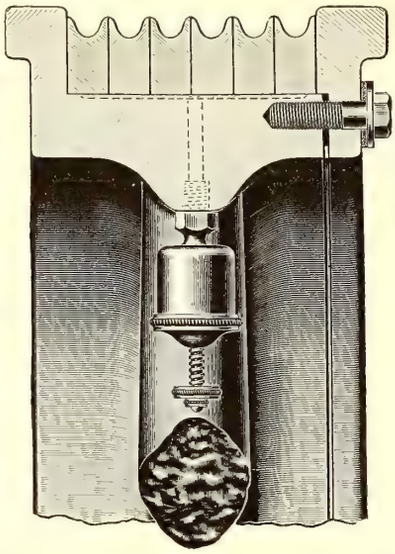
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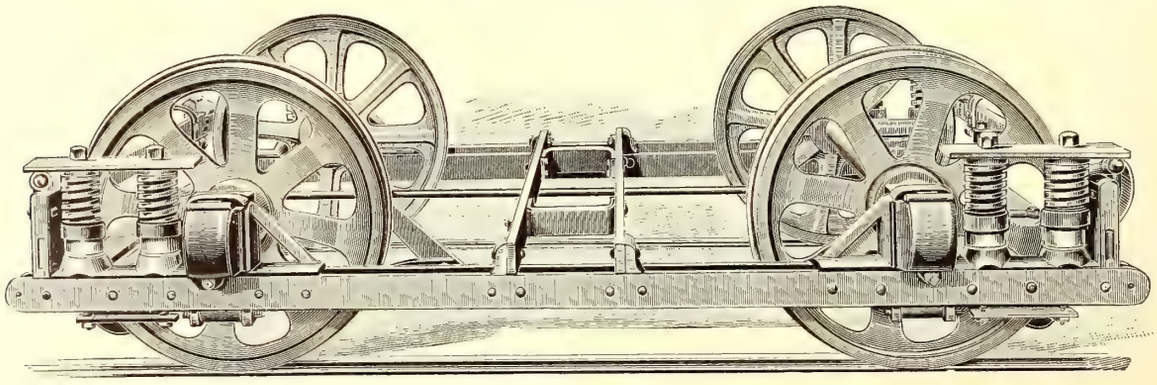
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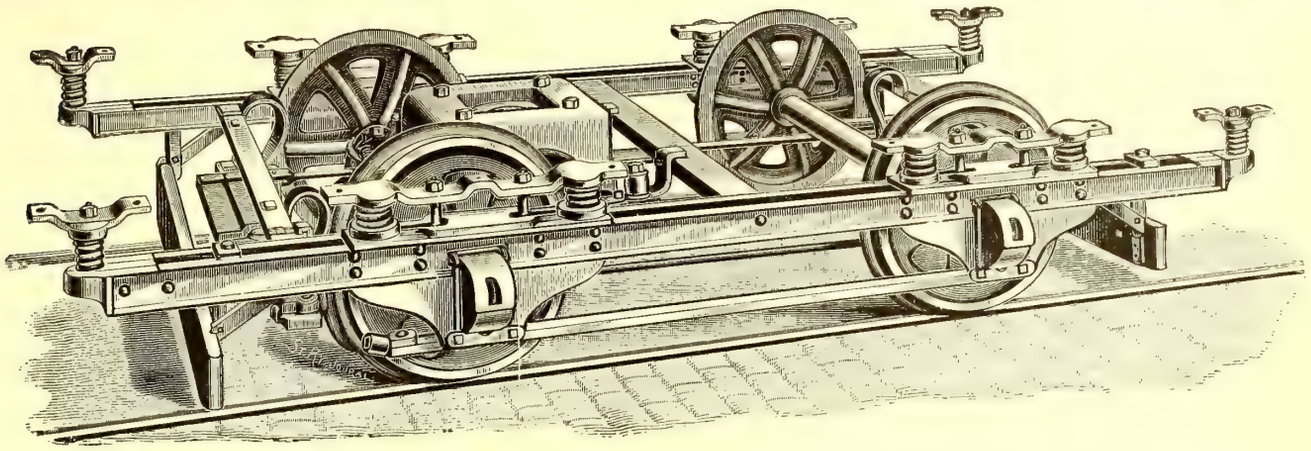
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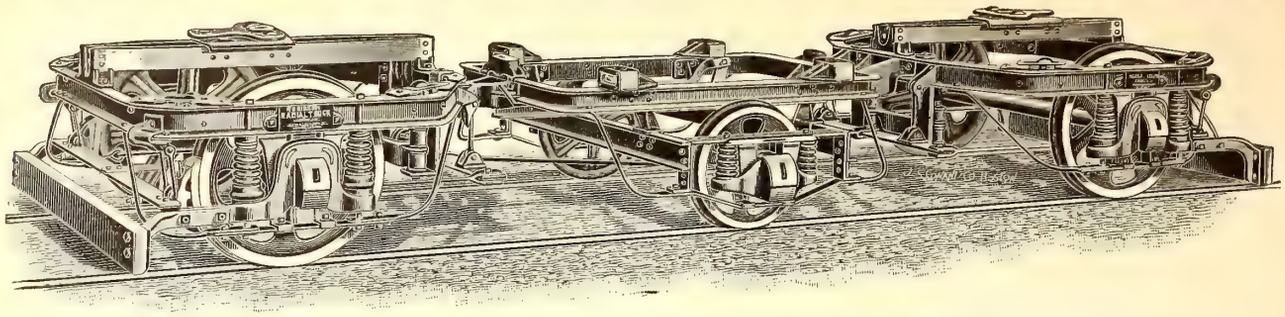
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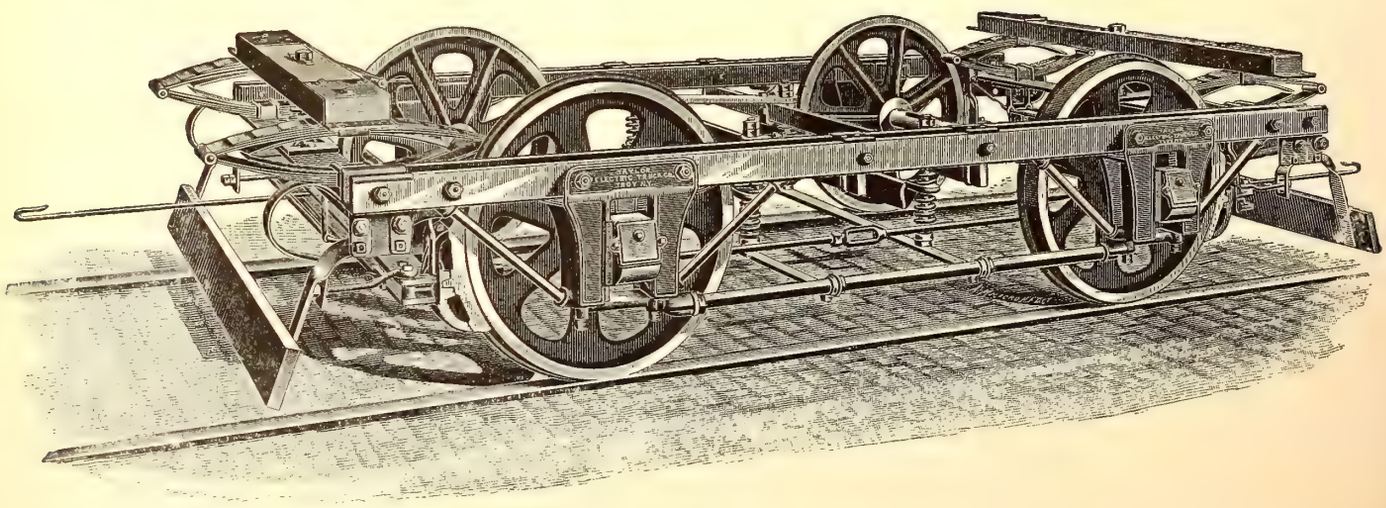
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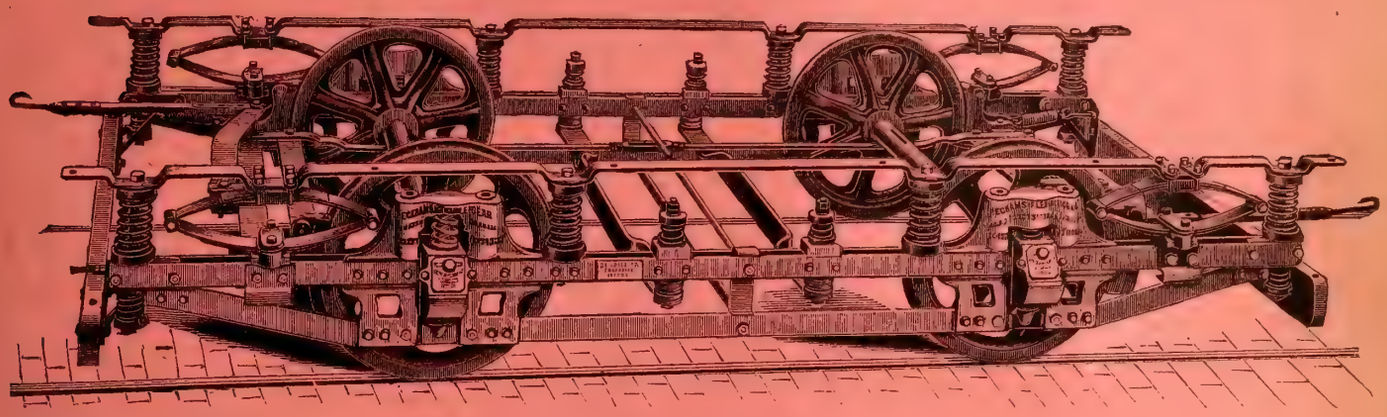
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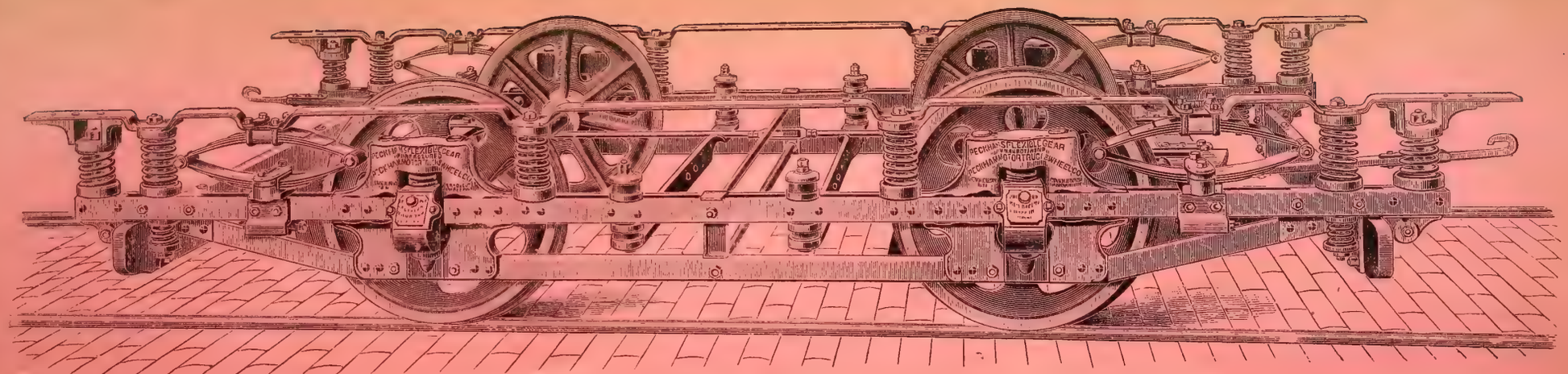
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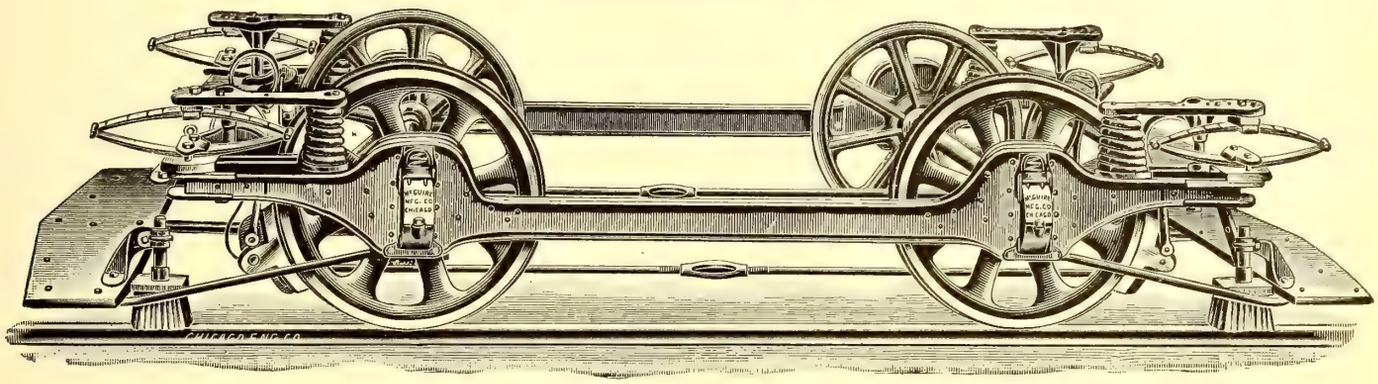
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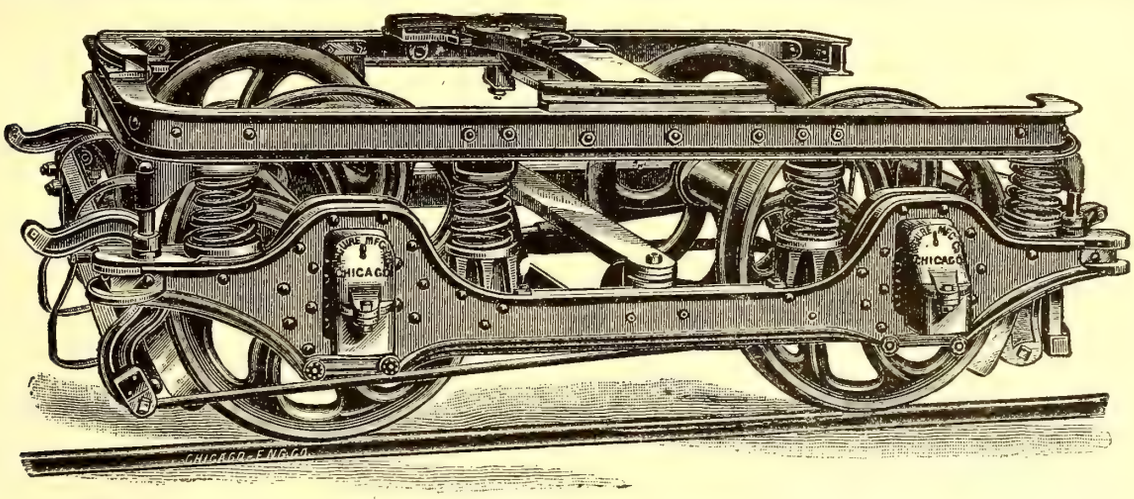
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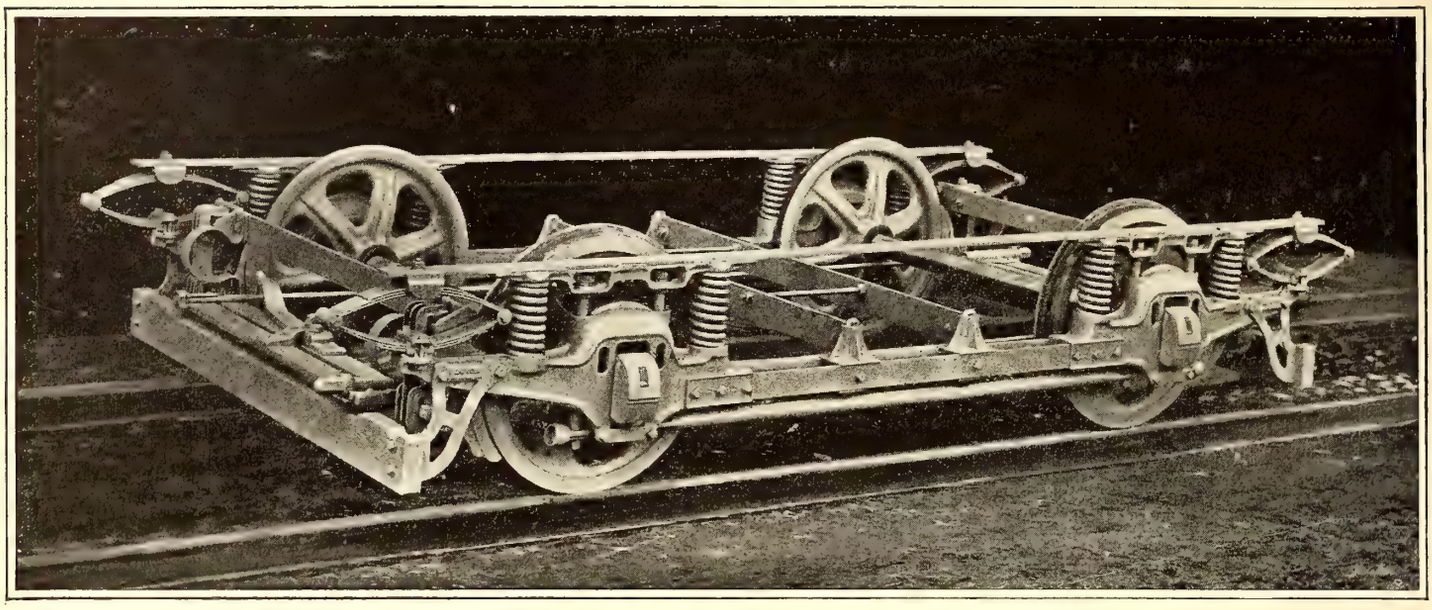
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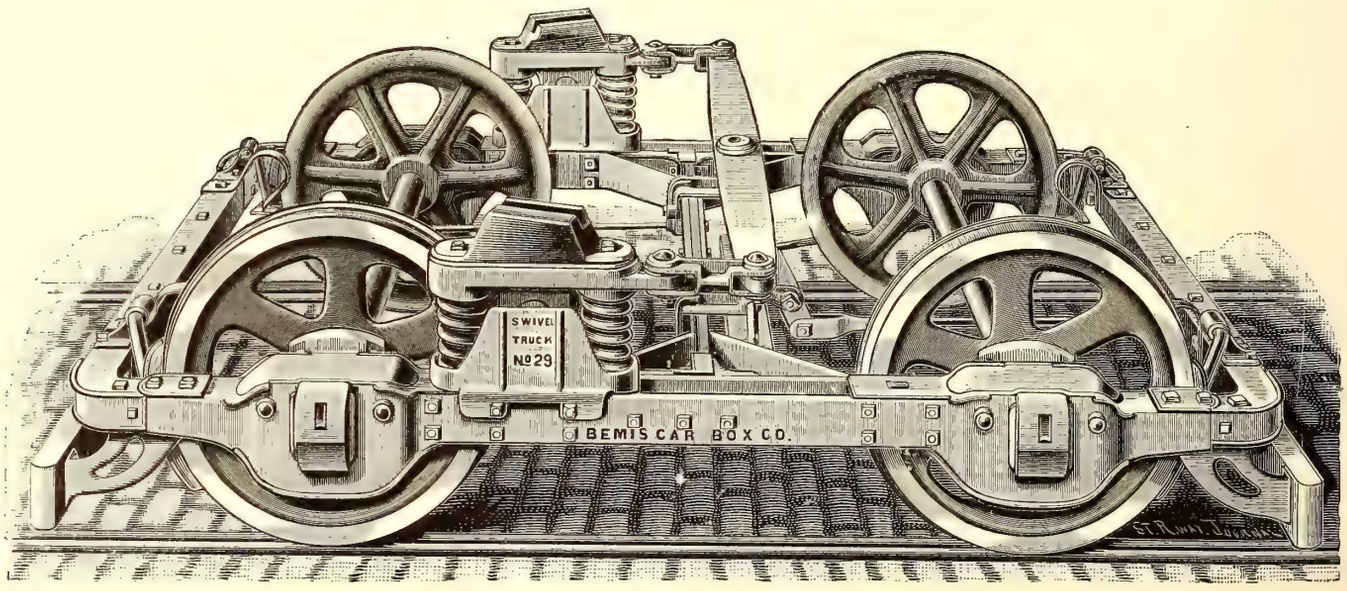
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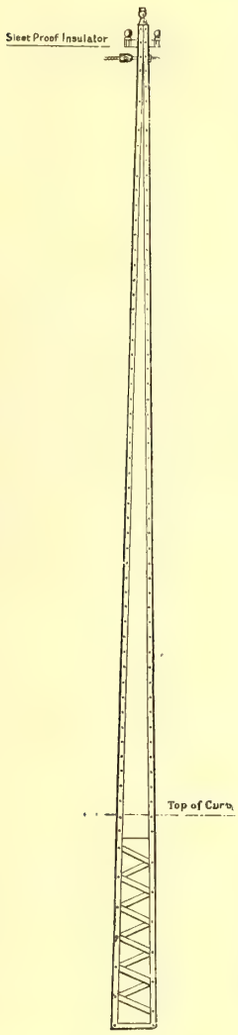
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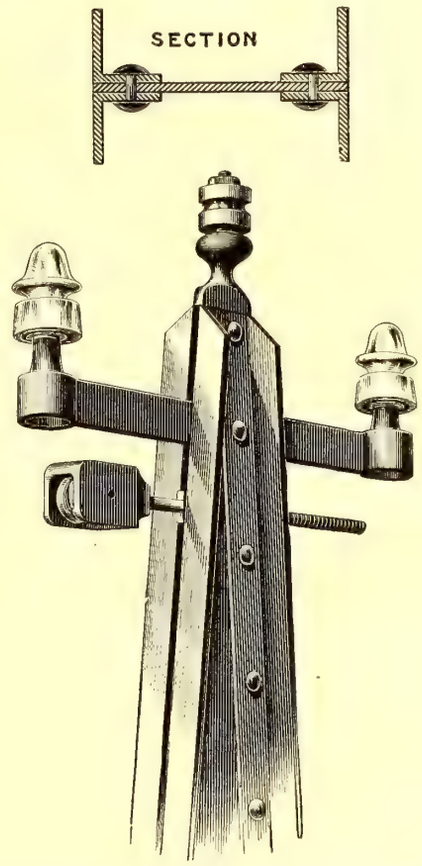
Increased traction on motor axles. Swivels from its center. Has standard size wheels on both axles. This gives light draught and good brake power, without increasing height of car above truck. No part of the truck over the motor. Short wheel base.

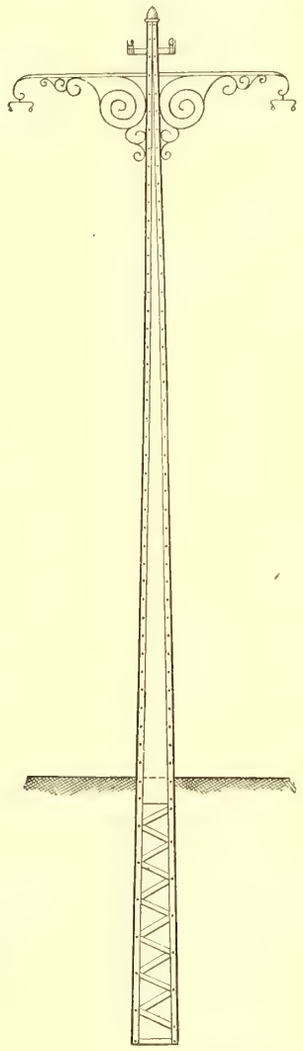
CHAS. M. JARVIS, President and Chief Engineer.
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BURR K. FIELD, Vice-President.
GEO. H. SAGE, Secretary.

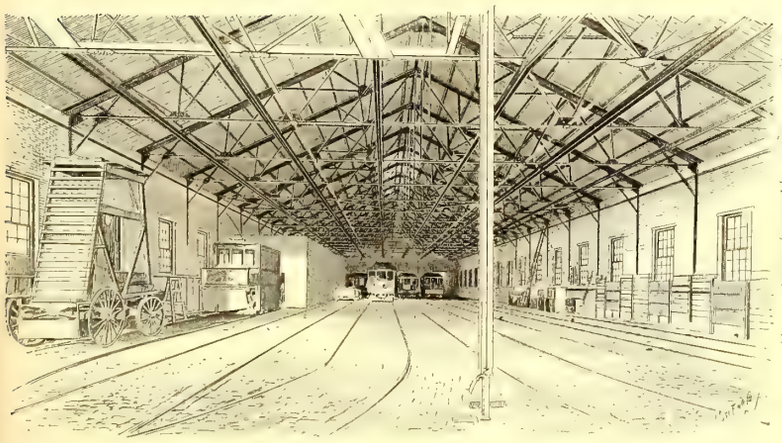
THE BERLIN IRON BRIDGE CO.



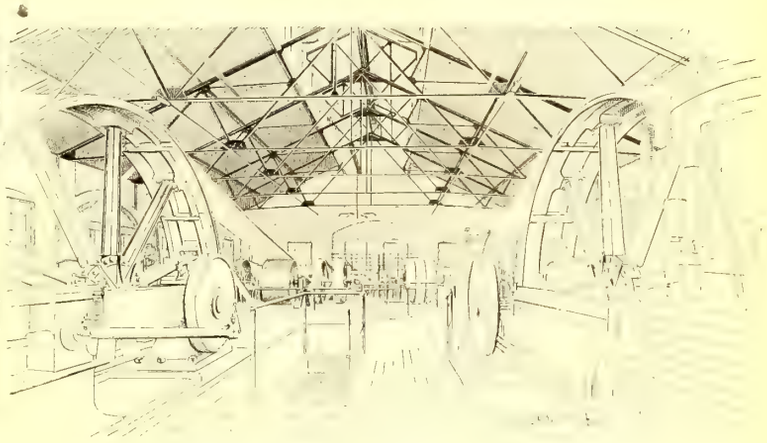




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The above illustration is taken direct from a photograph, and shows the interior of a car shed, designed and built by us for the Wilmington City Railway Co., at Wilmington, Del.



The above illustration is taken direct from a photograph, and shows the interior of a dynamo room, the roof of which was designed and built by us for the Worcester, Leicester & Spencer Street Railway Co., at Worcester, Mass.

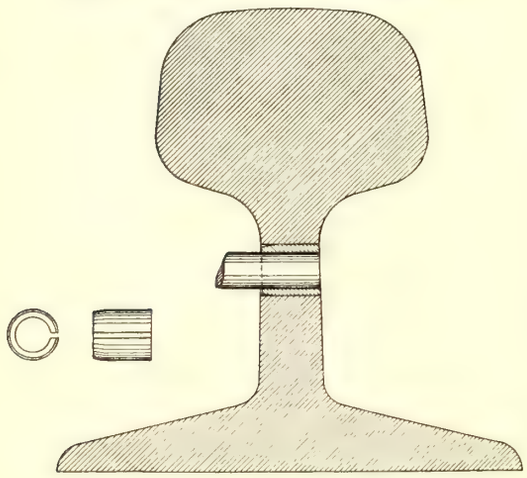
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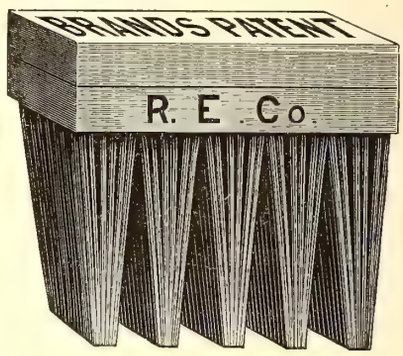
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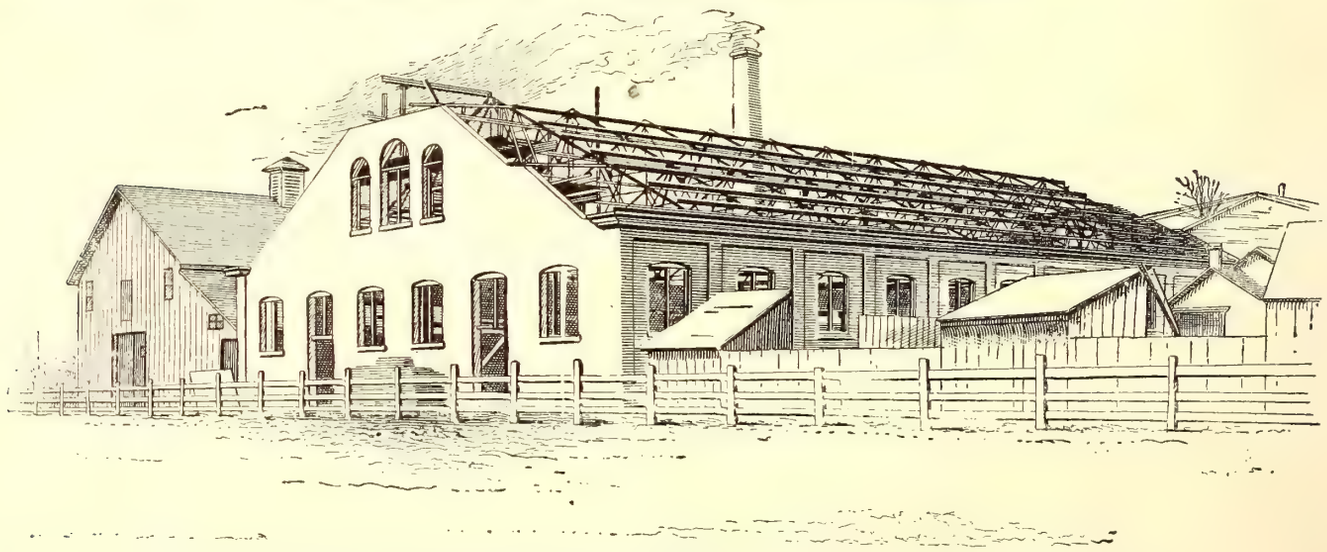
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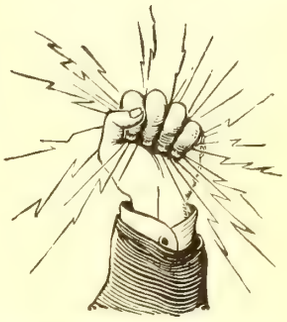
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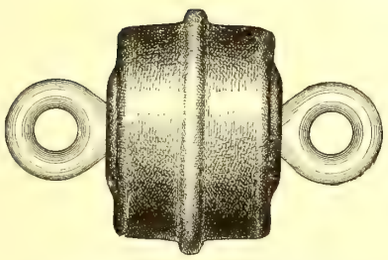
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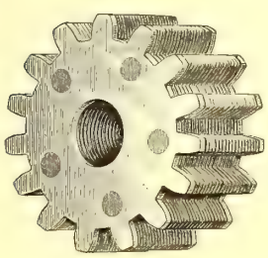
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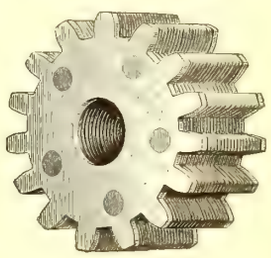
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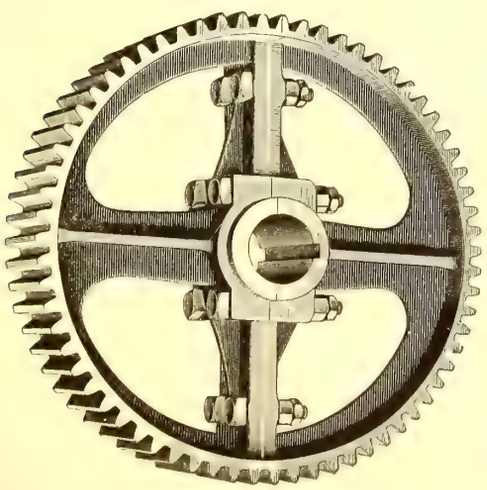
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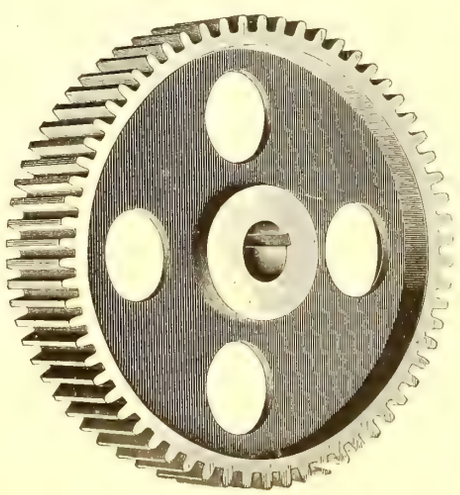
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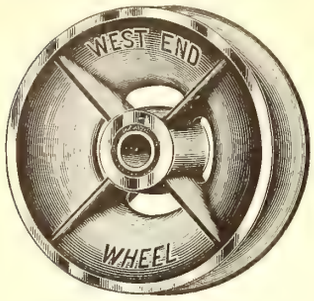
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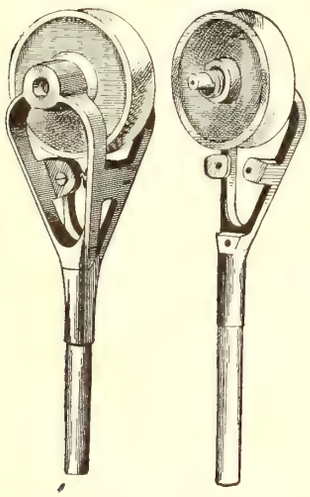
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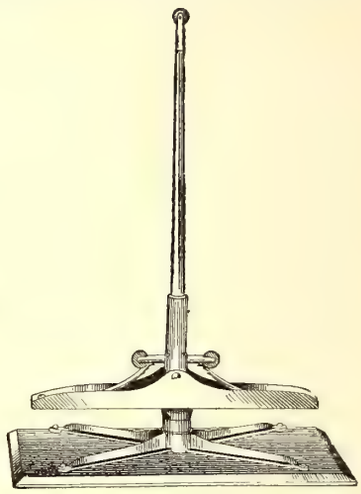
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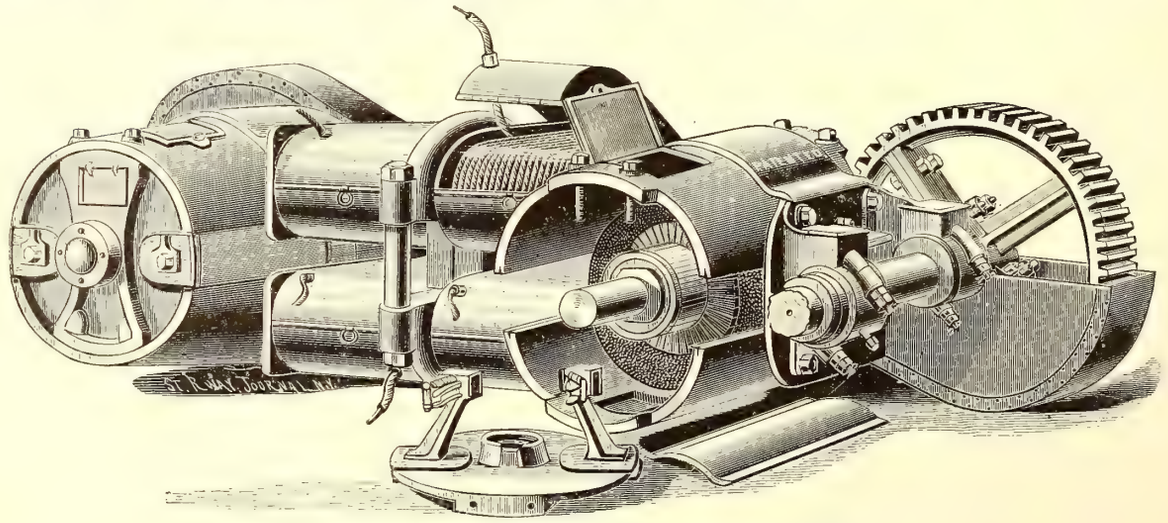
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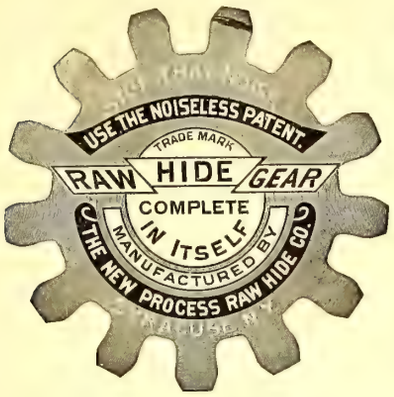
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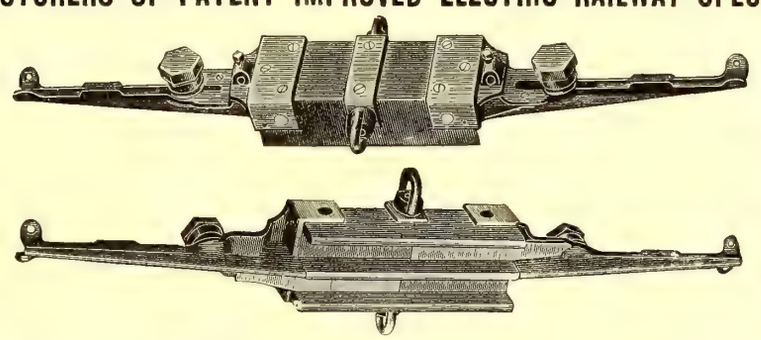
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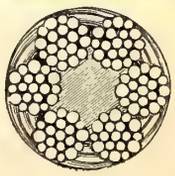
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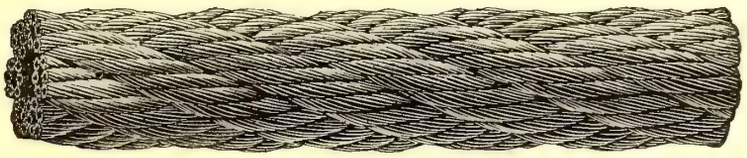
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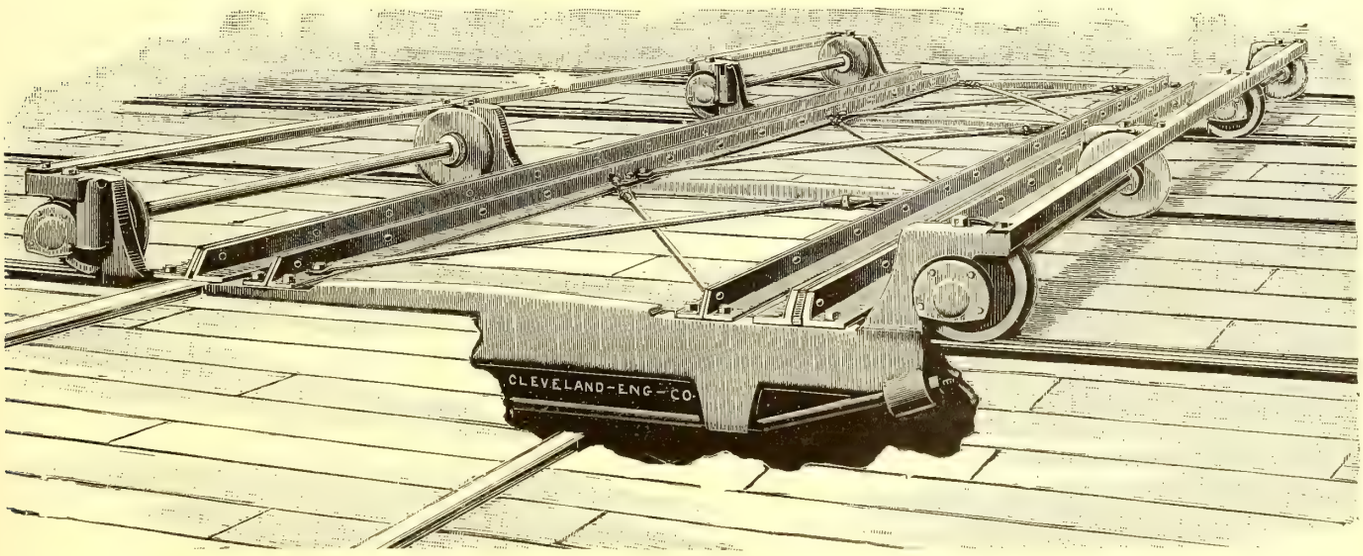
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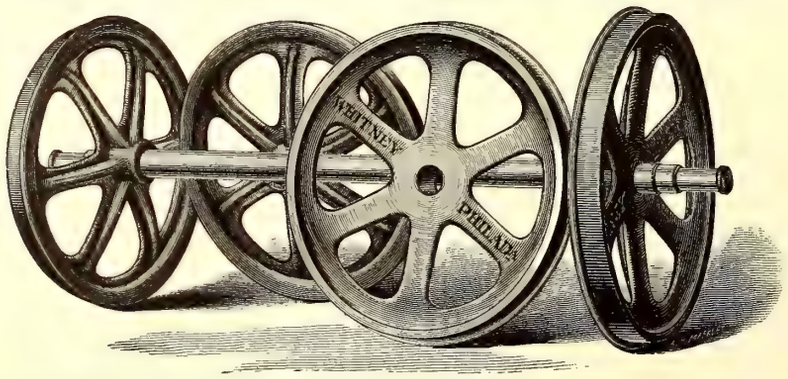
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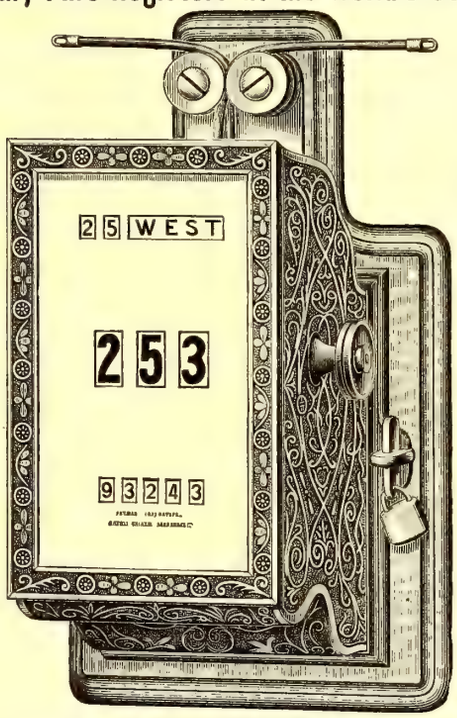
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THE WINNER OF THE HIGHEST AND ONLY MEDAL AND DIPLOMA

Awarded on Stationary Fare Registers at the World's Columbian Exposition.



These Registers are a **Marvel** in **Completeness** of **Registration, Reliability, Compactness, Beauty** of **Design** and **Finish,** and are Attracting World Wide Attention among **Practical Railroad Men,** and have been placed on **over 75 roads within the past year.**

The ONLY Register that cannot be beaten, which will show at a glance if the attempt is made.

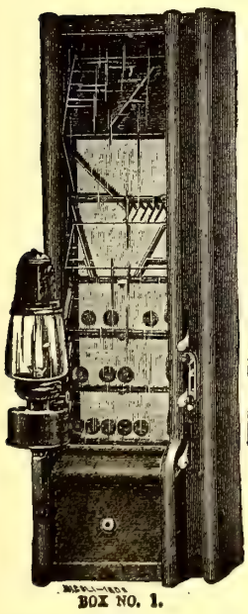
The ONLY Register which registers up to **one thousand fares** on a trip in **prominent numerals.**

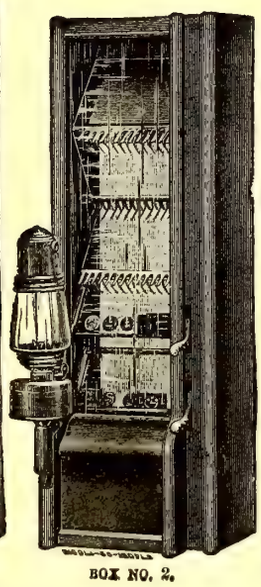
The ONLY Register which registers the **number of the trip** as well as the direction, from which the daily mileage can be computed.

MANUFACTURERS,

THE NEW HAVEN CAR REGISTER CO., New Haven, Ct., U. S. A.

TOM L. JOHNSON'S
NOW
St. Louis Car Company's
IMPROVED FARE BOX.


BOX NO. 1.


BOX NO. 2.

Patented Oct. 14, 1873.

CHEAPEST AND BEST.

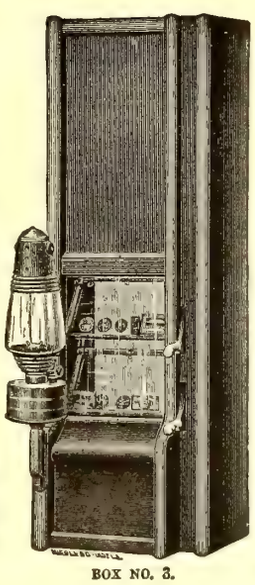
Fares Cannot be Extracted or boxes Robbed without violence.

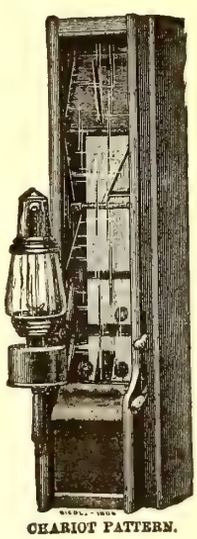
Roads Equipped with Boxes on Trial, and if not satisfactory, returned without any expense to the company trying them.

Ornamental to any Car.

Special Sizes built to order.

NOTICE.—All parties are cautioned against using fare boxes recently placed on the market which are direct infringements on our patents.


BOX NO. 3.


CHARIOT PATTERN.

REDUCED PRICES. **Write for Descriptive Circular and Price List.**

St. Louis Car Company,

MANUFACTURERS OF ALL KINDS OF HORSE, ELECTRIC, CABLE AND ALL OTHER MOTOR CARS.

3023 North Broadway, St. Louis, Mo.

See Pages 112-113.



"PAY HERE."

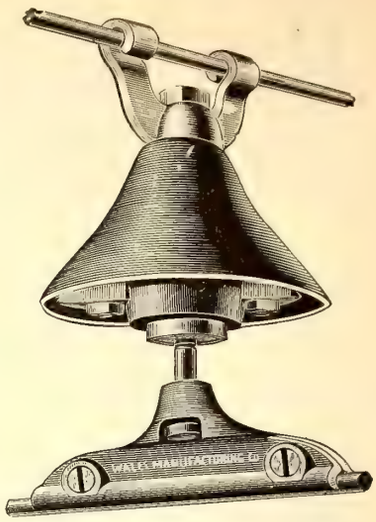
THE WALES FARE BOX

SO WELL KNOWN AND LARGELY USED IN THIS AND FOREIGN COUNTRIES.

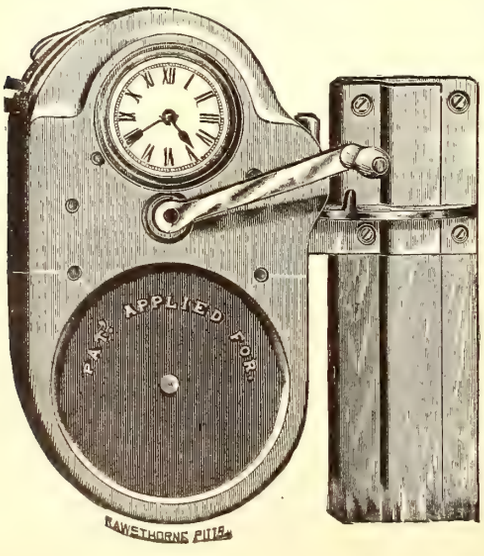
SPECIALTIES AND NOVELTIES,
INSULATOR, SELF-OILING TROLLEY WHEEL.
ELECTRIC HEADLIGHTS.

TICKET PUNCHES, UNIFORM BUTTONS, CAPS AND BADGES.
SEND FOR CATALOGUE.

WALES MANUFACTURING CO.,
SYRACUSE, N. Y.



The Catskill Mountain Incline, Weehawken Passenger Elevators, Eiffel Tower and Glasgow Harbor Tunnel are some of the big elevator plants furnished by OTIS BROTHERS & CO., 38 Park Row, New York.



THE NEW SYSTEM of ISSUING TRANSFERS.

The accompanying cut is one-quarter size of the Time Transfer Printer. By this system only the tickets actually needed are printed. The time is automatically and accurately recorded on each ticket, and mistakes are impossible.

GREAT SAVING OF TIME, LABOR AND MONEY.

FOR FULL PARTICULARS APPLY TO

THE TIME TRANSFER PRINTER MFG. CO.,

Schmidt Bldg., 95 5th Ave., Pittsburgh, Pa.

THE LEWIS & FOWLER MFG. CO.

BROOKLYN, N. Y.

PATENTEES AND MANUFACTURERS OF

Electric Snow Sweepers

AND PLOWS.



THE ONLY SUCCESSFUL ELECTRIC SWEEPER

IN THE MARKET.

MANUFACTURERS ALSO OF

Cable Road Snow Sweepers.

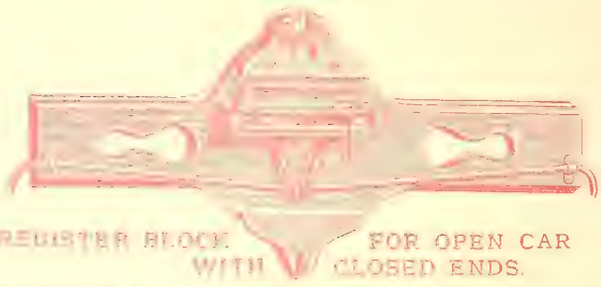
Send for Full Particulars and Photographs.

THE LEWIS & FOWLER MFG. CO.

BROOKLYN, N. Y.







REGISTER BLOCK WITH FOR OPEN CAR CLOSED ENDS.

INVENTORS AND SOLE MANUFACTURERS OF

THE IMPROVED "ALARM" PASSENGER REGISTER



Acknowledged to be the Safest and Most Complete Register in the World.

HAS BEEN ADOPTED BY 500 RAILROAD COMPANIES.

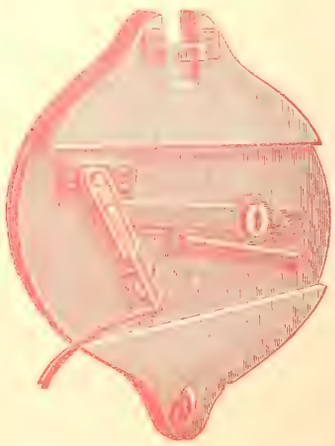


REGISTER BLOCK FOR OPEN CARS WITH OPEN ENDS.



Send for list of Railroad Companies that have Purchased our REGISTER.

Descriptive Circular Mailed on Application.



REGISTER BLOCK FOR CLOSED CARS.

THE LEWIS & FOWLER MFG. CO.

BROOKLYN, N. Y.

NOTICE TO STREET RAILWAY COMPANIES.

The Stationary Fare Register or Passenger Register of the Lewis & Fowler Manufacturing Company needs no introduction to Street Railway Companies of the United States and Canada, but such Companies cannot be expected to be fully informed as to the following facts which are of interest to every Railroad that uses a Fare Registering Device.

Our present perfected machine is the product and embodiment of numerous progressive improvements by practical Railway men and expert Machinists, occupying the past seventeen years in their completion, and costing together with their protection aud development a very large sum of money.

We own or control thirteen unexpired letters Patent of the United States as follows:—

No. 190021 granted April 24th, 1877, for Improvement in Passenger Registers.
No. 206553 granted July 30th, 1878, for Improvement in Passenger Registers.
No. 207728 granted September 3rd, 1878, for Improvement in Passenger Registers.
No. 231161 granted August 17th, 1880, for Improvement in Passenger Registers.
No. 247552 granted September 27th, 1881, for Improvement in Passenger Registers.
No. 247553 granted September 27th, 1881, for Trip Signal for Fare Registers.
No. 271976 granted February 6th, 1883, for Fare Registers and Recorder.
No. 271977 granted February 6th, 1883, for Improvement in Fare Registers.
No. 273675 granted March 6th, 1883, for Improvement in Fare Registers.
No. 280925 granted July 10th, 1883, for Improvement in Passenger Registers.
No. 391702 granted October 23rd, 1888, for Improvement in Fare Registers.
No. 487731 granted December 13th, 1892, for Improvement in Fare Registers.
No. 506629 granted October 10th, 1893, for Improvement in Fare Registers.

Nearly all of the above Patents are represented in each of the machines we send out, and our protection cannot be materially impaired by the expiration of any one Patent, while the earlier devices would be practically worthless at the present time without the latter improvements.

Notwithstanding the above, Stationary Fare Registering Machines more or less closely copied after our Patent Registers and infringing our Patents have been put upon the market, and are being pressed upon the attention of Street Railway Companies some of these infringements being without any show of Patent Protection, whatever.

We cannot, of course, permit our valuable property to be thus infringed upon, and must look to the Street Railway Companies which use infringing Registers for such redress as the Law affords.

We do not, however, desire to enter into litigation with any Street Railway Company, and in order to avoid, if possible, the necessity of any Legal action, we publish the foregoing as a friendly warning.

Respectfully,

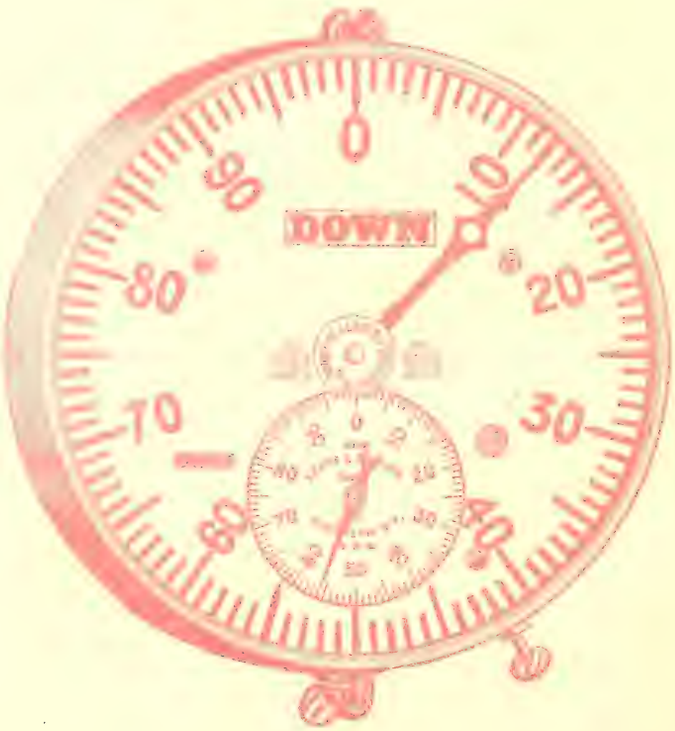
THE LEWIS & FOWLER MFG. CO.

ALBERT H. DOLLARD, President.
DANIEL F. LEWIS, Treasurer.
GEORGE W. MYERS, Secretary.

THE

LEWIS & FOWLER MFG. CO.

BROOKLYN, N. Y.



SEE PRECEDING PAGE

RAILWAY REGISTER

MANUFACTURING COMPANY.

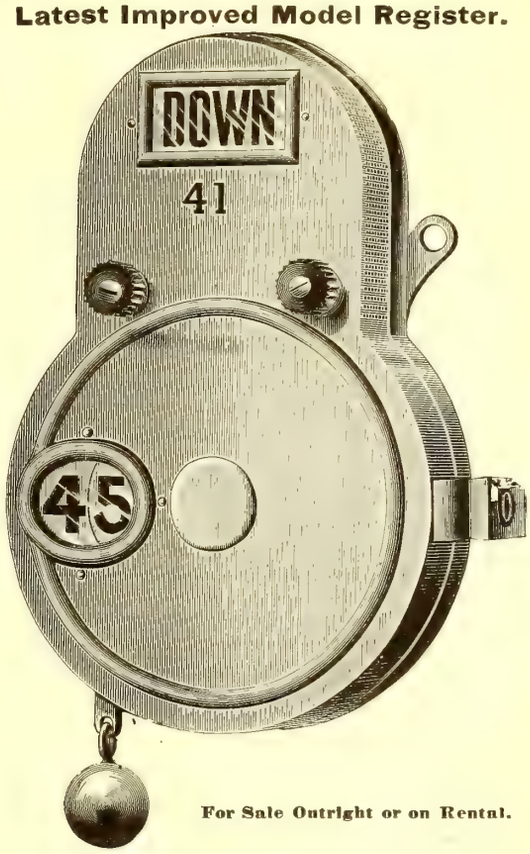


MANUFACTURERS AND OWNERS OF THE

Latest Designs, Improvements and Inventions in Registers, Indicators, Classifiers and Punches, for the Recording of Fares Collected on Street and Steam Railroads.

This company owns over 100 Patents embracing all the Valuable Features of Fare Registers, Indicators, etc., and was awarded three Medals at the Chicago Exposition of Railway Appliances.

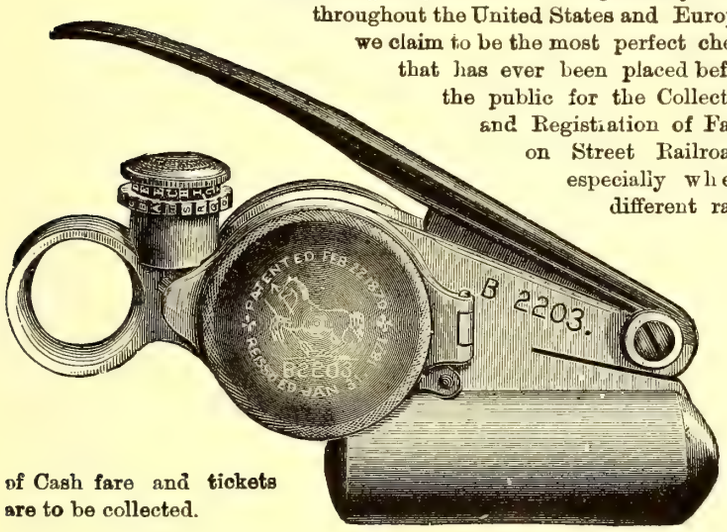
Latest Improved Model Register.



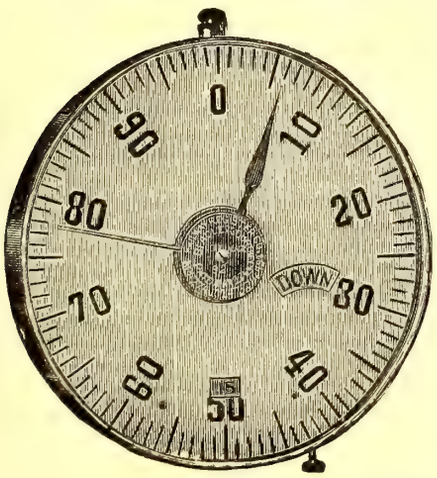
For Sale Outright or on Rental.

The Alarm Registering Punch.

This Register, which is so generally used throughout the United States and Europe, we claim to be the most perfect check that has ever been placed before the public for the Collection and Registration of Fares on Street Railroads, especially where different rates of Cash fare and tickets are to be collected.



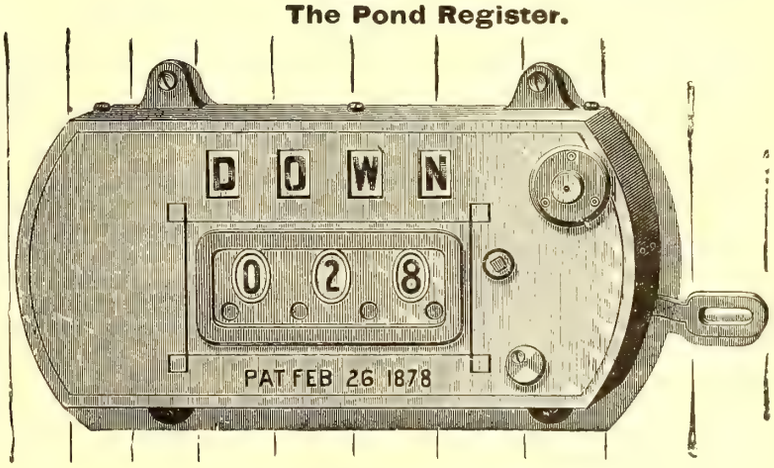
The Monitor Register.



For Sale Outright or on Rental.

Railway companies desiring to use a Stationary Register will consult their own interest by examining this Register before adopting any of the cheap devices now offered as it is the most Reliable Register of its kind. For further particulars address

The Pond Register.



For Sale Outright or on Rental.

SPECIAL ATTENTION PAID TO EXPORT ORDERS.

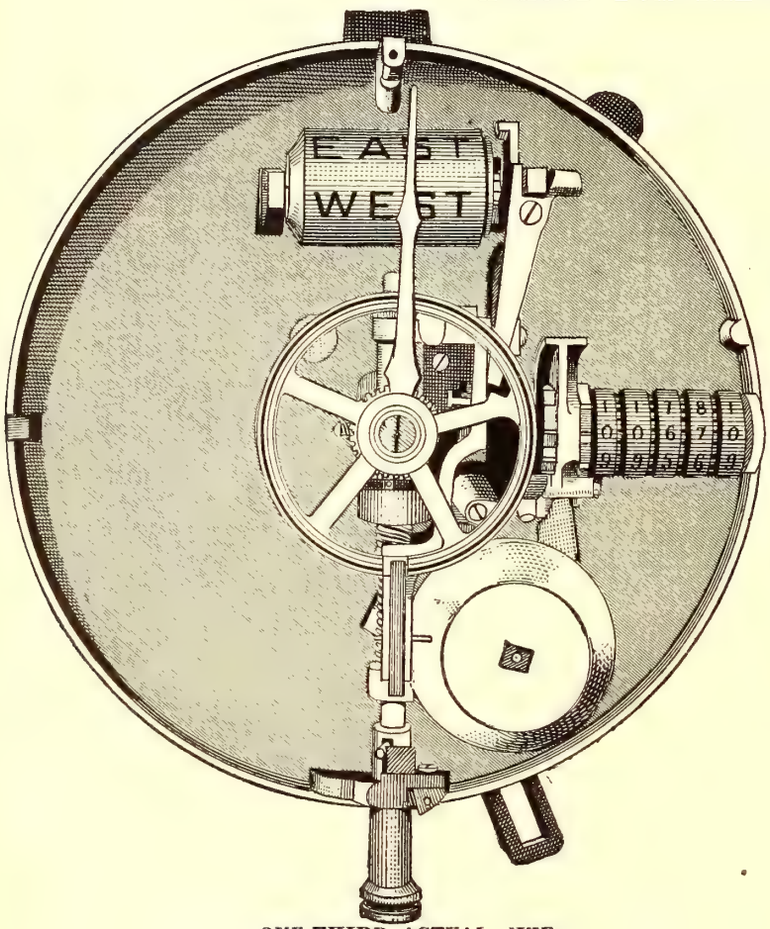
EDWARD BEADLE, Manager, 1193 Broadway, New York City, N. Y.

THE

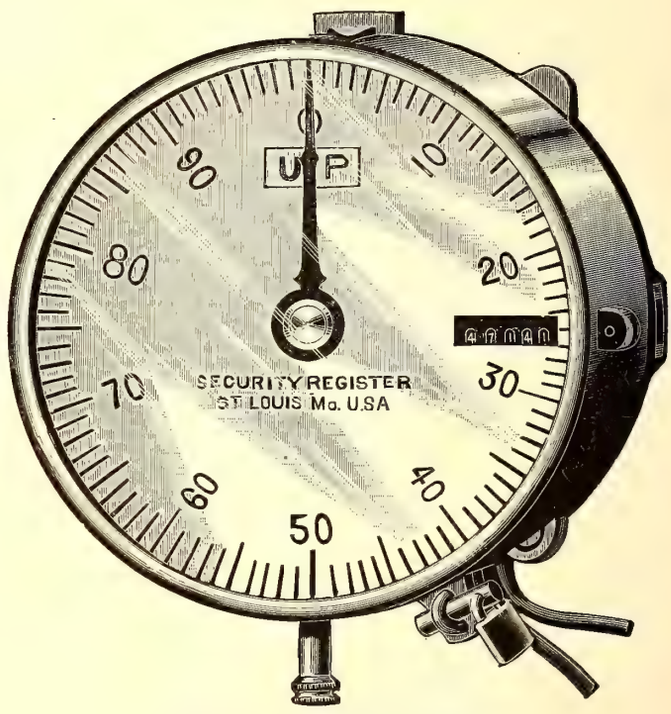
SECURITY REGISTER

THE SIMPLEST, MOST ACCURATE AND DURABLE REGISTER ON THE MARKET.

THE MECHANISM IS WORKED BY THE MOVEMENT OF ONE SHAFT. NOW IN USE ON MORE THAN TWENTY ROADS WITH ENTIRE SATISFACTION. IT TOTALIZES 99,999 AND IS FURNISHED WITH OR WITHOUT A HOOD FOR THE TOTALIZER.



ONE-THIRD ACTUAL SIZE.



ONE-FOURTH ACTUAL SIZE.

St. Louis, Mo., October 17, 1892.

ST. LOUIS REGISTER CO., City.

GENTLEMEN:—We have used your Register for the past year and have found it to be very simple and accurate, and, so far as our experience goes, I consider it superior to any register now in use.

Yours respectfully,
J. F. DAVIDSON, Supt., Missouri Railroad Co.

MANUFACTURED BY

THE ST. LOUIS REGISTER CO.

OFFICE, 703 HOUSER BUILDING, ST. LOUIS, MO.



THE

MEAKER

PORTABLE and STATIONARY REGISTERS

SIMPLE! DURABLE! RELIABLE!

THIS is a Double Register, being so constructed that the statement (settlement numbers) may be visible or not, at will, by the simple use of a key. It is impossible to change the direction signal without cancelling the fares recorded at the trip window, and said cancellers can only be removed by a return to zero. It is also impossible to ring the bell without registering, or register without ringing the bell. The pull cords will be placed on both sides of the car, without extra charge, if desired. The machine is made strong in all its parts, and being constructed without wheels, is not subject to the same wear as cogged devices.



THE IMPROVED STATIONARY.

Our Registers have been adopted by over Sixty Street Railway Companies. For Reference, Terms, Etc., address

THIIS Register can be read correctly from any part of the car.

Fac-simile of Figures Used.

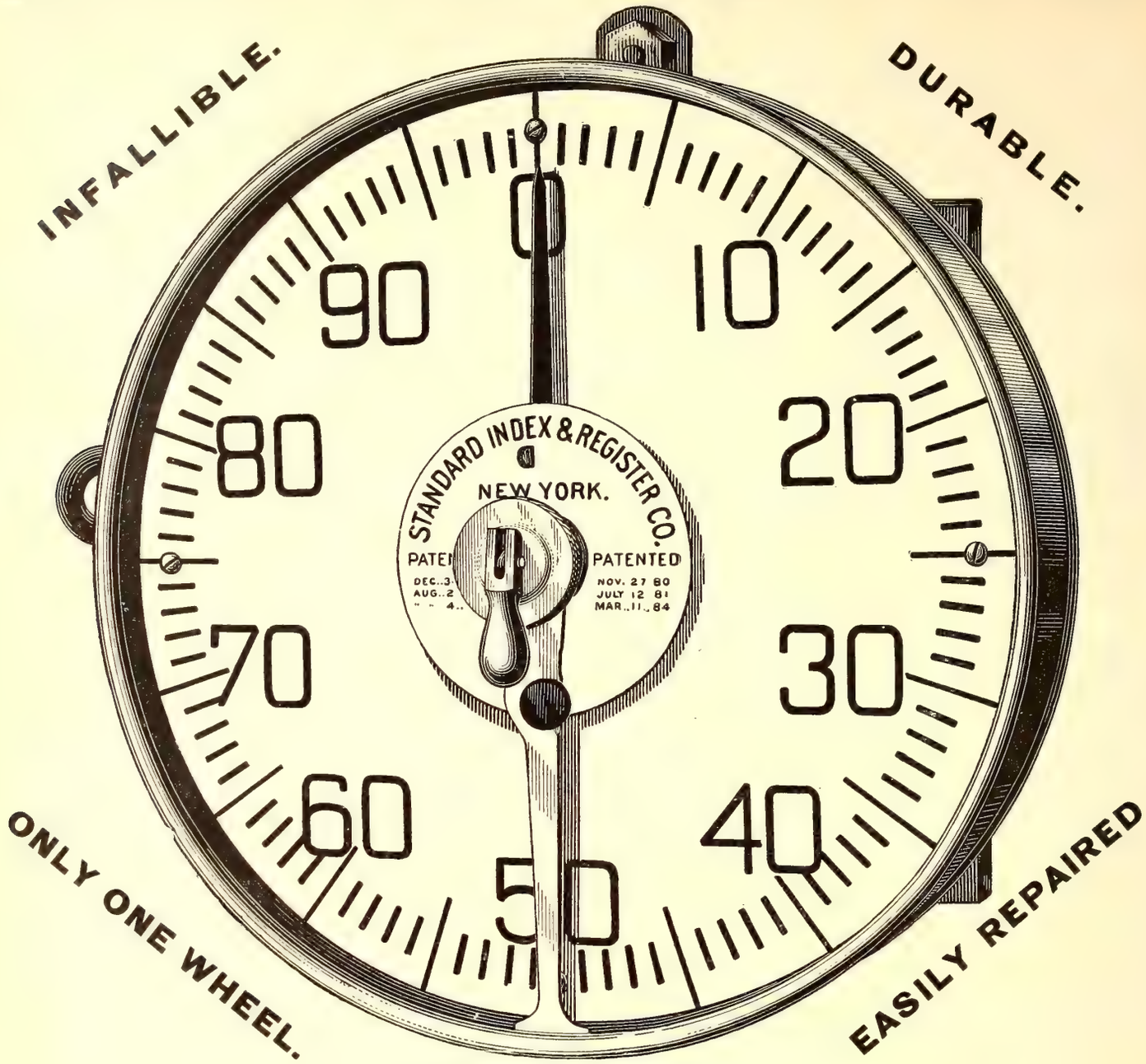


MEAKER MANUFACTURING CO.,

134 WEST WASHINGTON STREET,

CHICAGO.

Successors to Railway Register Company.



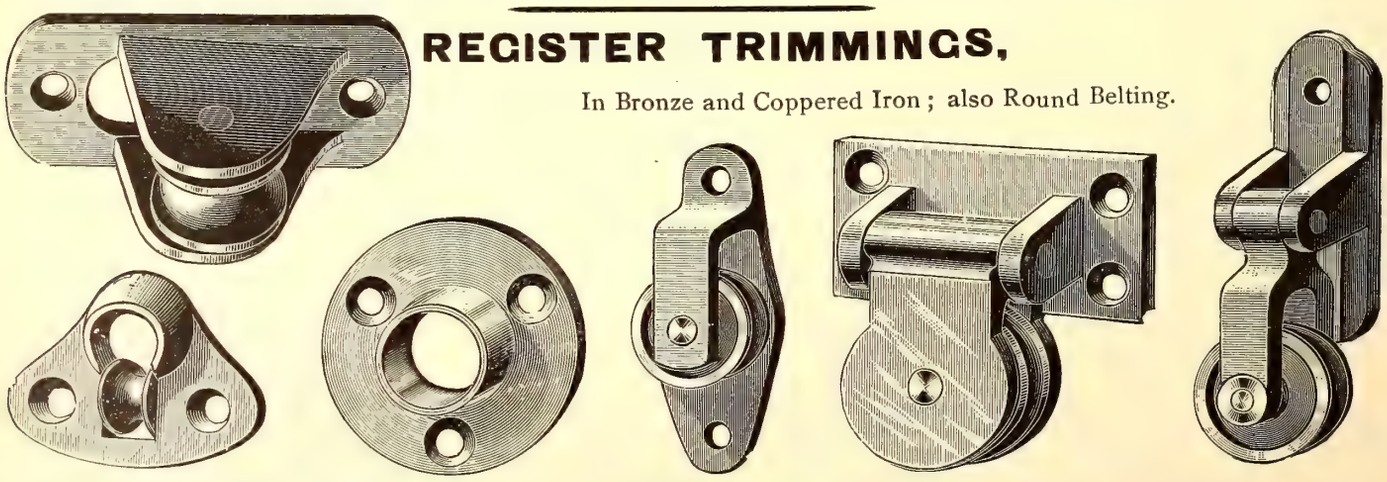
(THIS CUT IS ABOUT HALF SIZE.)

THE STANDARD

Is the best register for recording fares on street cars, because it gives two reports, one on the face and one inside, inaccessible to the conductor. The inside report is perforated on a paper dial, divided into trips, and is removed at the end of each day and compared with the returns, thus making a positive check on all who handle the fares. Our registers have been used for years all over the United States, South America, Europe and elsewhere.

REGISTER TRIMMINGS,

In Bronze and Coppered Iron; also Round Belting.

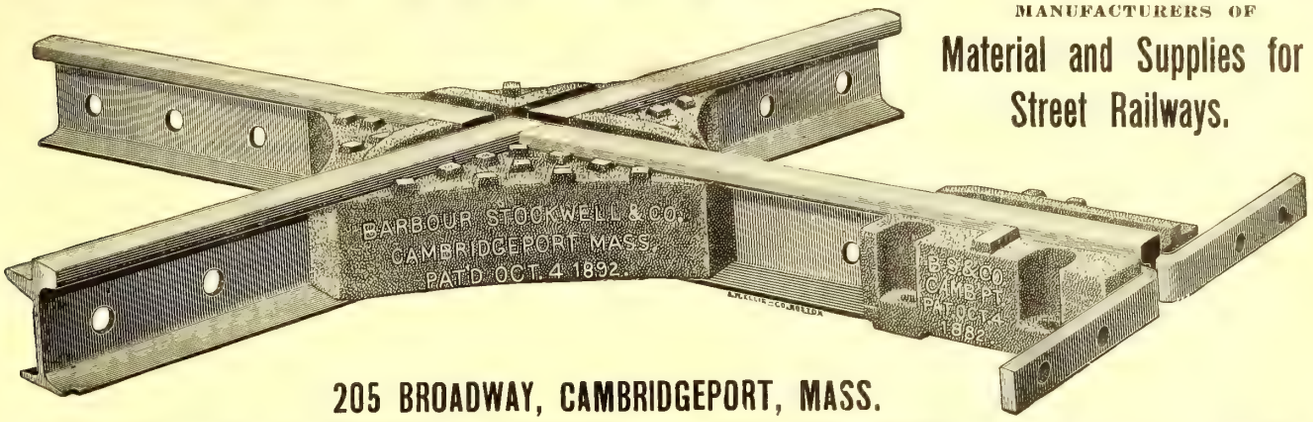


STANDARD INDEX & REGISTER CO., 138 Fulton St., New York.

BARBOUR, STOCKWELL COMPANY,

MANUFACTURERS OF

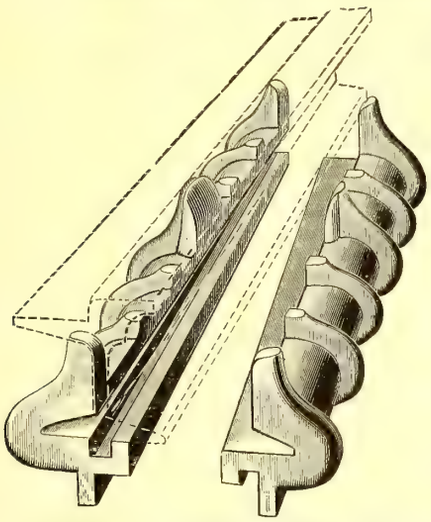
Material and Supplies for Street Railways.



205 BROADWAY, CAMBRIDGEPORT, MASS.

AMERICAN RAIL JOINT CO.

MARION, IND.



NO BOLTS.

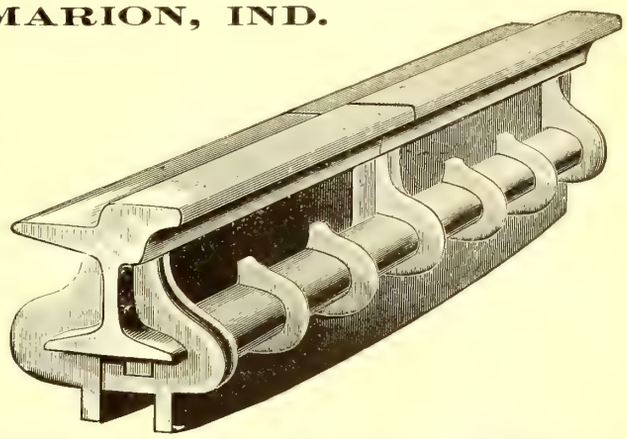
A Perfect Suspended Joint. Can be Used on Present Construction as well as New Work.

Pronounced a most thorough success after a years constant use on Cable and Electric Street Railways. Address.

AMERICAN RAIL JOINT COMPANY,

MARION, - IND.

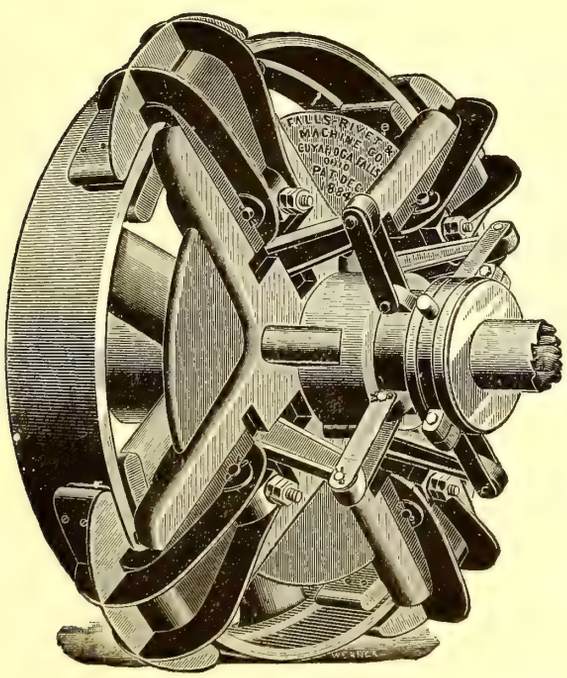
JAY WILLARD CLARK, Manager.



THE FALLS RIVET & MACHINE CO.

CUYAHOGA FALLS, OHIO,

MANUFACTURERS OF



FRICTION CLUTCH PULLEYS

AND

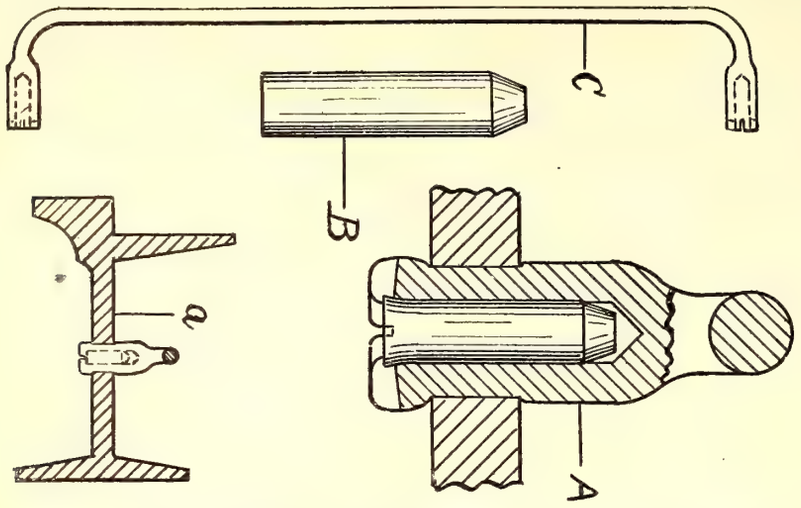
CUT-OFF COUPLINGS.

Power Transmitting Machinery of All Kinds.

SPECIAL ATTENTION GIVEN TO THE MANUFACTURE OF FRICTION CLUTCHES, SHAFTING, &c., FOR ELECTRIC RAILWAY, ELECTRIC LIGHT AND POWER STATIONS.

BRANCH OFFICES:

8 & 10 S. Canal St., Chicago, Ill. **39 Cortlandt St., New York.**



—THE—

Chicago Rail Bond.

The Bonding Question Solved at Last. The Only Real Practical Rail Bond Ever Offered to the Trade.

With the Chicago Rail Bond you can make a perfect all-rail, metallic return circuit. Can be furnished any length or size, from 0 to 0000.

H. R. KEITHLEY,

107-109 Lake St., Chicago, Ill.

Care Washburn-Moen Mfg. Co.

STREET RAILWAY MEN

WHEN VISITING NEW YORK, SHOULD NOT FAIL TO SEE THE PALACE CAR OF THE 10th AVE. & 125th ST. CABLE LINE, WHICH IS LIGHTED AND HEATED BY

THE PINTSCH GAS SYSTEM.

John H. Robertson, Superintendent of the Third Avenue R. R. Co., which operates the above road, states that the lamps furnish a steady, bright and clear flame, and have given entire satisfaction.

The New York, Lake Erie & Western R. R. has 223 Passenger Cars equipped with it, and says there is no other system to compare with the Pintsch.

FOR FULL PARTICULARS, ADDRESS

THE SAFETY CAR HEATING & LIGHTING CO., 160 Broadway, New York.

JOHN SHEPARD, JR., President, Providence, R. I. | WM. L. HAINES, Treasurer. 430 Butler Exchange, Providence, R. I. | HARRY W. SMITH, Gen. Manager. 86 Ames Bldg., Boston, Mass.

FIELD ELECTRIC CAR LIFE GUARD CO.



PERFECT CAR FENDER.



FRONT VIEW. REAR VIEW.

Perfectly Satisfactory Results from Most Severe Tests.

Impossible for a person to be thrown under the wheels of cars equipped with our fenders. Takes up no room in the street, and can be lowered by the motorman's knee in an instant to the surface of the track.

CORRESPONDENCE SOLICITED. **HARRY W. SMITH, Gen'l Man., Room 86 Ames Bldg., Boston, Mass.**

HIGH GRADE FEEDER WIRES.

ABSOLUTELY SAFE.

Grimshaw White Core Wires. Raven Core Wires.

COMPETITION LINE WIRE. GRIMSHAW TAPES. VULCA DUCTS.

MANUFACTURED BY

NEW YORK INSULATED WIRE CO.

Chicago, 80 Franklin St. New York, 15 Cortlandt St. Boston, 182 Summer St. San Francisco, Cal., 102 Sacramento St.

A MISS is as good as a mile. The cold air comes within an inch of the steam pipes, but it stops there and does no harm, if the pipes are covered with **Magnesia Sections.**



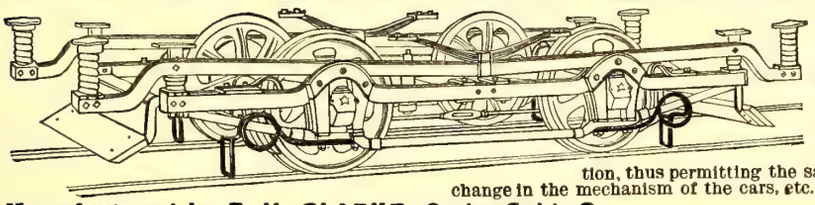
ROBERT A. KEASBEY, 54 Warren St., New York.

Long Distance Telephone 1515 Cortlandt.

BRANCH OFFICE: 119 Franklin St., Buffalo, N. Y.

Telephone Call 1844.

CLARKE'S CAR WHEEL FENDERS



To Prevent Accidents by the Wheels of ELECTRIC, CABLE and HORSE CARS, Switch and Locomotive Engines, Suburban, Passenger and Freight Cars. SIMPLE, CHEAP and EFFECTIVE.

Our devices are constructed of one piece of spring steel, so designed as to be placed close above the rail and directly in front of the wheel. The bottom is formed into a loop placed oblique to the rail, thus effectually preventing any body or limb passing under the wheel, and with a tendency to remove them to the outside of the track. The coil is designed to provide, with certainty, for an ample lateral yield in case of the fender striking a fixed obstruction, thus permitting the safe running of the car. These devices can be applied without any change in the mechanism of the cars, etc., being attached by bolts now in use.

Manufactured by F. H. CLARKE, Springfield, O.

New York Office, 1267 Broadway, Room 7.

THE ROBINS LIFE GUARD OR SAFETY FENDER

FOR ELECTRIC AND CABLE CARS.

SIMPLE,

PRACTICAL,

DURABLE.



AUTOMATIC,

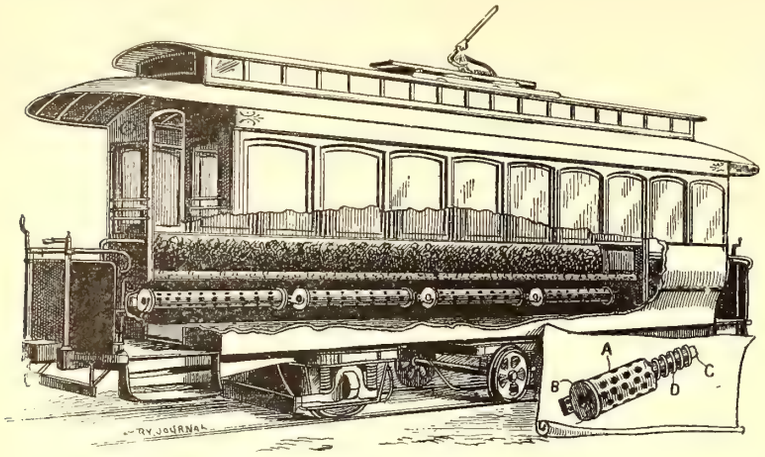
ECONOMICAL,

EFFECTIVE.

ALL OF OUR TESTS HAVE BEEN MADE WITH **HUMAN BEINGS.**

THE ROBINS LIFE GUARD & MFG. CO.

Room 60 Manhattan Bldg., Philadelphia, Pa.



THE COCHRANE

Reliable Electric Heater

WARRANTED TO GIVE MORE HEAT WITH LESS POWER THAN ANY OTHER HEATER NOW IN USE.

Arranged in series of four of two circuits, one on each side of car. Guaranteed not to burn out, and safe in every particular. Correspondence solicited.

Reliable Manufacturing Co.,

SOLE MAKERS,

53 State Street, Boston, Mass.

Consolidated Car-Heating Co.

GENERAL OFFICES AND FACTORY:

936 BROADWAY, ALBANY, N. Y.

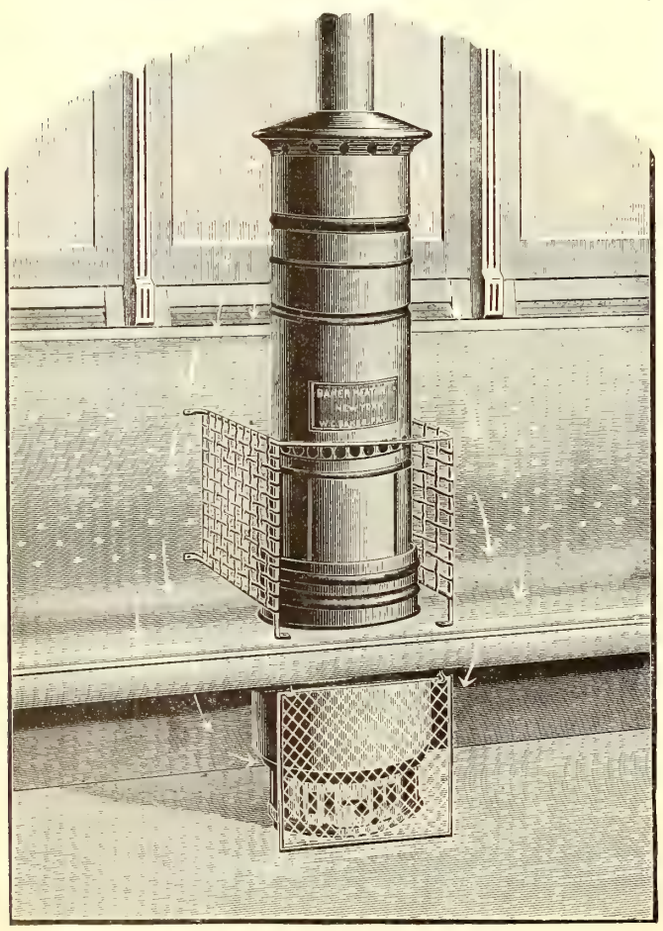
BRANCH OFFICES:

Chicago,	New York,	Canada,
200 Phenix Building.	114 Broadway.	Coaticooke, P. Q.

ELECTRIC HEATERS.—Regulating Switch. Five different intensities of heat. Leading lines already equipped in Albany, N. Y.; Troy, N. Y.; Rochester, N, Y.; Cleveland, Ohio; Chicago, Ill.; Montreal, Toronto, Hamilton, Canada; Holyoke, Mass.; Cincinnati, Ohio, and New York City.

SEND FOR CATALOGUE.

"NO EXPERIMENT."



THE HOT AIR CIRCULATOR IN POSITION.

WM. C. BAKER'S

Street Car Heater.

"NOT A STOVE."

A HOT AIR CIRCULATOR,

For Horse and Electric Motor Cars.

A NEW DEPARTURE FROM THE COMMON CAR STOVE.

This Heater is the Smallest, yet the Most Effective Street Car Heater Made.

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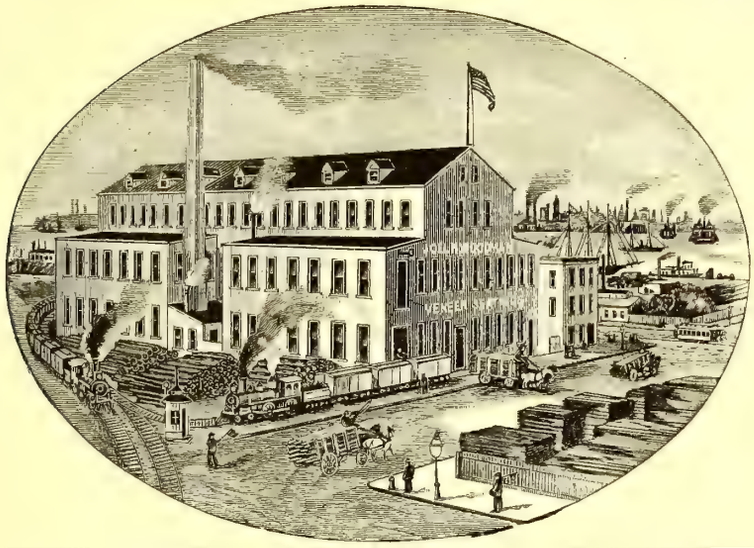
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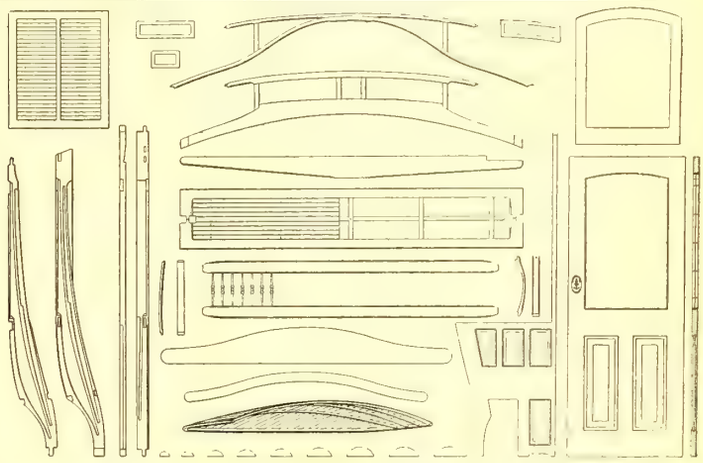
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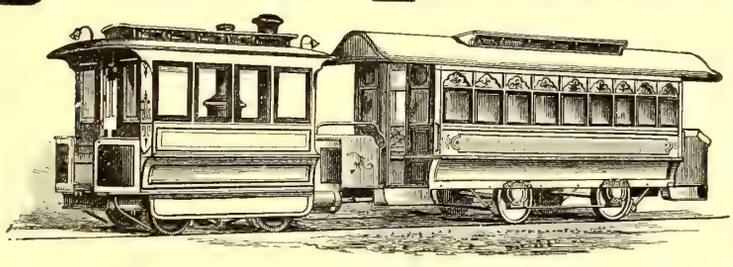
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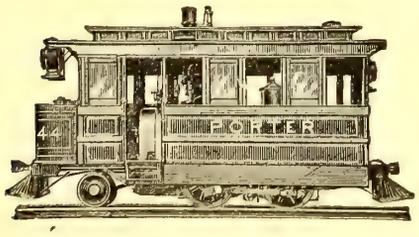
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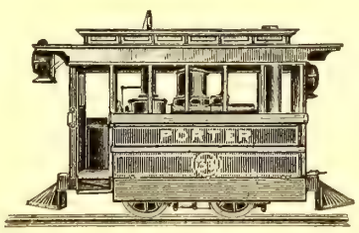
Steam Motors for Street Railways.

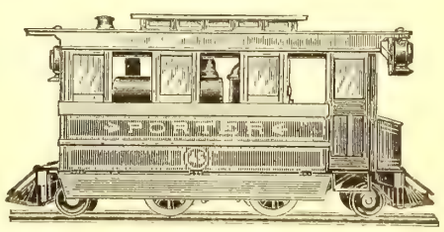
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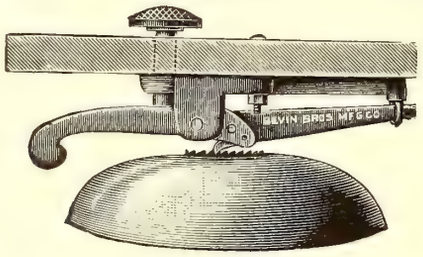
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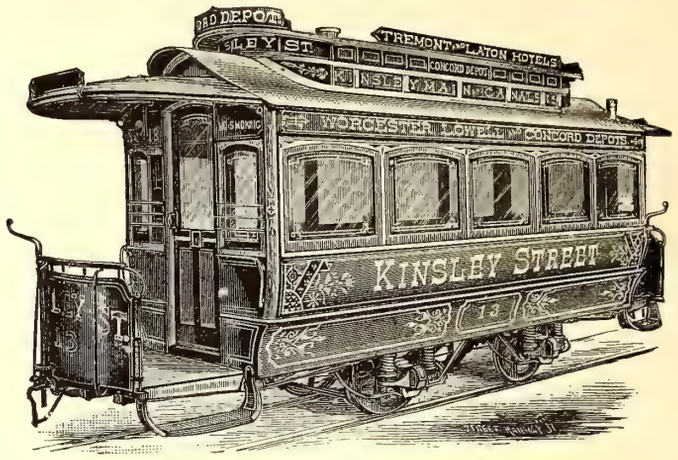
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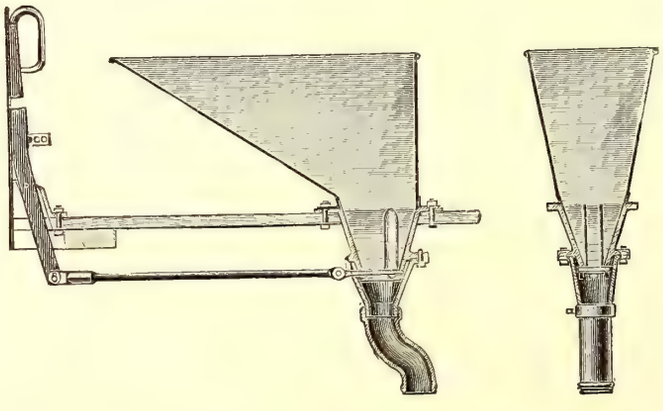
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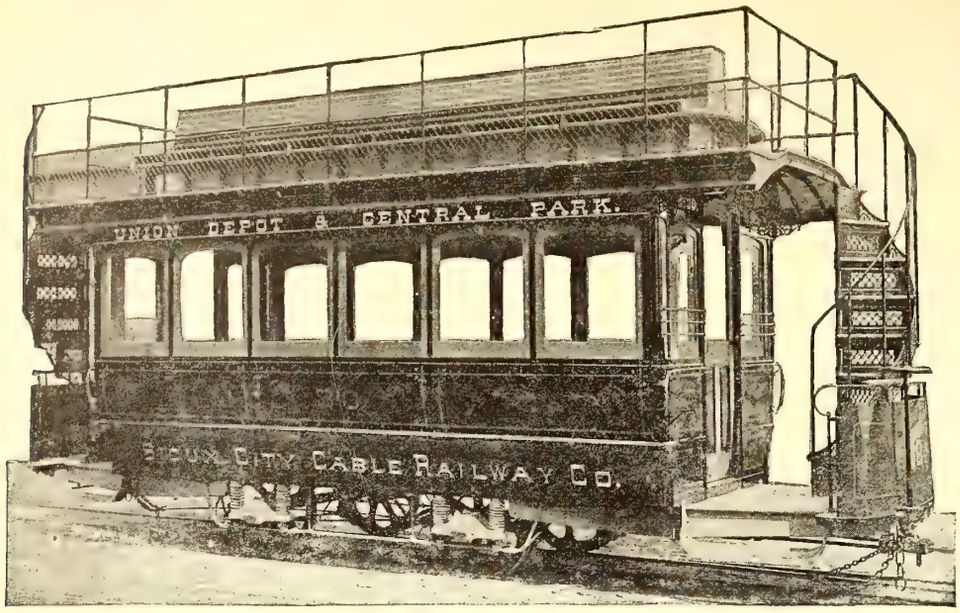
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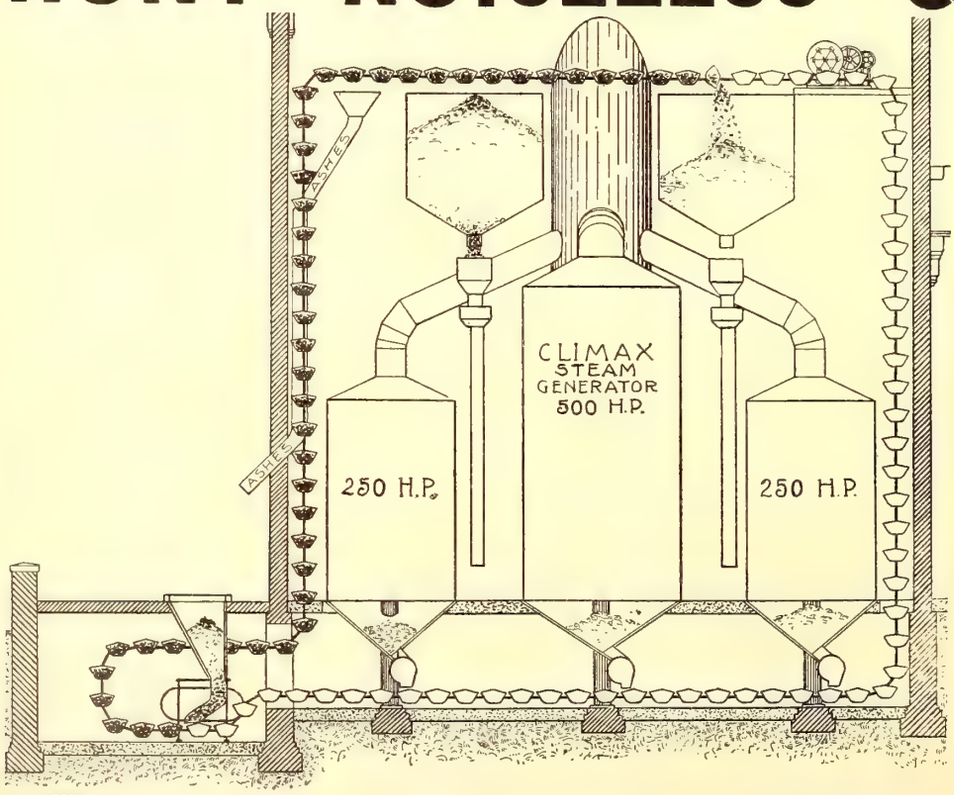
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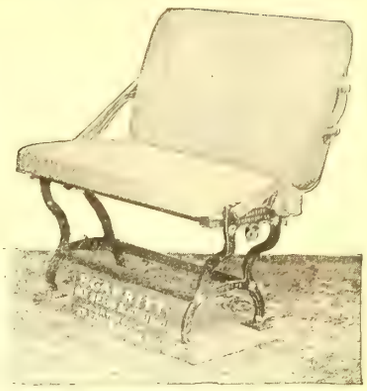
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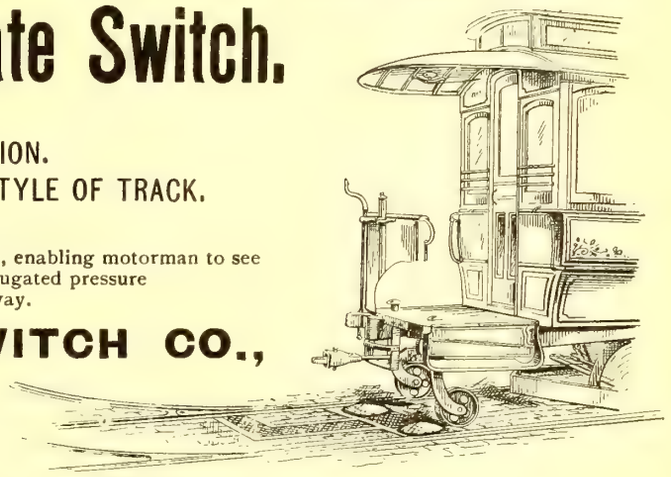
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CAN BE USED ON ANY STYLE OF TRACK.

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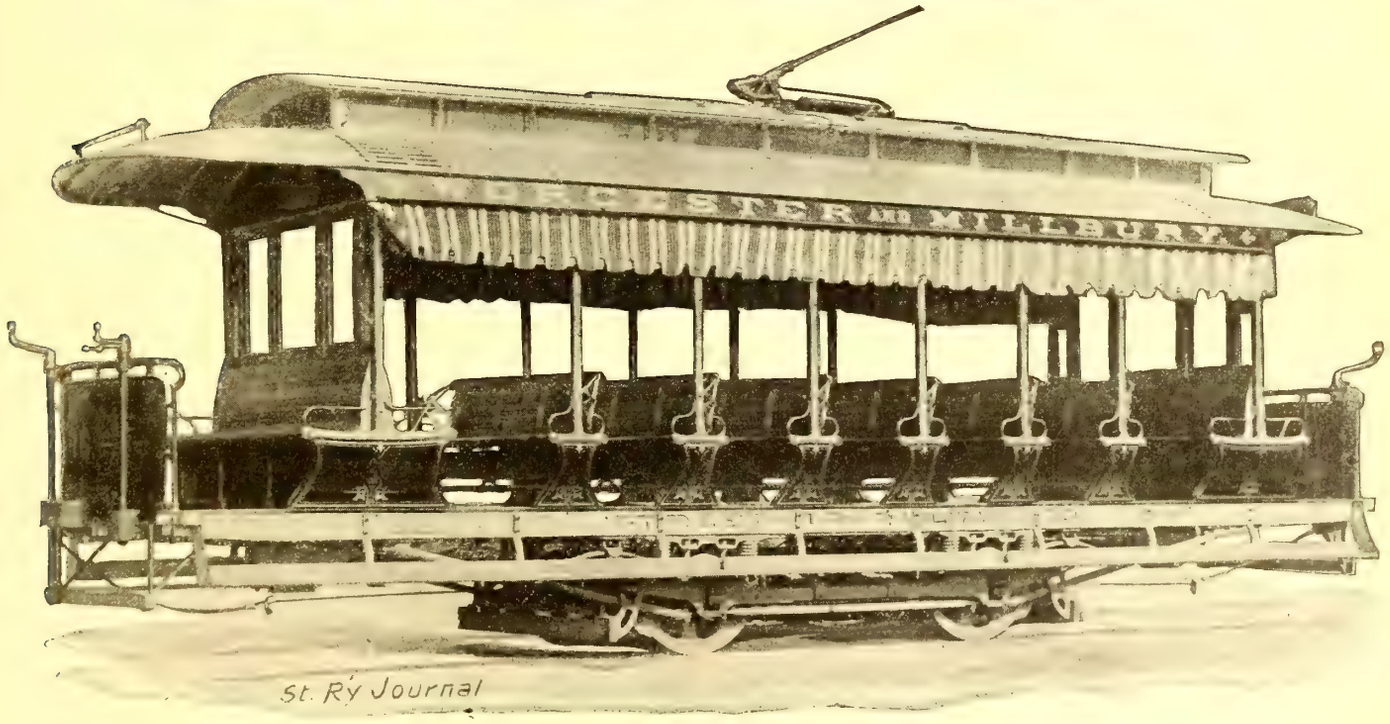
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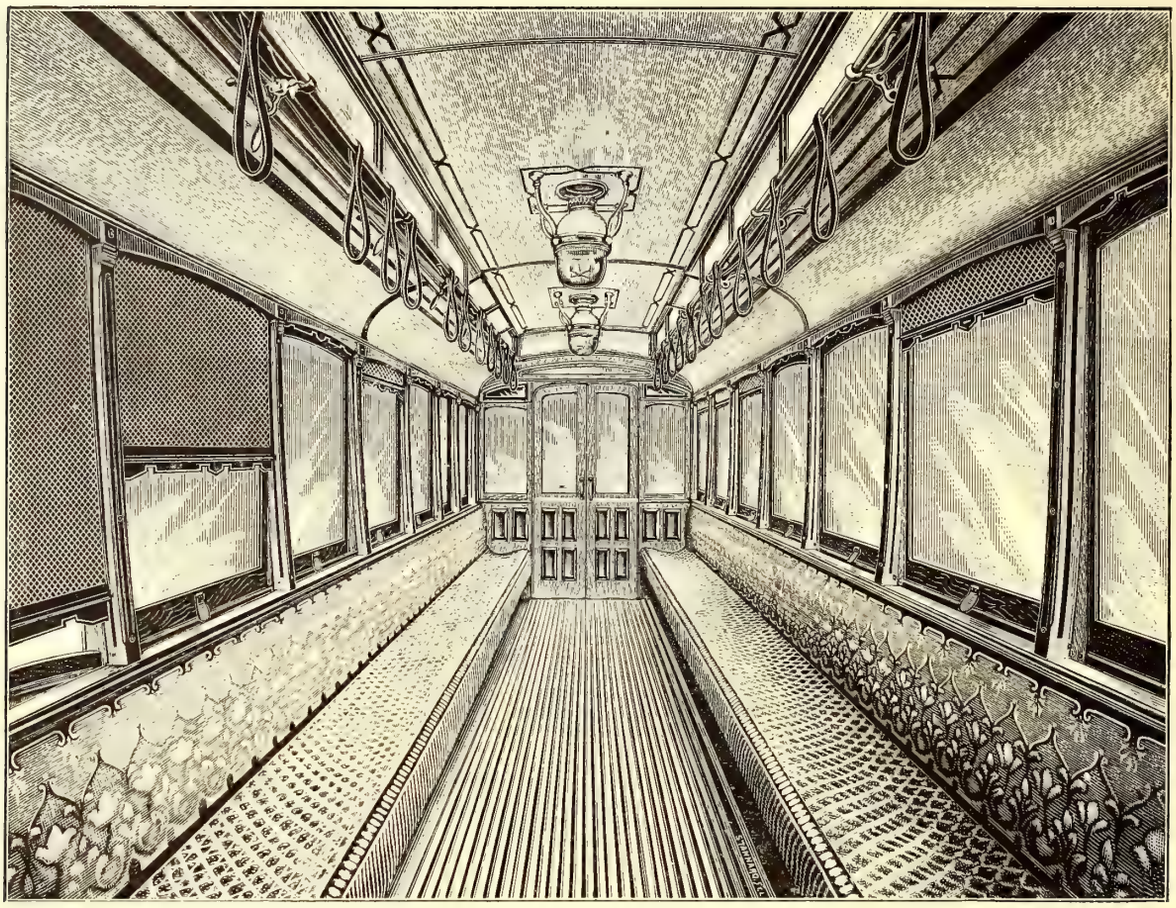
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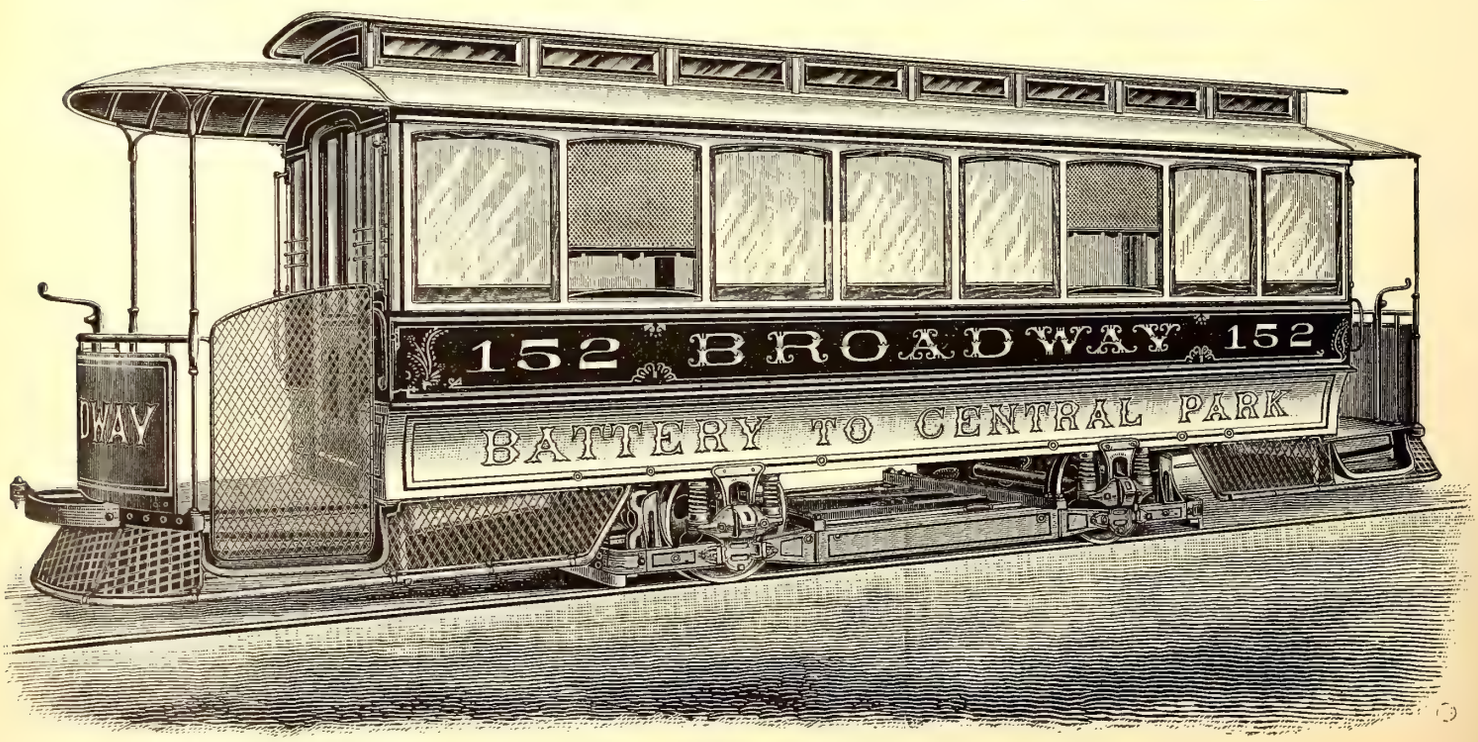
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INTERIOR OF CAR BUILT FOR THE BROADWAY CABLE LINE, NEW YORK CITY.

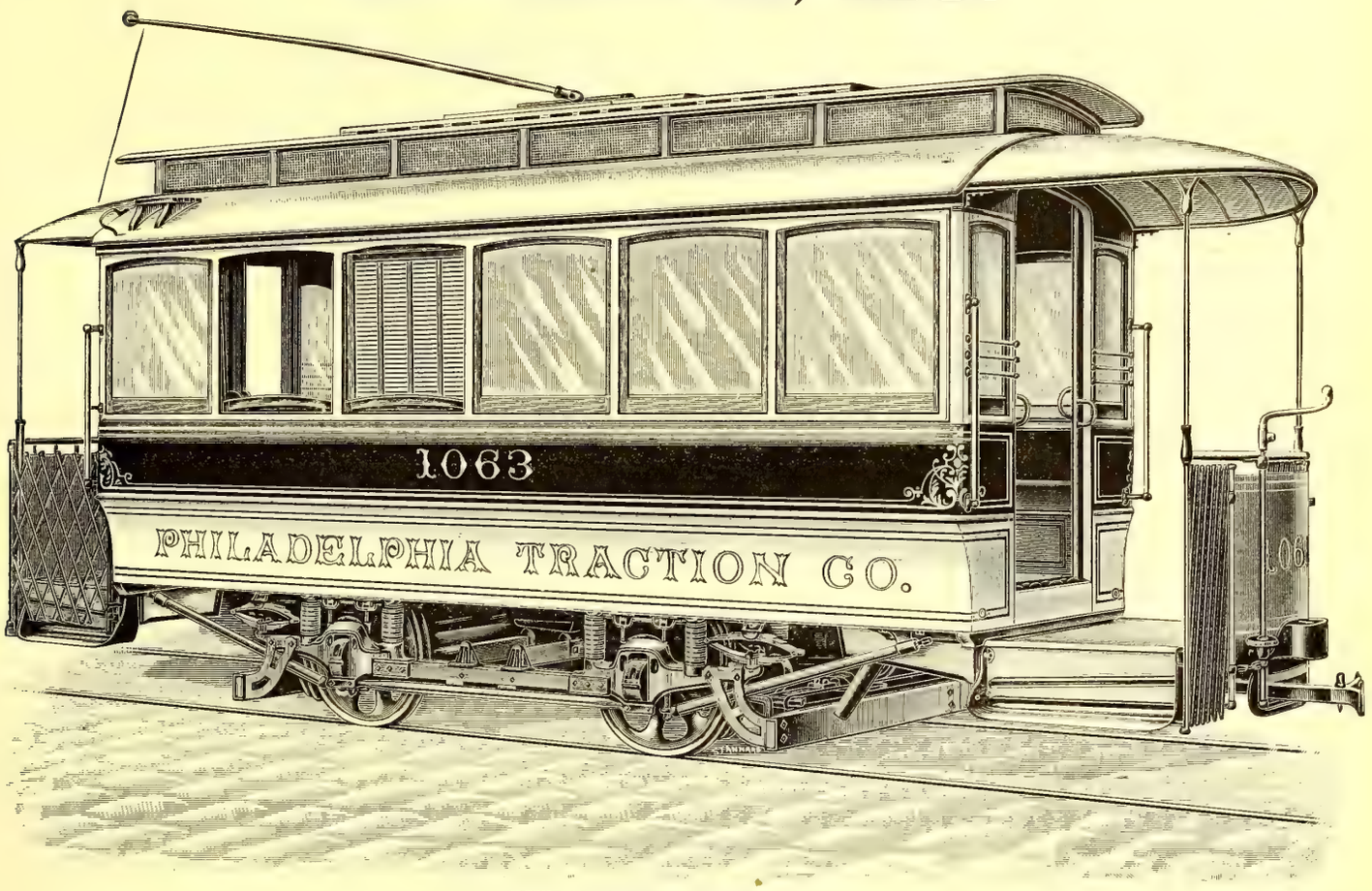
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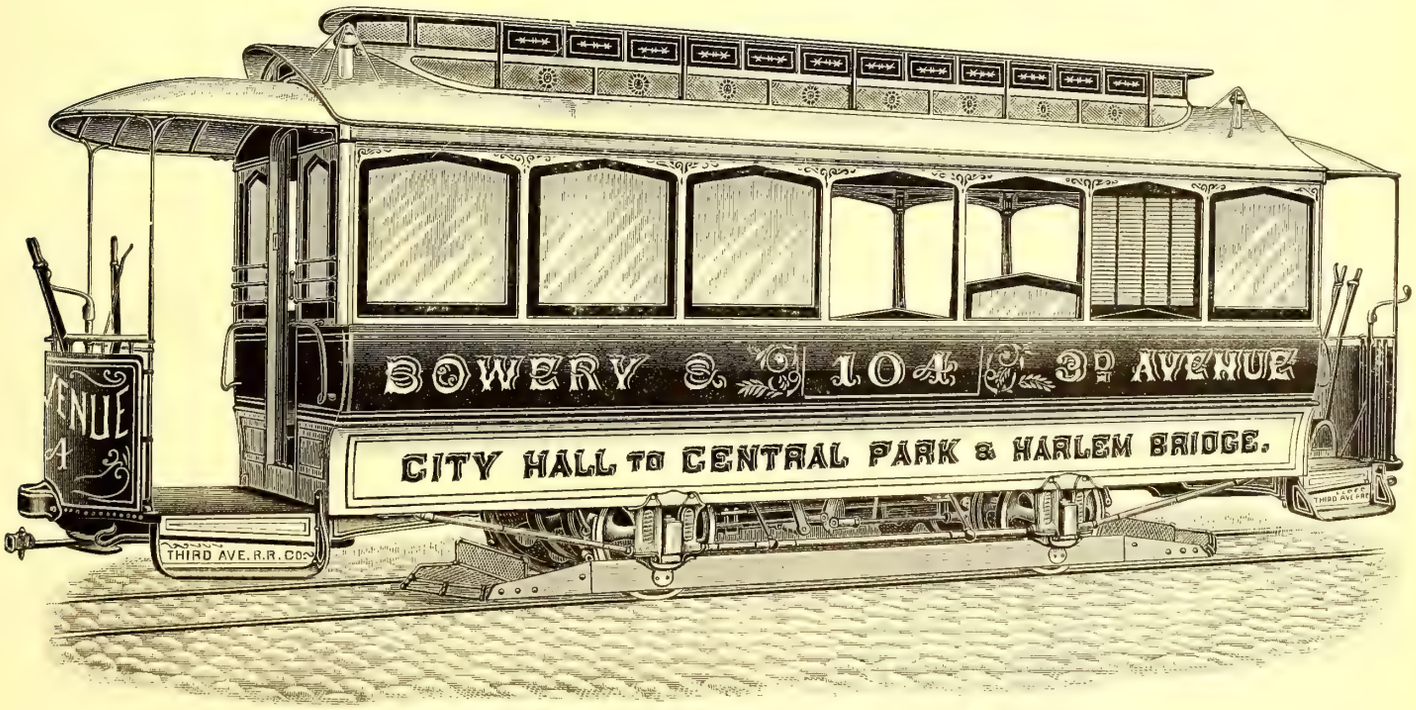
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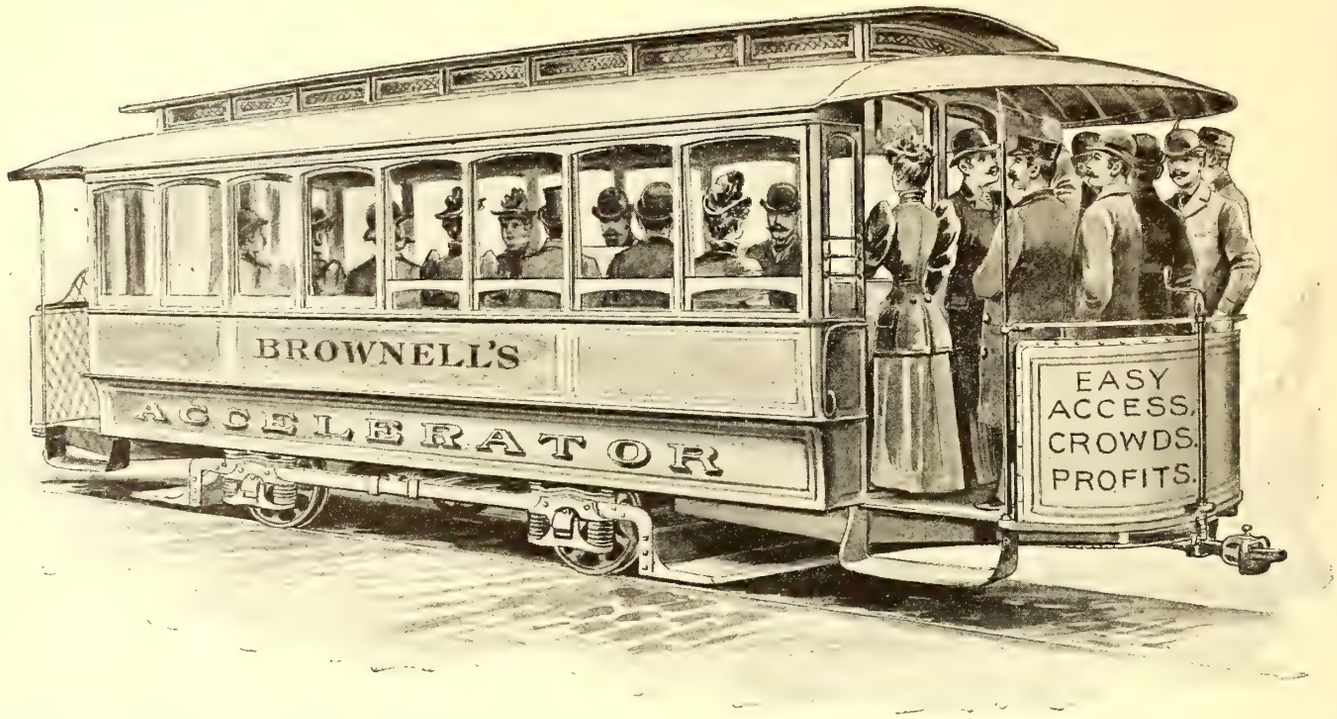
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TALK WILL NOT ALONE DO IT.

DON'T BE DECEIVED.

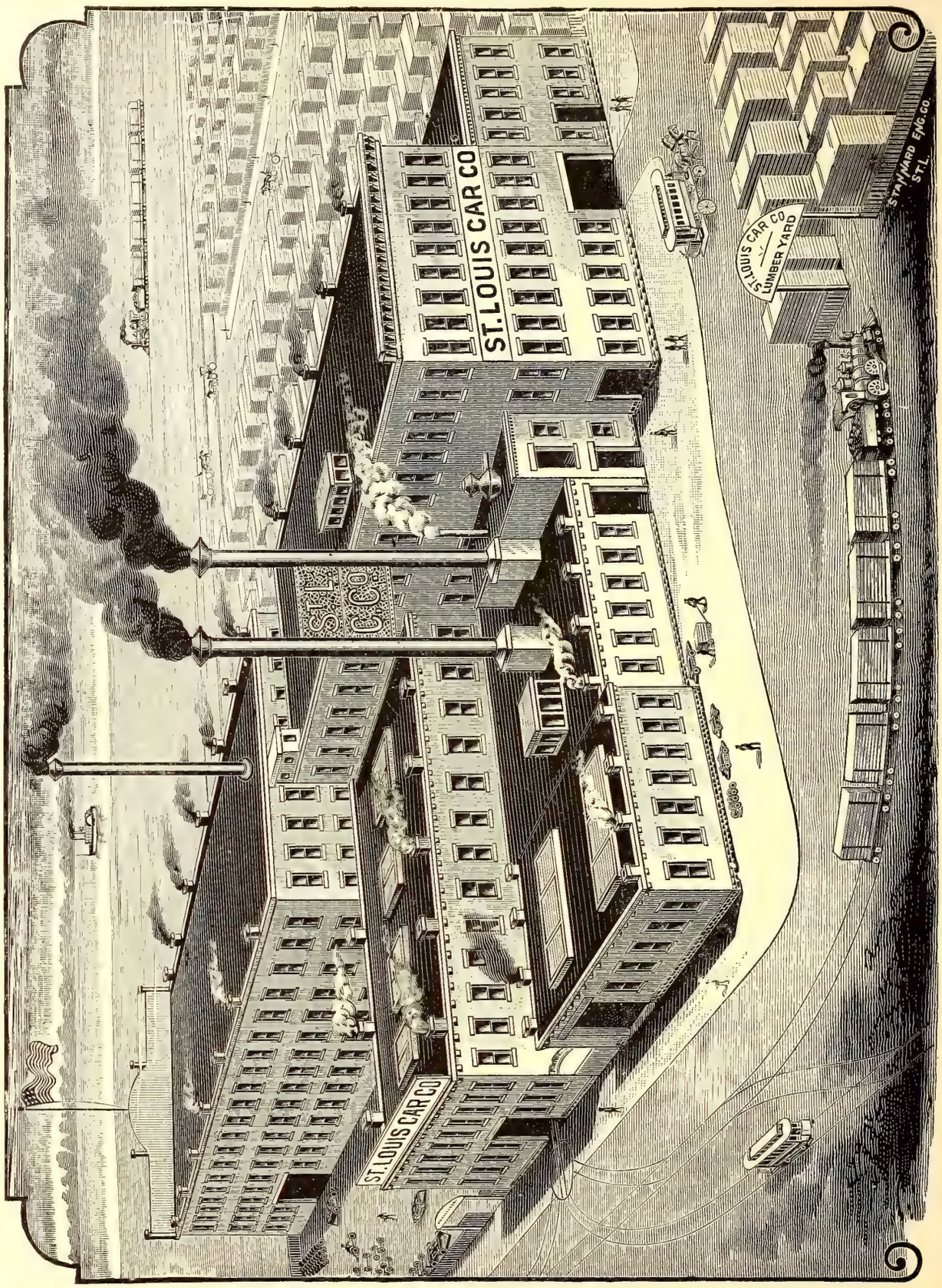
Twin eyes in one socket will not serve the same purpose as separate eyes in separate sockets.
This is also true of car doors.

SEE OPPOSITE PAGE.

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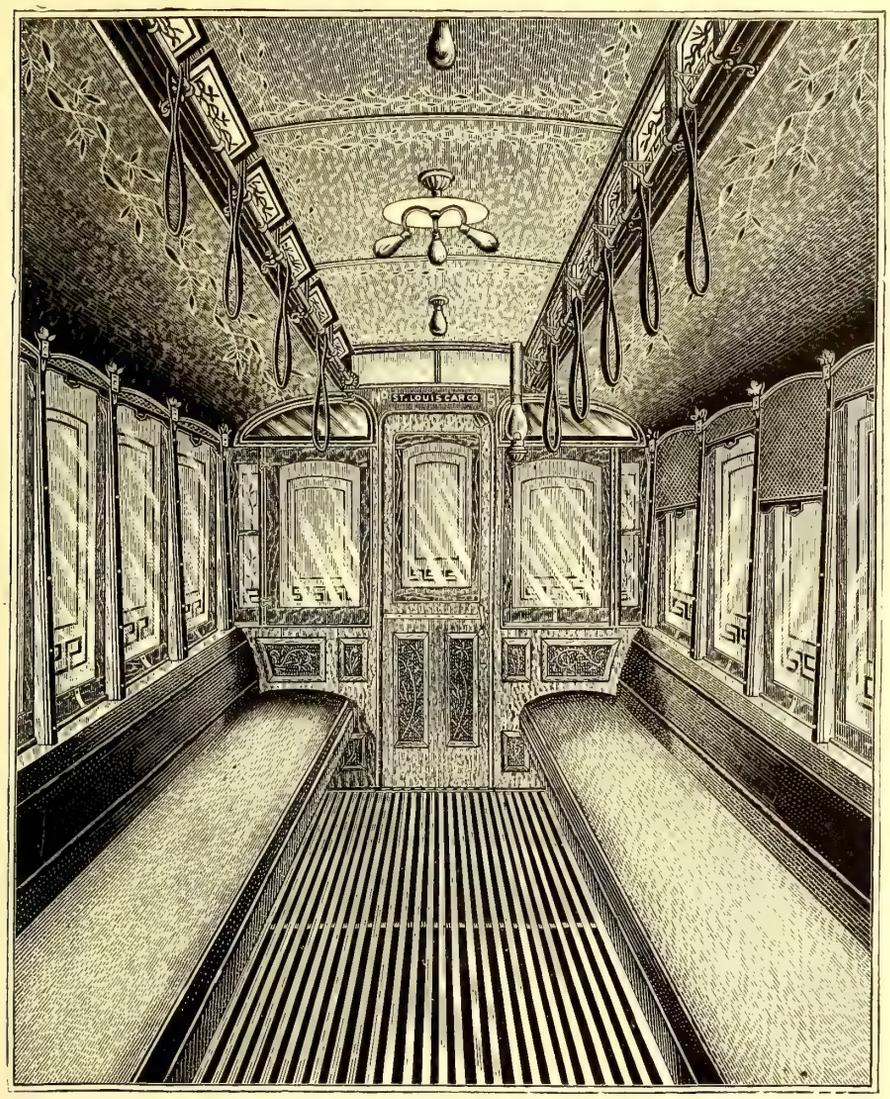


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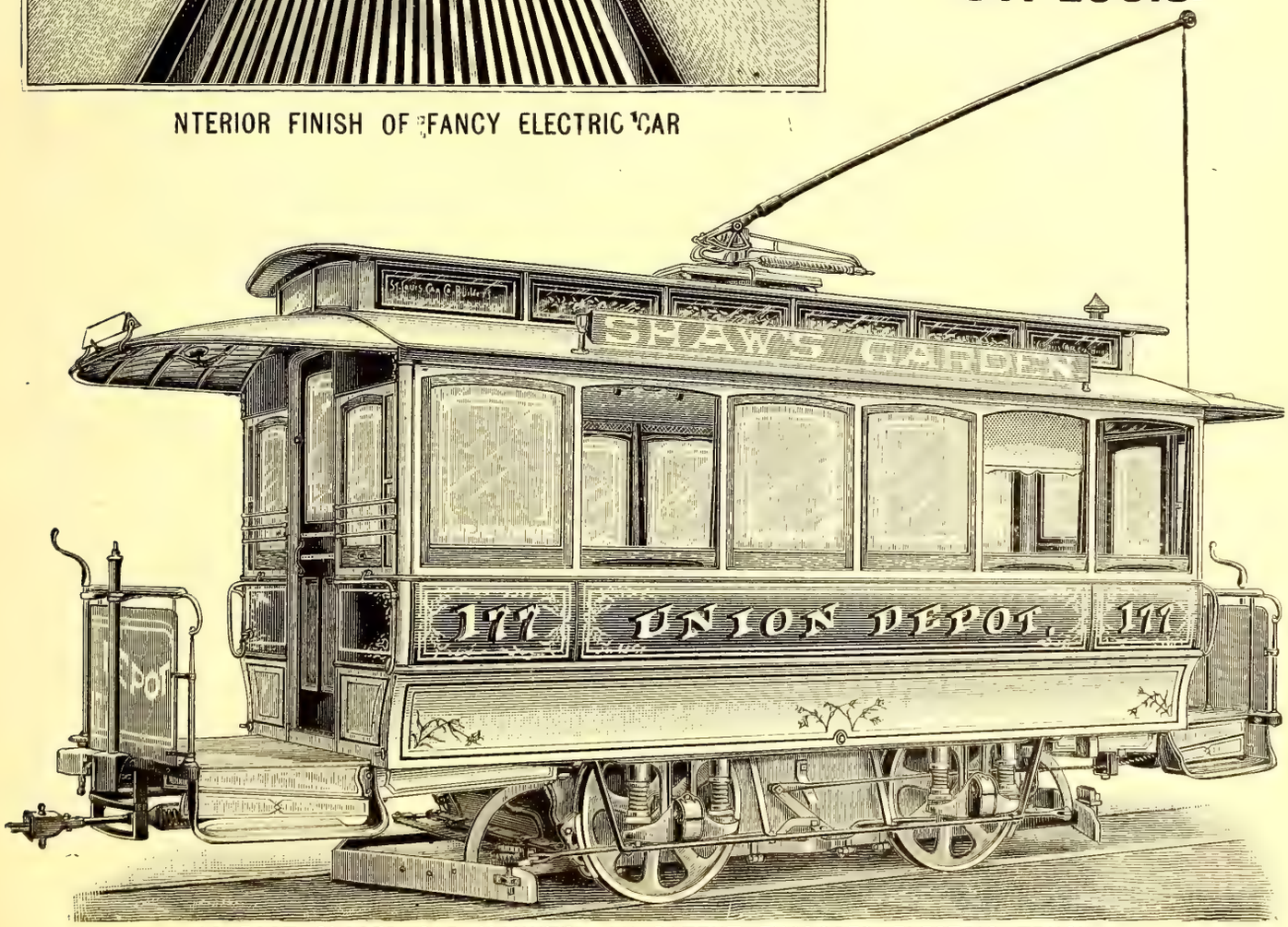
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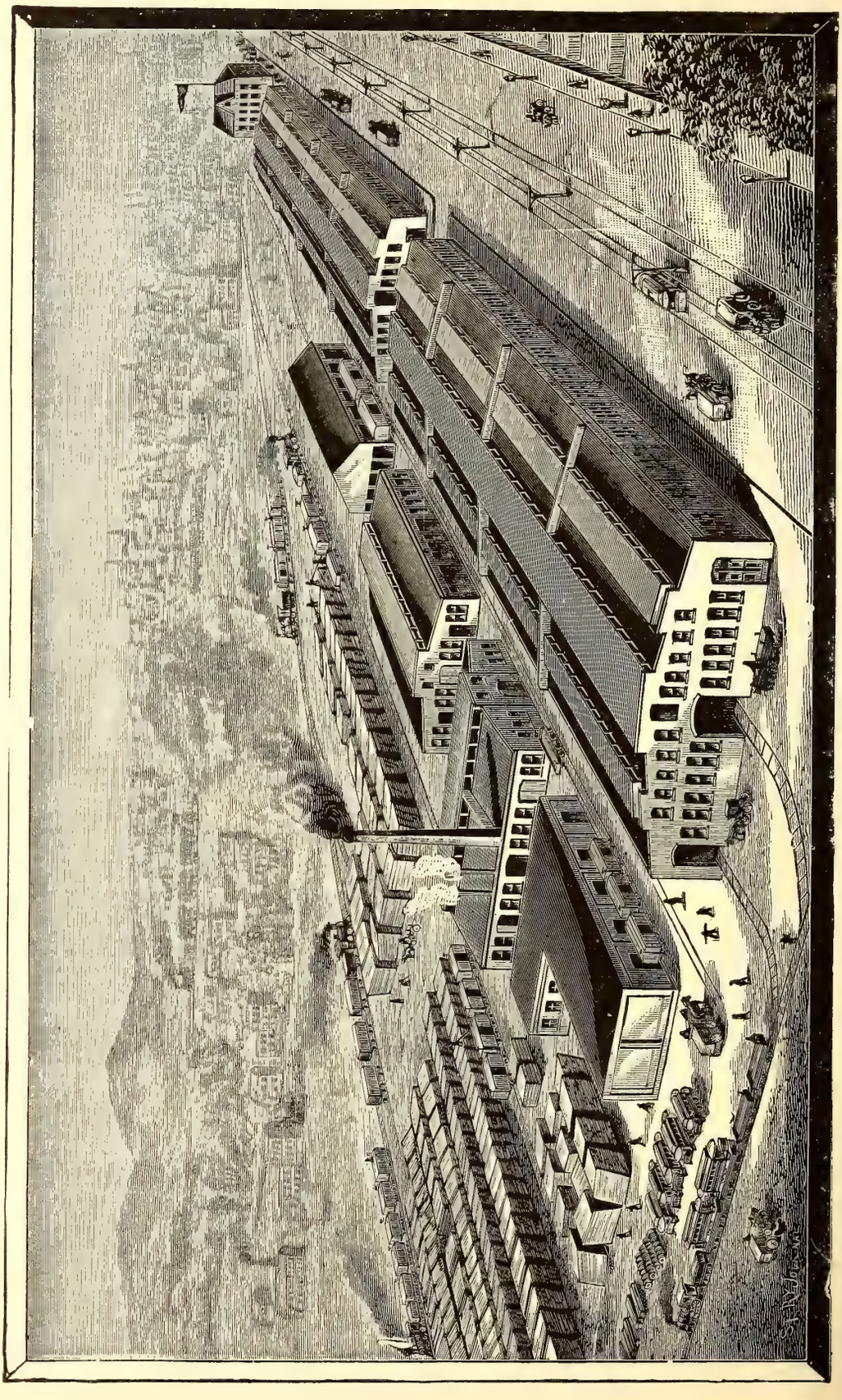
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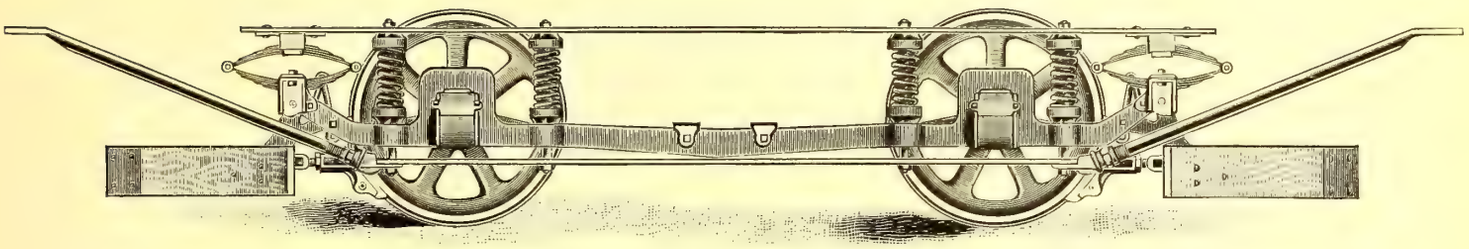
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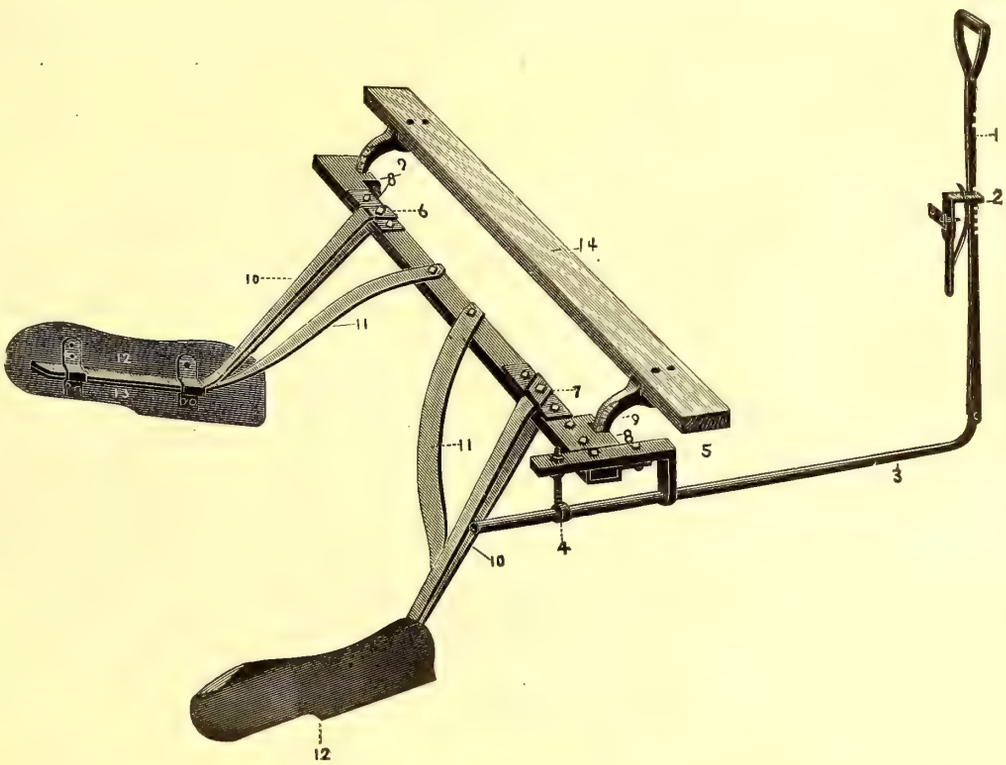
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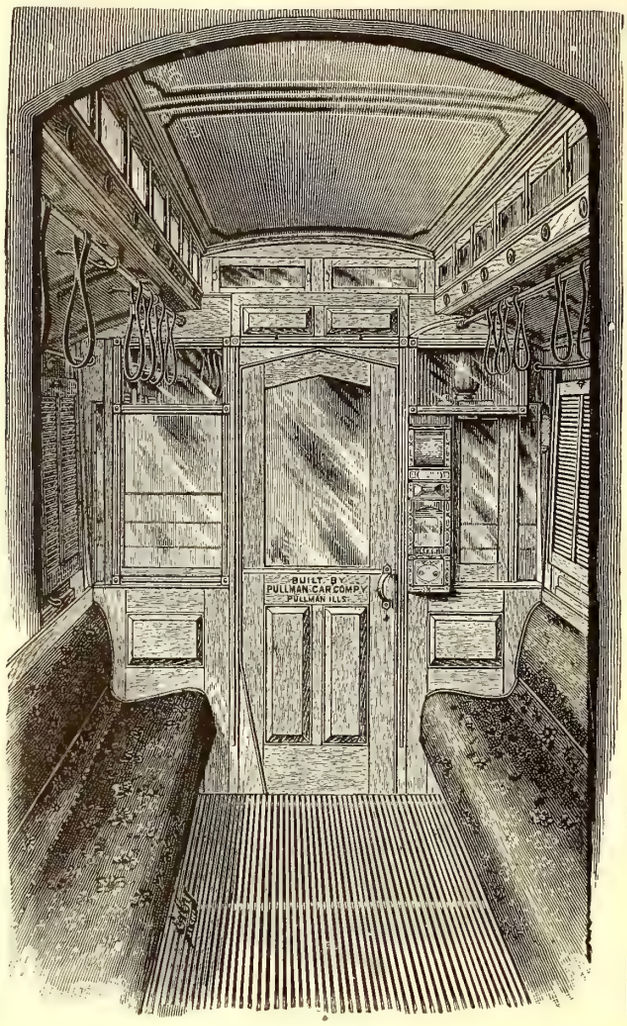
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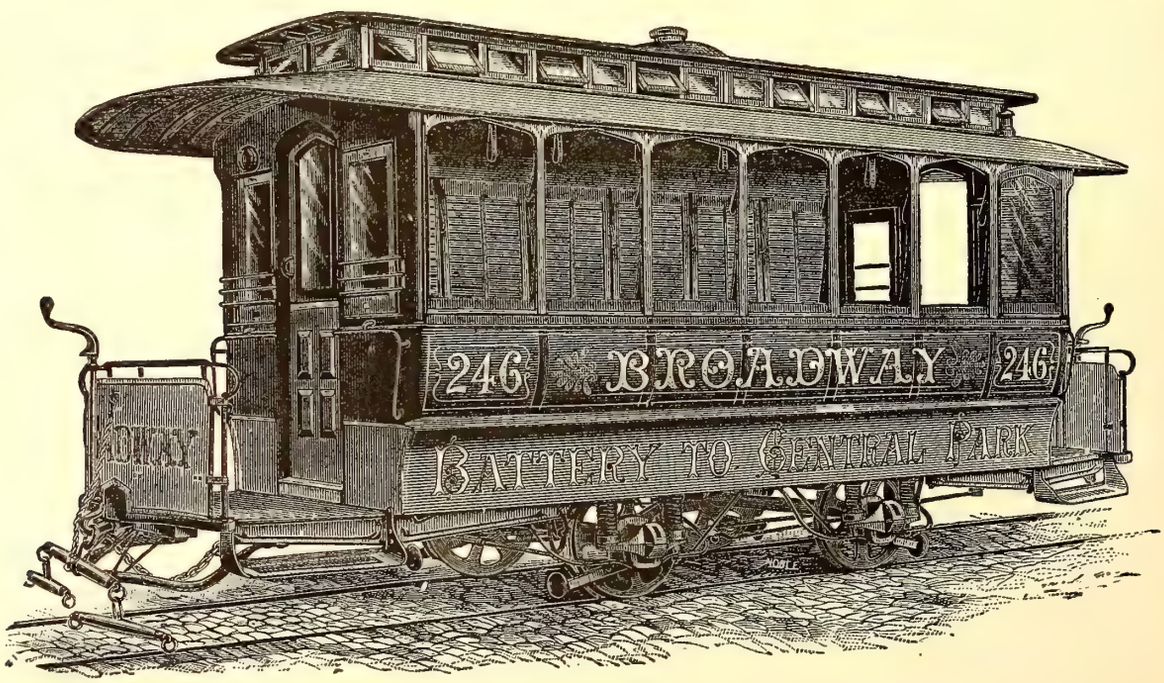


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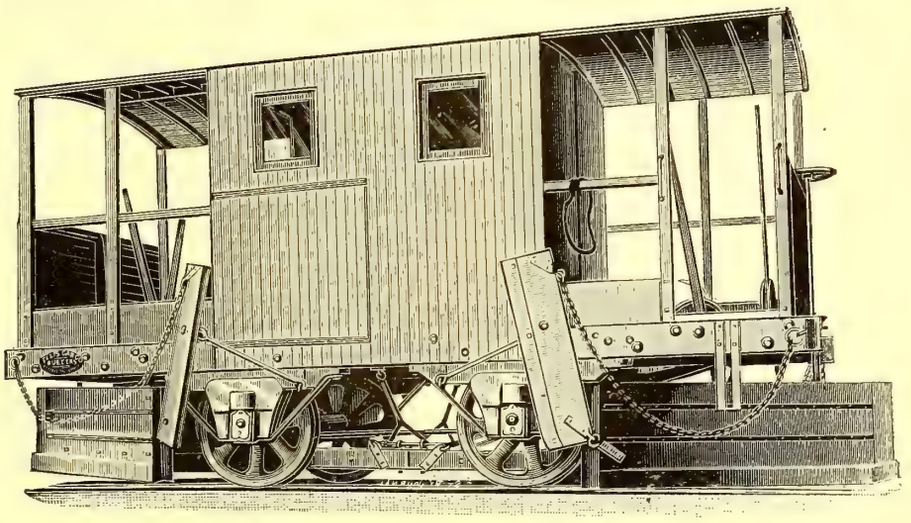
Street Railway Cars

—AND—

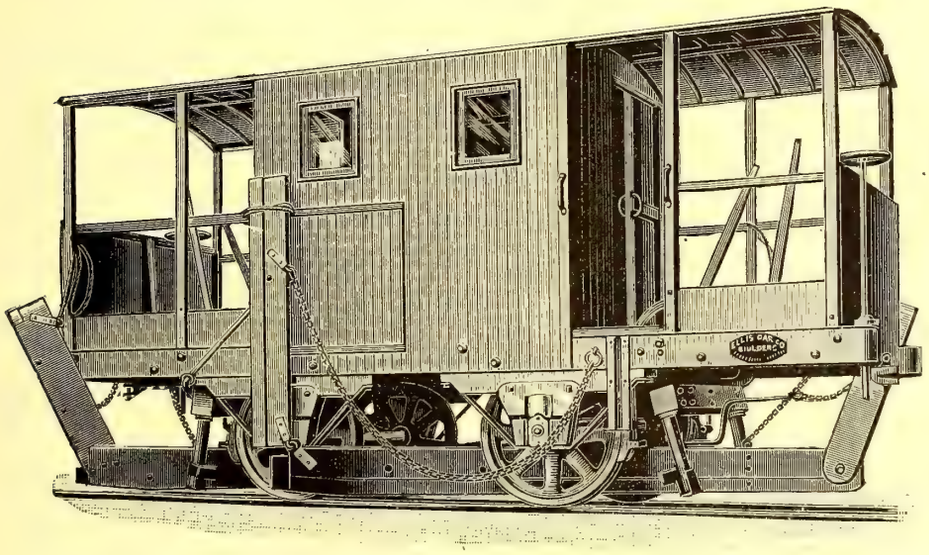
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SPECIALLY DESIGNED FOR SINGLE TRACK WORK.



WE FURNISH SNOW PLOWS COMPLETE



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13	"	"	Elizabeth Street Railway Co., Elizabeth, N. J.
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25	"	"	Superior Rapid Transit Ry. Co., West Superior, Wis.
20	"	"	Citizens' Street Railway Co., Kalamazoo, Mich.
25	"	"	N. F. & Susp. Bridge Ry. Co., Niagara Falls, N.Y.
200	"	"	Milwaukee Street Railway Co., Milwaukee, Wis.
60	"	"	Buffalo & Tonawanda Ry. Co., Tonawanda, N. Y.
17	"	"	West End Street Railway Co., Denver, Colo.
170	"	"	Denver City Cable Ry. Co., Denver, Colo.
850	Cars	of the	West Chicago Street Railway, Chicago, Ill.
75	"	"	Chicago Passenger Railway Co.
400	"	"	North Chicago Street Railway, Chicago, Ill.
225	"	"	Third Avenue Railway, New York.
65	"	"	125th St. & 10th Ave. Cable Railway, New York.
47	"	"	Central Crosstown Railway, New York.
50	"	"	Bleecker St. & Broadway Railway, New York.
100	"	"	Sixth Avenue Railway, New York.
41	"	"	Chistopher & 10th St. Railway Co., New York.
200	"	"	Brooklyn City & Newtown Ry., Brooklyn, N. Y.
50	"	"	South Covington & Cincinnati Railway Co.
50	"	"	Newark & South Orange Ry. Co., Newark, N. J.
175	"	"	Rochester Railway Co., Rochester, N. Y.
250	"	"	Buffalo Street and Crosstown St. Ry. Cos., Buffalo, N.Y.
200	"	"	Minneapolis St. Railway Co., Minneapolis, Minn.
20	"	"	New Jersey Traction Co., Elizabeth, N. J.
50	"	"	Patterson Railway Co., Paterson, N. J.
18	"	"	Hamilton & Lindenwald Elec. Transit Co., Hamilton, O.
13	"	"	New Brunswick City Ry. Co., New Brunswick, N. J.
27	"	"	Springfield Railway Co., Springfield, O.
25	"	"	Second Avenue Pass. Railway Co. Pittsburgh, Pa.
107	"	"	Albany Railway, Albany, N. Y.
5	"	"	Plainfield St. Ry. Co., Plainfield, N. J.
6	"	"	Buffalo, Bellevue & Lancaster Ry., Buffalo, N. Y.

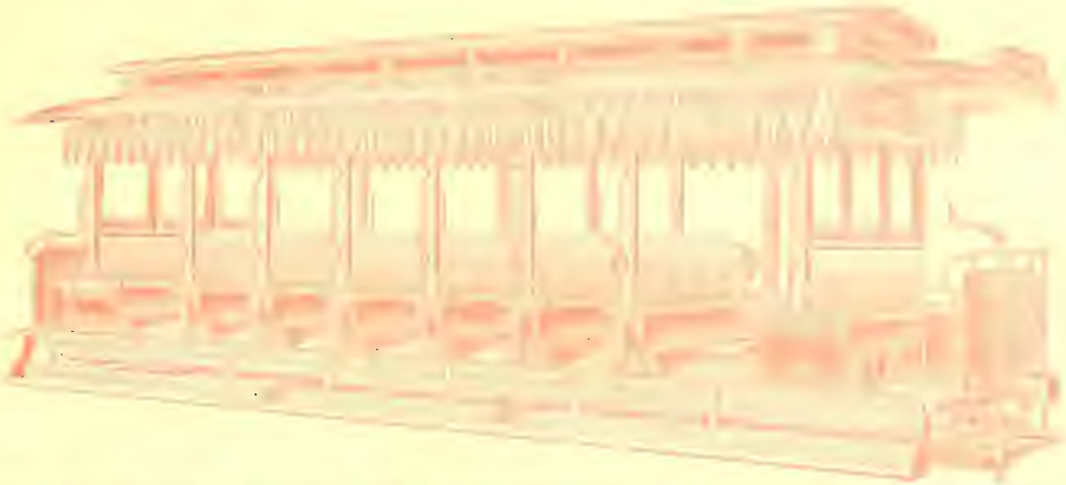
And has Special Contracts with many other Companies.

References: Presidents of all the above Roads.

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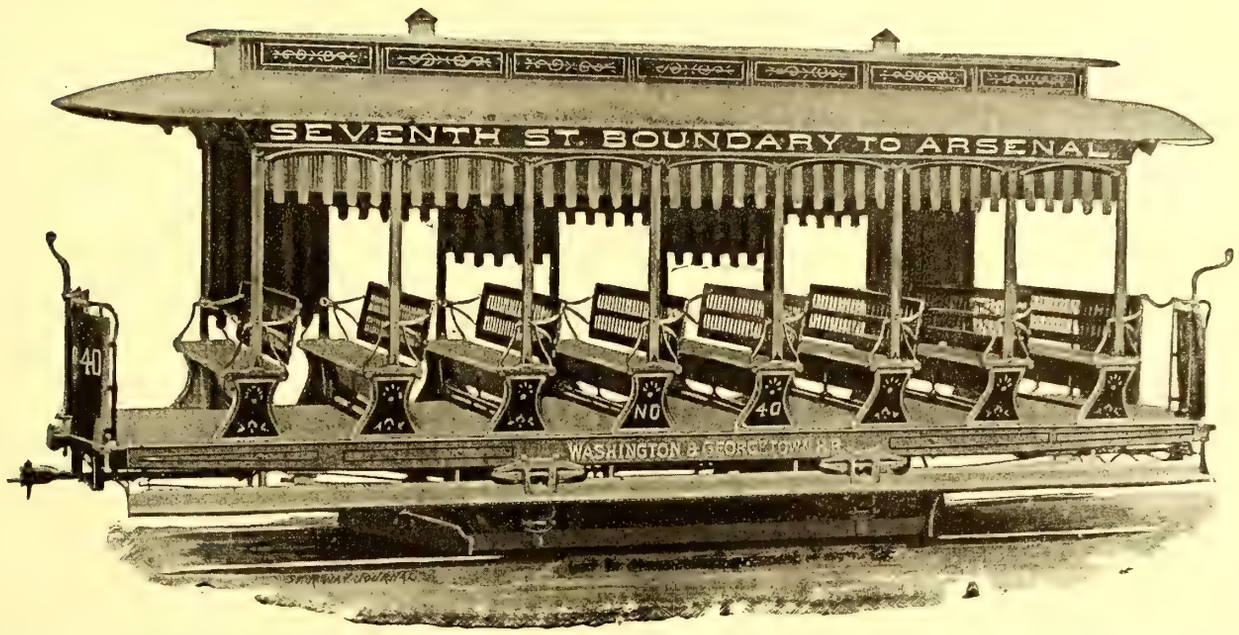
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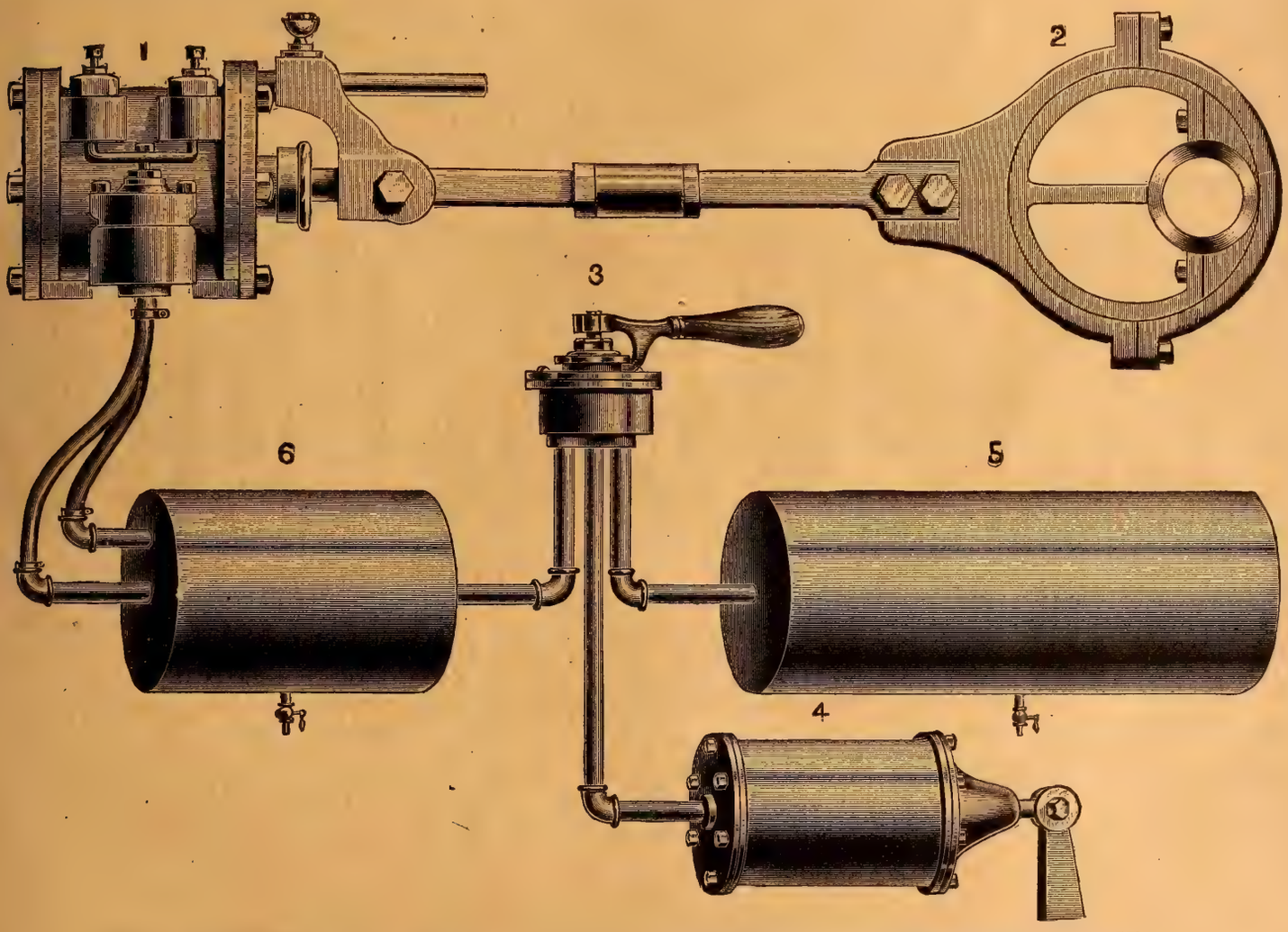
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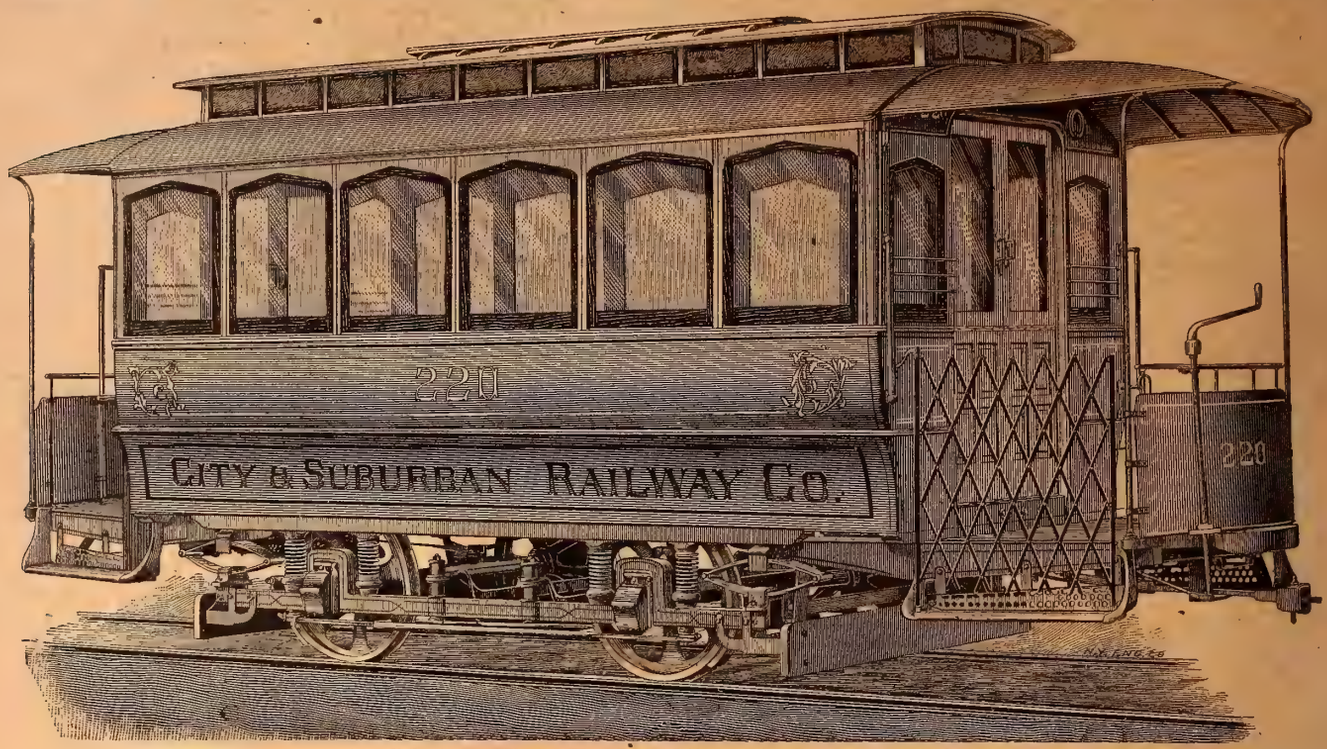
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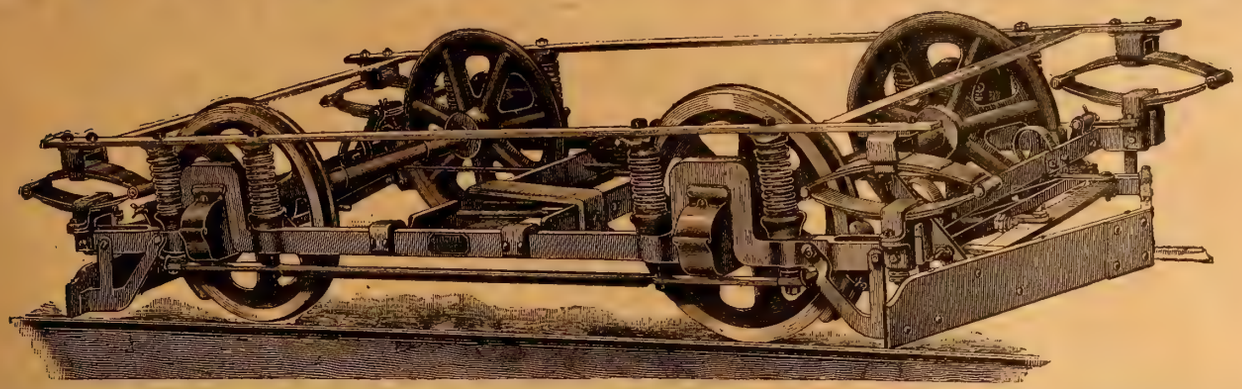
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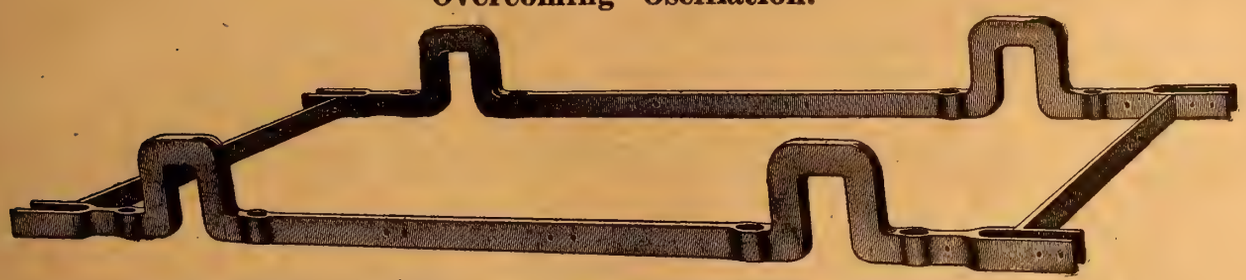
PHILADELPHIA.

Western Office, Western Union Building, Chicago, Ill.

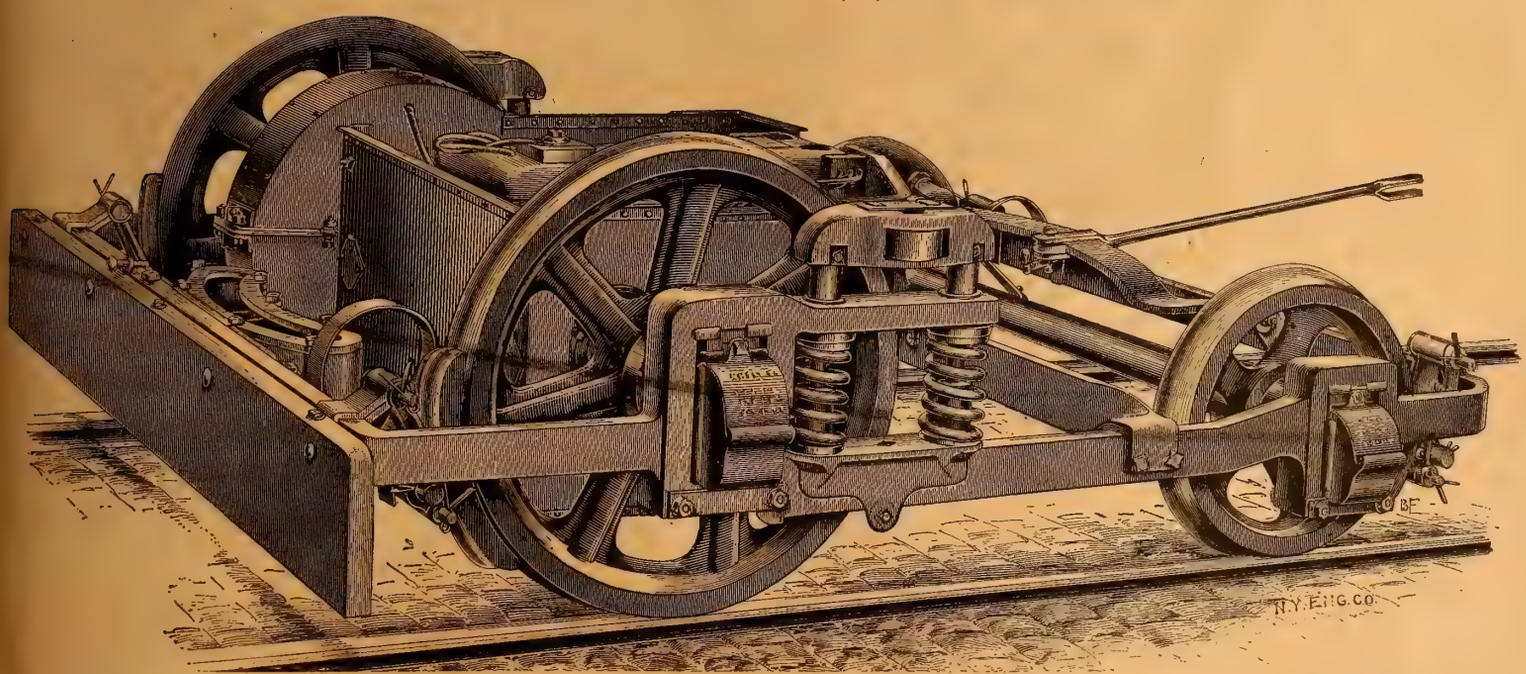
BRILL TRUCKS.



Brill No. 21 Independent Rigid Electric Motor Truck, embodying Simplicity of Construction, Most Powerful Brakes, Upper "Chord" Holding Truck and Car Body in Square. SOLID WROUGHT FORGED AXLE BOX FRAME, Elliptic Spring Buffers being Auxiliary in their Action to the Coil Springs, Overcoming Oscillation.



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IN THIS ISSUE: THE INTRINSIC VALUE OF STREET RAILWAY INVESTMENTS—SIXTH PAPER; BY EDWARD E. HIGGINS.

THE STREET RAILWAY JOURNAL

VOL. X. NO. 6. JUNE, 1894. $4.00 per Year. Single Copies, 35 Cts.

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—THE—
STREET RAILWAY JOURNAL,
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Monadnock Block, Chicago, Ill.
620 Atlantic Ave., Boston, Mass.

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EUROPEAN REPRESENTATIVE:
ROBERT W. BLACKWELL,
39 Victoria St., Westminster, London, Eng.

NEW ADVERTISEMENTS.

JULIUS T. DUDLEY, of New York, mentions his business.

THIEL'S DETECTIVE SERVICE, of New York, urges its claims.

CHARLES M. RUMRILL & BRO., of New York, advertise insulators, etc.

HORSBURGH & SCOTT, of Cleveland, O., advertise their gears and pinions.

THE ST. LOUIS REGISTER CO., of St. Louis, Mo., has a total change in this issue.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has a new illustration.

THE BROWNELL CAR CO., of St. Louis, Mo., has two very entertaining pages.

THE JEWETT CAR CO., of Jewett, O., devotes a half page to its street cars.

THE OHIO BRASS CO., of Mansfield, O., illustrates railway overhead material.

THE WALLACE ELECTRIC CO., of Chicago, draws attention to its rail bond caps.

ALFRED BOX & CO., of Philadelphia, illustrate one of their traveling cranes.

THE WESTON ELECTRICAL INSTRUMENT CO., of Newark, N. J., makes a change.

THE LODGE & DAVIS MACHINE TOOL CO., of Cincinnati, advertises machine tools.

THE DEWEY ELECTRIC SIGNAL CO., of New York, explains its car signal system.

LOUIS WARFIELD, of Detroit, Mich., mentions the Detroit motor equipments,

THE PECKHAM MOTOR TRUCK & WHEEL CO., of Kingston, N. Y., has two additional pages.

THE CHANGEABLE ELECTRIC HEADLIGHT CO., of Syracuse, N. Y., illustrates its specialty.

THE CENTRAL ELECTRIC HEATING CO., of New York, has a page on its electric heater for cars.

THE DEANE STEAM PUMP CO., of Holyoke, Mass., mentions its pumps and condensing apparatus.

THE ROBINSON ELECTRIC TRUCK & SUPPLY CO., of Boston, Mass., has more about its radial truck.

THE HAMMOND CLEAT & INSULATOR CO., of Boston, illustrates its guard wire and strain insulator.

THE CAR EQUIPMENT CO., of Philadelphia, Pa., has a few words on the merits of the Johnston rail bond.

THE GARVIN MACHINE CO., of New York, has a quarter page devoted to its metal working machinery.

THE WROUGHT IRON BRIDGE CO., of Canton, O., speaks of its business in iron and steel structural work.

THE LEWIS & FOWLER MANUFACTURING CO., of Brooklyn, N. Y., has several pages of new matter in this issue. It illustrates a large number of street car fittings, and has a page showing the popularity of its fare register.

CONTENTS.

Illustrated Articles.

The Cincinnati, Newport & Covington Railway..... 345
Electric Railway Construction in Philadelphia..... 354
The Street Railway System of Terre Haute..... 357
New Suburban Line Near Philadelphia..... 359
William J. Clark..... 368
Editorial Correspondence:—Fort Worth, Dallas..... 369
Track Construction at New Orleans..... 375
The Capital Railway of Frankfort, Ky..... 376
The Johnson-Lundell Surface Contact Electric Railway System 378
The Card Electric Street Railway Motor..... 380
Electric Freight Cars..... 382
Boiler Plant of the Southern Station of the Brooklyn City Ry. 383
San Francisco Cable Sheaves..... 383
The Johnston Rail Bond..... 385
An Electric Headlight..... 385
New Motor Truck..... 385
Works of the Curtis Electric Manufacturing Co..... 386
The Works of a Large Wrought Iron Bridge Co..... 388
New Elliptic Spring Truck..... 389
The Peckham Automatic Life and Wheel Guard..... 390
Compound, Duplex, Double Plunger Pump for Boston..... 390
New "American" Engine..... 391
The Arnold System of Electric Power Station Construction 392
Forty Inch Standard Engine Lathe..... 393
New Electric Heater..... 393
Wooden Faced Brake Shoes..... 393
Car Trimmings..... 394
A Complete Line of Overhead Construction Material..... 396
New Type of Electric Switch..... 396
New Overhead Switch..... 396

Editorial.

Hurry the Bane of Street Railway Operations..... 366
Suggestions Concerning Exhibits at the Atlanta Convention 366
Injury Wrought by Irresponsible Street Railway Promoters.. 366
The Future Prospects of the Electric Railway Business..... 366
Street Railway Companies and the Financial Depression..... 367
The Function of the Street Railway Association..... 367
Our Supplement, "American Street Railway Investments" 367

Miscellaneous.

The Intrinsic Value of Street Railway Investments.—Sixth Paper..... 360
Suburban Roads in St. Louis..... 375
Wood Paving in Sydney, Australia..... 376
Electric Emergency Ambulances..... 377
Exhibits at the Atlanta Convention..... 382
A Danger Signal for Electric Roads..... 383
New 2,000 H. P. Walker Generators..... 384
Earnings of Street Railroads..... 384
The Brownlee Injector..... 385
Electric Welding of Rails in St. Louis..... 389
$250 in Prizes..... 393
Annual Report of the Westinghouse Co..... 395
Annual Meeting of the Am. Institute Electrical Engineers 396
Trucks..... 397
Crawford Fenders..... 399
Fenders Adopted in Paterson and Hoboken..... 400
A Well Known Detective Service..... 400
Permanent Pan-American Exhibit..... 401
Electric Launches for Street Railways..... 401
Obituary..... 402
Electric Signals for Street Cars..... 402

Patents.....403
Quotations of Street Railway Stocks.....407
Financial.....410
Street Railway Supply Directory.....xxxiii
Index to Advertisers.....v, vi

New Advertisements—Continued.

THE GENERAL ELECTRIC LAUNCH CO., of New York, advertises World's Fair electric launches for sale.

THE VENEER SEATING & CHURCH FURNITURE CO., of Brooklyn, N. Y., returns to the JOURNAL this month.

THE SOUTHWARK FOUNDRY & MACHINE CO., of Philadelphia, gives a new illustration of one of its engines.

THE FULTON TRUCK & FOUNDRY CO., of Cleveland, O., gives a testimonial to the value of the Troy sand box.

THE PHŒNIX IRON WORKS CO., of Meadville, Pa., has a half page advertisement of the Dick & Church engines.

THE HUBLEY MANUFACTURING CO., of Lancaster, Pa., advertises its various appliances for electric railways.

W. R. BRIXEY, of New York, has four advertisements of Day's Kerite insulation for electric light and power service.

THE PARADIGM CONSTRUCTION CO., of New York, has a page illustrative and descriptive of its system of glass roofing.

THE R. A. CRAWFORD MANUFACTURING CO., of Pittsburgh, Pa., shows the growing popularity of its safety appliances.

THE JOHN SIMMONS CO., of New York, shows the construction of its metallic poles and brackets for electric railways.

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Next meeting, Atlanta, Ga., third Wednesday in October, 1894. Special committees to report are as follows:

Can the T Rail be Satisfactorily Used in Paved Streets? Joel Hurt, Pres. Atlanta Cons. St. Ry. Co., Atlanta, Ga.; S. Hendrie, Mgr. Wyandotte & Detroit River Ry. Co., Detroit, Mich.; H. J. Crowley, Engr. Atlanta Cons. St. Ry. Co., Atlanta, Ga.

City and Suburban Electric Railways. Elwin C. Foster, Supt. Lynn & Boston R. R., Boston, Mass.

Mail, Express and Freight Service on Street Railway Cars. Richard McCulloch, Elec. Engr. Citizens' Ry. Co., St. Louis, Mo.

The Best Method of Treating Accidents and Complaints. John B. Parsons, Gen. Mgr. West Chicago St. R. R. Chicago, Ill.

Street Car Wheels and Axles. D. S. Cook, Elec. Engr. Trenton Pass. Ry. Co., Trenton, N. J.

Transfers and Commutation. Rodney Curtis, Pres. Denver Tramway Co., Denver, Colo.

The T Rail Construction of the Terre Haute Street Railway Company. M. F. Burke, Supt. Terre Haute St. Ry.

A Standard Form of Street Railway Accounts. H. I. Bettis, Cons. Engr. Atlanta Cons. St. Ry. Co., Atlanta, Ga.

A directory of State Street Railway Associations will be found on page 26.

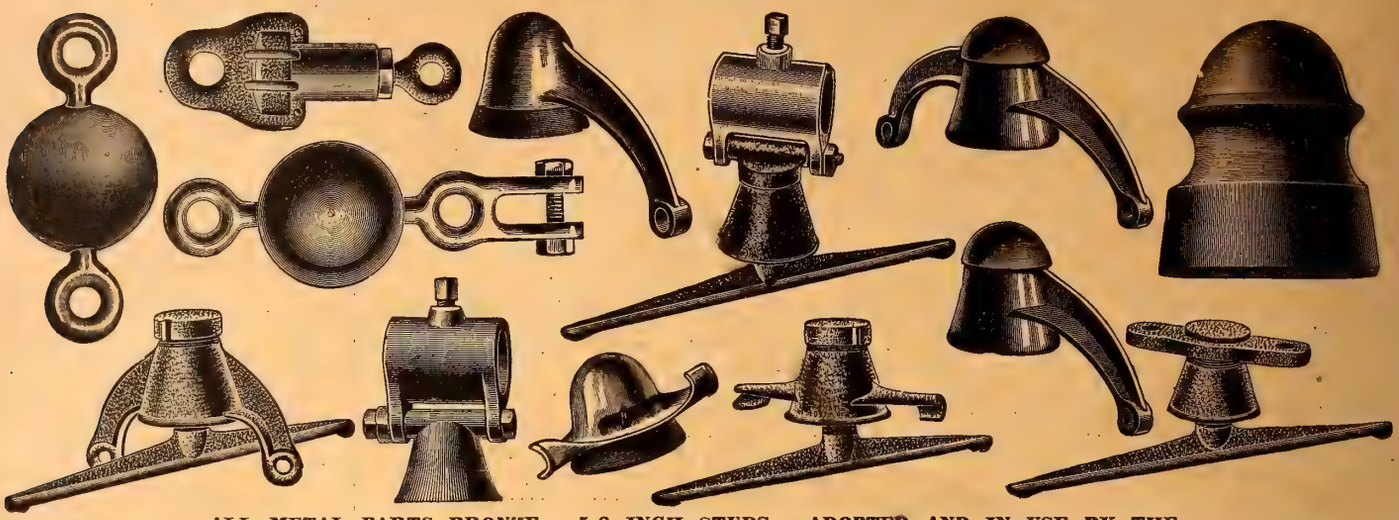
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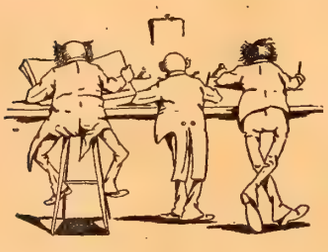
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Reger & Atwater, San Francisco, Cal.
The Mountain Electric Co., Denver, Colo.
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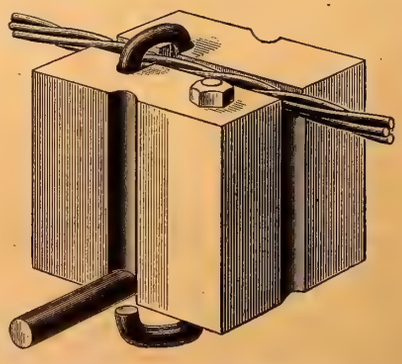
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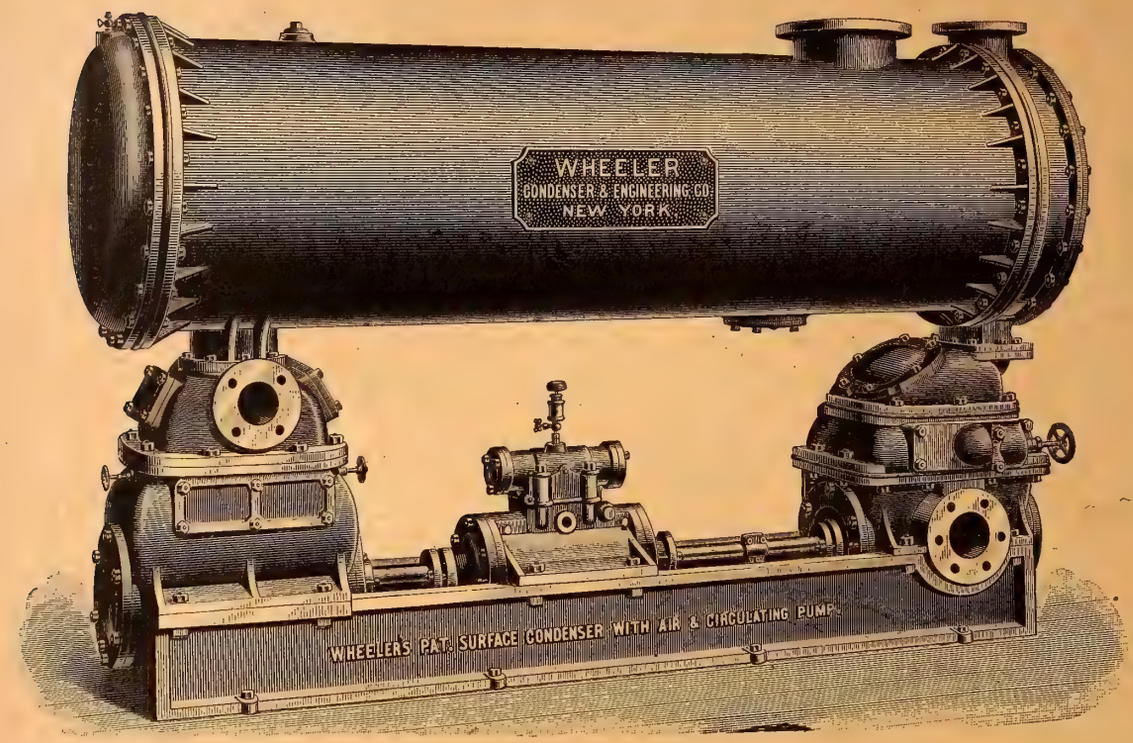
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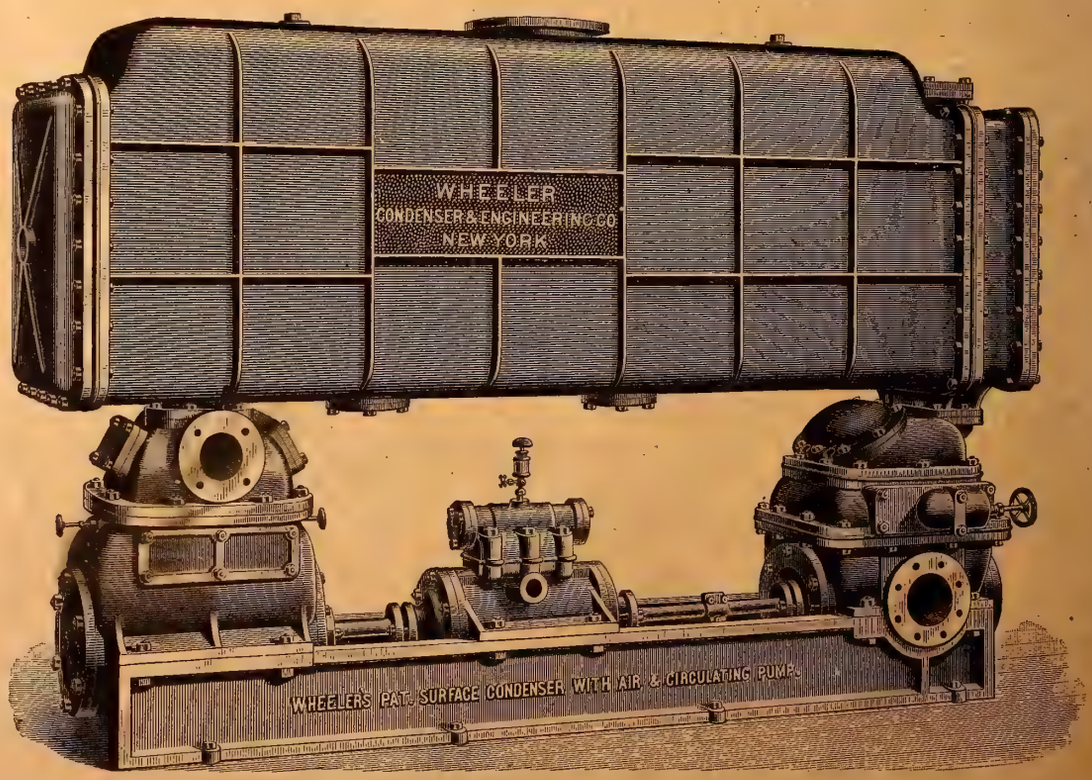
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INDEX TO ADVERTISERS.

Allen, James A., Philadelphia, Pa. XIV
Allis, Edward P., Co., The, Milwaukee, Wis. 52
Altoona Manufacturing Co., Altoona, Pa. 49
American Car Co., St. Louis, Mo 116
American District Steam Co., Lockport, N. Y. 76
American Electrical Works, Providence, R. I. 72
American Hard Fibre Co., Newark, Del. 77
American Rail Joint Co., Marion, Ind. 61
Ames Iron Works, Oswego, N. Y. 46
Ames Register Co., Boston, Mass. 88
Anderson, A. & J. M., Boston, Mass. III
Anthony, Wm. A., Vineland, N. J. 31
Arnold, B. J., Chicago, Ill. 31
Ashley, Frank M., New York 31
Babcock & Wilcox, New York 58
Ball & Wood Co., The, New York 54
Ball Engine Co., Erie, Pa. 51
Barbour, Stockwell & Co., Cambridgeport, Mass. 38
Barney & Smith Car Co., Dayton, O. 108
Bates Machine Co., Joliet, Ill. 45
Bemis Car Box Co., The, Springfield, Mass. 70
Berlin Iron Bridge Co., East Berlin, Conn. 93
Bevin Bros. Manufacturing Co., East Hampton, Conn. 98
Bickford, J. H., Salem, Mass. 31
Billings & Spencer Co., Hartford, Conn. 44
Blackwell, Robt. W., London, Eng. 30
Box, Alfred, Philadelphia Pa. XXXVIII
Briggs Carriage Company, Amesbury, Mass. 104
Brightman Stoker Co., Cleveland, O. 55
Brill, J. G. Co., Philadelphia, Pa. 124, 125
Brixey, W R., New York ..... X, XI, XII, XIII
Brooklyn Railway Supply Co., Stamford, Conn. 77
Brownell Car Co., St. Louis, Mo. 112, 113
Buckeye Engine Co., Salem, O. 52
Buffalo Forge Co., Buffalo, N. Y. VIII
Burnham & Duggan Ry. Appliance Co., Boston, Mass. 56
Burrowes, E. T., Co., The, Portland, Me. 97
California Wire Works, San Francisco, Cal. 78
Cambria Iron Co., Philadelphia, Pa. 37
Car Equipment Co., The, Philadelphia, Pa. 37
Carleton & Kissam, Boston, New York, etc. 120
Central Electric Heating Co., New York 41
Changeable Elec. Headlight Co., The, Syracuse, N. Y. 37
Chester Steel Castings Co., Philadelphi,a Pa. 43
Chicago Electric Truck Co., Chicago, Ill. 67
Clarke, F. H., Springfield, O. 92
Cleveland Construction Co., Akron, O. 31
Clonbrock Steam Boiler Works, Brooklyn, N. Y. 59
Colby, C. B. & W. H., Philadelphia, Pa. 31
Complete Electric Construction Co., New York 26
Comstock, The Louis K., Co., Chicago, Ill. 31
Consolidated Car Heating Co., Albany, N. Y. 96
Conway, M. W., Brooklyn, N. Y. 30
Cooper, C. & G., & Co, Mt. Vernon, O. 28, 49
Corresp. School Mech. & Indust. Sciences, Scranton, Pa. 39
Cradock, George, & Co., Wakefield, England 80
Craig, Wm. P., East Orange, N. J. 30
Crawford, R. A., Manufacturing Co., Pittsburgh, Pa. .. 92
Creaghead Engineering Co., The, Cincinnati, O. 77
Currier, Mayo & Co., Boston, Mass. 50
Curtis Electric Mfg. Co., Jersey City, N. J. XL
Davidson, M. T., Brooklyn, N. Y. 56
Davis, Lewis K., New York 31
Davis, W. S., & Sons, Concord, N. H. VII
Deane Steam Pump Co., Holyoke, Mass. III
Delaware Hard Fibre Co., Wilmington, Del. VII
Dewey Electric Signal Co., New York 38
DeWitt, E. F., & Co., Lansingburgh, N. Y. 98
Dick, Kerr & Co., London, Eng. 62
Dickson Manufacturing Co., Scranton, Pa. 82
Dixon, Joseph, Crucible Co., Jersey City, N. J. 28
Dorner & Dutton Manufacturing Co., Cleveland, O. .. 35, 71
Dudley, Julius T., & Co., New York 30
Eastern Electric Cable Co., Boston, Mass. 27
Economy Trolley Co., Chicago, Ill. 37
Eddy Electric Manufacturing Co., Windsor, Conn. XLI
Electric Railway Equipment Co., Cincinnati, O. 76
Electric Storage Battery Co., The, Philadelphia, Pa. .. 45
Elec. & Mechanical Eng. & Trading Co., New York... VII
Ellis Car Co., Amesbury, Mass 119
Eppley, Francis M., New York 37
Fiberite Co., The, Mechanicville, N. Y. II
Fibre Conduit Co., New York XXXVIII
Field & Beattie, New York 77
Field, C. J., New York 411
Field Life Guard Co., Providence, R. I. 90
Fishkill Landing Mach. Co., Fishkill-on-Hudson, N. Y. 56
Fitzgerald-Van Dorn Co., The, Lincoln, Neb. 60
Fleming, W. R., & Co., New York 46
Floyd, James R., & Sons, New York 64
Foster Automatic Safety Guard Co,. New York. 90
Fowler, Geo. L., New York 30
Fowler, J. W., Car Co., Elizabethport, N. J. 122
French, S. A., New York 26
Frost Veneer Seating Co., New York XXX
Fuel Economizer Co., The, Matteawan, N. Y. 57
Fulton Foundry & Machine Works, Brooklyn, N. Y., XXXII
Fulton Truck & Foundry Co., Cleveland, O. XXXI
Gagnier-Griffin Susp'd Ry. Bridge Co., Chicago, Ill. ..XXX
Garvin Machine Co., New York III
General Electric Co., Schenectady and New York. XLIII, XLIV
General Electric Launch Co., New York 40
General Incandescent Arc Light Co., New York XV
Genett Air Brake Co., New York and Chicago, Ill. 123
Gleason & Bailey Manufacturing Co., New York. 77
Globe Iron Works, New York 67
Goubert Manufacturing Co., The, New York 57
Graham Equipment Co., Boston and Philadelphia. 66
Groetzinger, A., & Sons, Allegheny Pa. 98
Habirshaw Wire, Yonkers, N. Y. XXXIV
Hale & Kilburn Mfg. Co., Phila, N. Y., Chicago. 25
Hall, J. P., New York 31
Hallowell, Eli B., & Co., Philadelphia, Pa. VII
Hammond Cleat & Insulator Co., Boston Mass. II
Hampson, Edw. P., & Co. V
Harrington, Edwin, Son & Co., Incor. Phila. Pa. 61
Harrington, Robinson & Co., Boston, Mass 28
Harrisburg Foundry & Machine Co., Harrisburg, Pa.. 46
Hathaway, Alfred G., Cleveland, O. 81
Hazard Manufacturing Co., Wilkesbarre, Pa. 78
Hazelton, Wm., 3d, New York 82
Heine Safety Boiler Co., St. Louis, Mo. 57
Higgins, Edward E., New York 411
Hill, W. S., Electric Co., Boston, Mass. VIII
Hine & Robertson, New York 28
Hirsch, L. K., Chicago, Ill. 29
Hoffmann & Billings Mfg. Co., Milwaukee, Wis. 55
Hooper, W. E., & Sons, Baltimore, Md. VIII
Hooven, Owens & Rentschler Co., Hamilton, O. 51
Hoppes Manufacturing Co., The, Springfield, O. 57
Horsburgh & Scott, Cleveland, O. VIII
Hotel Hanover, Philadelphia, Pa. XXII
Hubley Manufacturing Co., Lancaster, Pa. 412
Hunt, C. W., Co., New York 79
Hutchinson, A. J., New York 30
Huxley & Hoffman, Boston, Mass. 31
Ide, A. L., & Son, Springfield, Ill. 56
Insulated Electric Light Wires, New York VI
Jackson & Sharp Co., Wilmington, Del. 109
Jewett Car Co., Jewett, O. 96
Johns, H. W., Manufacturing Co. New York. 72
Jones' Sons, J. M., West Troy, N. Y. 121

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Keithley, H. R., Chicago, Ill..... 76
Kuhlman, G. C., Co., Cleveland, O..... 98
"L. P. & D." Transmitter Co., Montpelier, Vt..... vii
Laclede Car Co., St. Louis, Mo.....110, 111
Lake, J. H. & D., Co., Massillon. O..... 64
Lane & Bodley Co., The, Cincinnati, O..... 53
Leonard, H. Ward, & Co., New York..... 26
Leonhardt Pneumatic Car Fender Co., Baltimore, Md. 91
Lewis & Fowler Girder Rail Co., The, Brooklyn, N. Y.103
Lewis & Fowler Mfg Co., Bklyn..99, 100, 101, 102, 86 A, 86 B
Lewis, Samuel, Brooklyn, N. Y..... 84
Link-Belt Engineering Co., Nicetown, Pa..... 60
Livingston, Chas. Ludlow, Pittsburgh, Pa..... 30
Lobdell Car Wheel Co., Wilmington, Del.....vii
Lodge & Davis Machine Tool Co., Cincinnati, O..... 44
Loss, C. E., & Co., Chicago, Ill.....411
Loud, H. M., & Sons Lumber Co., Au Sable, Mich.... vii
McCarthy, F. E., & Co., Boston, Mass..... 30
McClure, Chas. L., New York.....xvii
McEwen, J. H., Mfg. Co., Ridgway, Pa..... 53
McGuire Manufacturing Co., Chicago, Ill..... 69
McIntosh, Seymour & Co., Auburn, N. Y..... 50
McNally, Thomas, Pittsburgh and Indianapolis..... 30
Mailloux, C. O., New York..... 37
Malochée, H. J., New Orleans, La..... 31
Mason Electric Co., Chicago, Ill..... 36
Meaker Manufacturing Co., Chicago, Ill..... 87
Mertes, A., Manufacturing Co., Allegheny, Pa..... 25
Meyer Julius, New York..... 31
Moore, Alfred F., Philadelphia, Pa..... 36
Morris, Tasker & Co., Philadelphia, Pa.....xxxii
Morse, C. D., Car Mfg. Co., Millbury, Mass..... 97
Morse, Williams & Co., Philadelphia, Pa..... 56
Mosher Electric Co., Chicago, Ill..... 43
Mundt & Sons, New York..... 27
Munsell, Eugene, New York..... 29
Munson, Charles, Belting Co., Chicago, Ill..... 46
Murray, J. D., New Brunswick, N. J..... 30
National Railroad Detective Agency, Newark, N. J... 26
Neftel, O'Connor & Co., Incorporated, New York.... 30
New Castle Car Manufacturing Co., New Castle, Pa..117
New Haven Car Register Co., New Haven, Conn..... 83
New Process Raw Hide Co., The, Syracuse, N. Y..... 75
New York Electrical Works, New York..... 75
New York Equipment Co., New York.....411
Newburyport Car M'f'g. Co., Newburyport, Mass..... 98
Nuttall, R. D., Co., Allegheny, Pa..... 75
Office Specialty Manufacturing Co., New York..... 97
Ohio Brass Co., Mansfield, O..... 74
Okonite Co. (Ltd.), The, New York.....xxix
Otto Gas Engine Works, Philadelphia, Pa..... 53
Paradigm Construction Co., New York.....xxxix
Parker, J. W., & Co., Philadelphia, Pa.....xxviii
Partridge, Arthur S., St. Louis, Mo.....105
Peckham Motor Truck & Wheel Co., Kingston, N.Y..A, B, C, D
Pennsylvania Iron Works Co., Philadelphia, Pa..... 63
Pepper & Register, Philadelphia, Pa..... 31
Pfingst, Louis, Boston, Mass..... 91
Philadelphia Engineering Works (Ltd.), Phila., Pa.... 45
Phœnix Iron Works, Cleveland, O..... 61
Phœnix Iron Works Co., Meadville, Pa..... 54
Phosphor Bronze Smelting Co., Philadelphia, Pa..... 37
Pierce & Miller Engineering Co., New York..... 50
Pitt, Wm. R., Composite Iron Works, New York..... 25
Pittsburgh Steel Hollow Ware Co., Allegheny City, Pa. 74
Pullman's Palace Car Co., Chicago, Ill.....118
Railway Register Manufacturing Co., New York..... 85
Ralston & Co., Philadelphia, Pa..... 28
Rankin, W. L & Bro., Latta, S. C..... 31
Reed & McKibbin, New York.....411
Reliable Detective Agency, The, New York..... 26
Reliance Gauge Co., Cleveland, O.....412
Robinson Electric Truck & Supply Co., Boston, Mass. 68
Roebling's, John A., Sons Co., Trenton, N. J..... 81
Rosenbaum, Wm. A., New York..... 31
Ruff, W. H., Washington, D. C..... 39
Rumrill, Charles M, & Bro. New York..... 38
Safety Car Heating & Lighting Co., New York..... 96
Safety Clutch Brake Co., The, Philadelphia, Pa..... 94
St. Louis Car Co., St. Louis, Mo. 83, 114, 115
St. Louis Register Co., St. Louis, Mo..... 86
Scarritt Furniture Co., St. Louis, Mo..... 11
Schieren, Chas. A., & Co., New York.....xxxv
Schumacher, T., Chicago, Ill..... 28
Scott, Charles, Spring Co., Philadelphia, Pa..... 65
Shaw, Benjamin F., Wilmington, Del..... 47
Sheppard Manufacturing Co., Louisville, Ky..... 66
Shook, Anderson Manufacturing Co., Pittsburgh, Pa.. 47
Shriver, T., & Co., New York..... 61
Shultz Belting Co., St. Louis, Mo..... 60
Siemens & Halske Electric Co., of America, Chicago, Ill. 29
Simmons, John, Co., New York..... 11
Sjoberg, J. P., & Co., New York..... 92
Smith, Edward & Co., New York.....xxxiii
Smith, Josephine D., New York.....106
Smith, Thos. G., Jr., Cincinnati, O.....
Société Establissements Arbel, Rive-de-Gier France... 82
Solar Carbon & Manufacturing Co., Pittsburgh, Pa... 72
Southwark Foundry & Machine Co., Philadelphia, Pa. 52
Standard Paint Co., New York..... 60
Stanwood Manufacturing Co., Chicago, Ill..... 95
Steel Motor Co., Cleveland, O..... 73
Steel Rail Supply Co., New York..... 25
Stephenson, John, Co., Limited, New York.....126
Sterling Supply & Manufacturing Co., New York 89
Stern & Silverman, Philadelphia, Pa..... 31
Stirling Co., The, Chicago, Ill.....42, 59
Strieby & Foote, Newark, N. J..... 44
Sturtevant, B. F., & Co, Boston, Mass..... 55
Taylor Electric Truck Co., Troy, N. Y..... 68
Thayer, William C., Cleveland, O..... 31
Thiel's Detective Service, New York..... 26
Time Transfer Printer Mfg. Co., Pittsburgh, Pa..... 84
Trenton Iron Co., Trenton, N. J..... 78
Trimble, Jas. A., New York.....92, 107
Tupper, W. W., & Co., New York..... 56
U. S. Steam & St. Ry. Adver'g. Co., Boston, N.Y., etc..120
United Columbian Electric Co., The, New York.....xli
Van Nuis, C. S., New York..... ix
Veneer Seating & Church Furniture Co., Bklyn, N. Y. 27
Vose Spring Co., The, New York..... 64
Vulcanized Fibre Co., New York..... 56
Wadhams Oil & Grease Co., Milwaukee, Wis..... 25
Wakefield Electrical Engineering Co., Philadelphia, Pa.. 31
Wales Manufacturing Co, Syracuse, N. Y..... 84
Walker Manufacturing Co., Cleveland, O.....xlii
Wallace Electric Co., Chicago, Ill.....xxxviii
Warfield, Louis, Detroit, Mich..... 37
Washburn & Moen Manufacturing Co., Worcester, Mass 79
Watson & Stillman, New York..... 43
Webster, Warren, & Co., Camden, N. J..... 47
West End Street Railway Co., Boston, Mass..... 36
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.... 76
Westinghouse, Church, Kerr & Co., New York..... 48
Weston Electrical Instrument Co., Newark, N. J..... 25
Wetherill, Robert, & Co., Chester, Pa..... 53
Wetmore, A. B., New York.....xxx
Wharton, Wm., Jr., & Co. Philadelphia, Pa..... 65
Wheeler Condenser & Engineering Co., New York..... iv
Wheeler Reflector Co., Boston, Mass 25
White Manufacturing Co., The, New York..... 67
White Crosby Co., Baltimore, Md.....411, 412
Willcox, E. B., Brooklyn, N. Y.....xxxii
Wilmot & Hobbs Manufacturing Co., New York.....412
Woodbridge & Turner Engineering Co., New York...411
Woodman, Joel H., Hoboken, N. J.....xxxvii
Woodman, The R., M'f'g & Supply Co., Boston, Mass. viii
Wrought Iron Bridge Co., Canton, O..... 43
Yeats Engineering Co., Chicago, Ill..... 58
Young Lock Nut Co., New York..... 36

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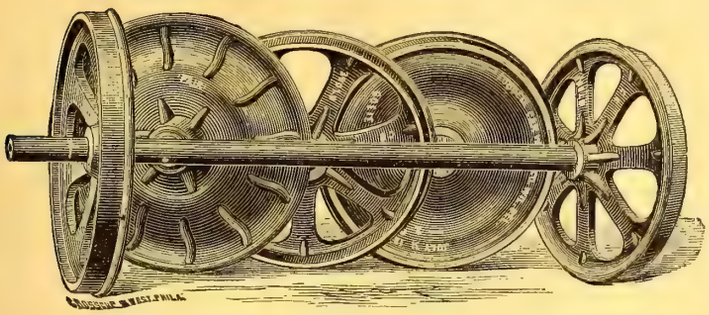
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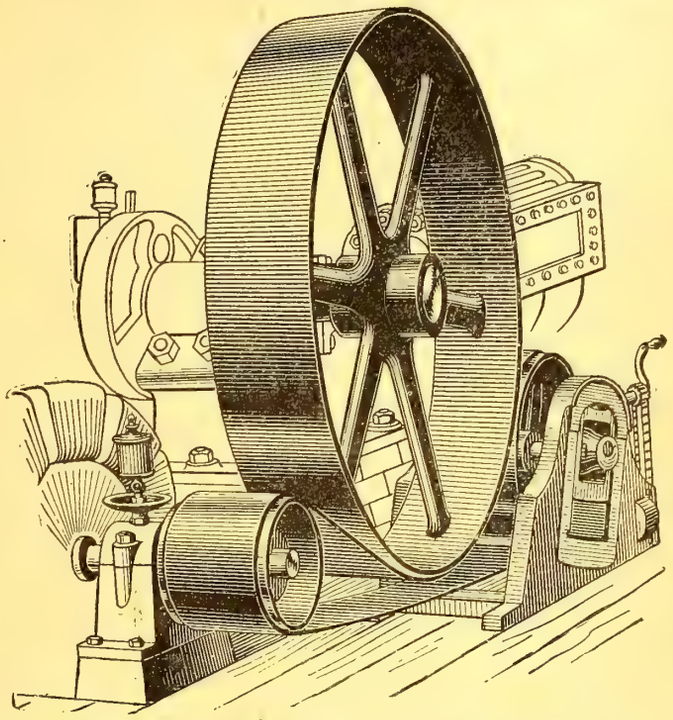
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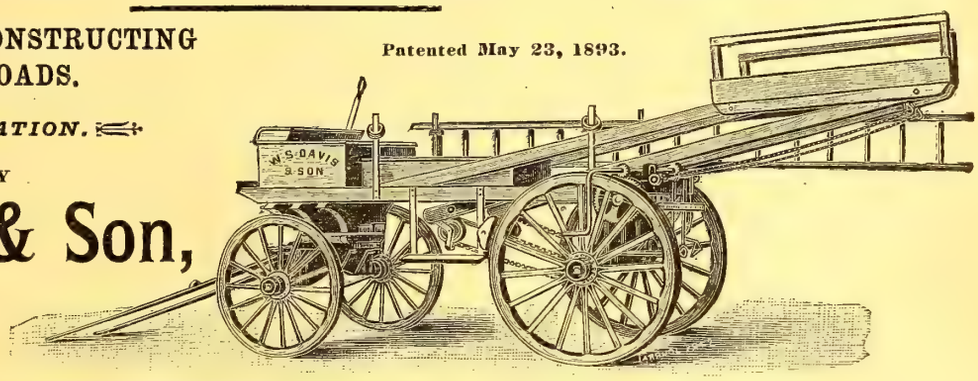
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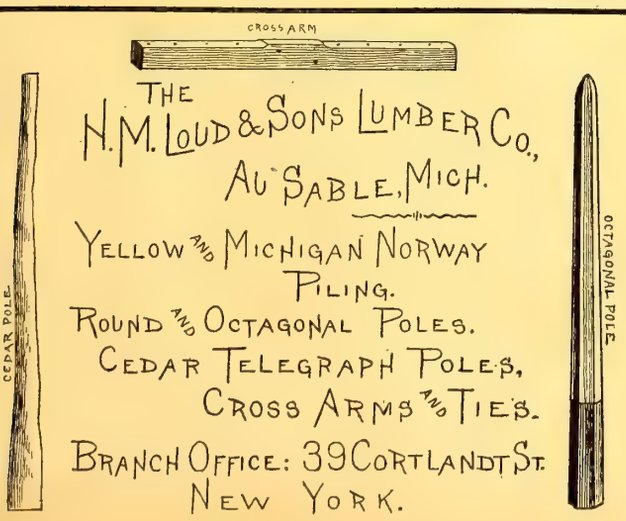
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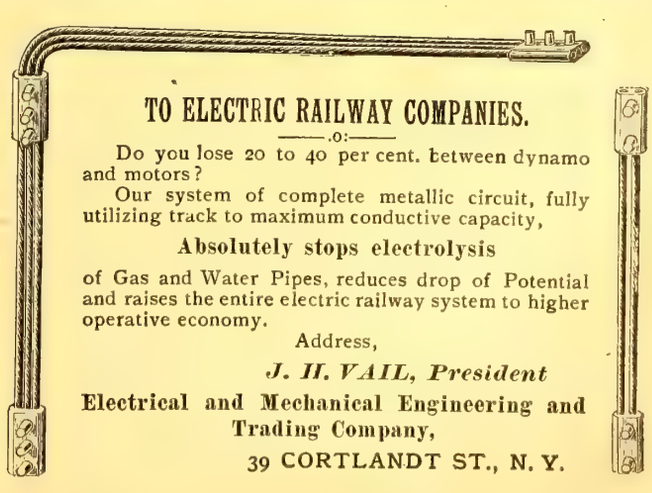
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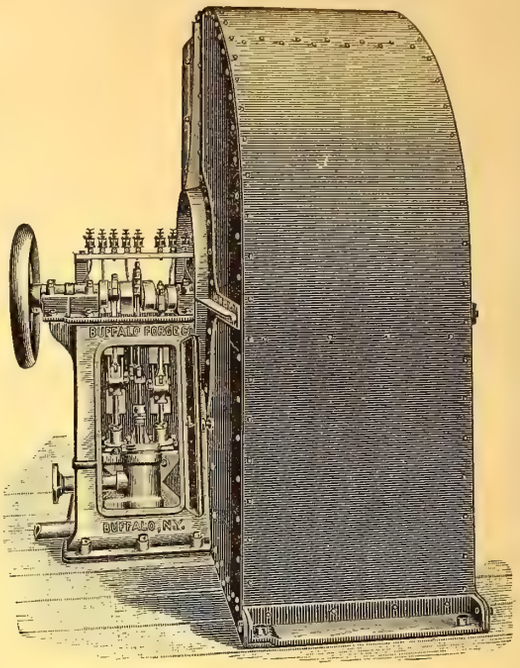
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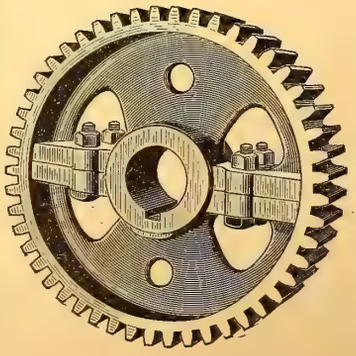
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Officials of Street Railways are earnestly requested to observe whether their roads are properly represented in this directory, and if not to send us the facts to make every item correct. For use in the July issue, directory matter must reach us by June 13.

ABBREVIATIONS.—m, miles of track; m s, miles of street; g, gauge; lb r, pounds rail to the yard; c-b r, center-bearing rail; s-b r, side-bearing rail; c, cars; m. c. motor cars; t. c. trail cars; g. c. grip cars; h, horses; mu, mules.

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The figures of track mileage mean entire length of single track, counting one mile of double track as two of single, and counting switches as additional length.

Elec. after name of a road means that the road is operated wholly or partly by electric power. Capital means capital issued unless otherwise expressly stated.

A

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AKRON, O.—Akron St. R. R. Co. 14 m elec. 4-8½ g, 52 lb girder r, 46 c, of which 25 are m. c. and 21 t. c. Edison system. Pres. J. F. Seiberling, V. Pres I. M. Miller, Sec. & Treas. F. A. Seiberling. Gen. Supt. W. D. Chapman. Capital, $200,000 Bonds, $185,000. 10 2

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ALLIANCE, O.—Alliance St. Ry. Co. 4 m, 4 m s, 4-8½ g, 45, 56 lb T and girder r, 4 m c. T-H and Short systems. Brill and Laclede cars. Phœnix Iron Works engines. Pres. W. W. Hazzard, Sec. Treas. & Gen. Man. W. H. Whitacre. Electrician G. J. Davis. Ch. Eng. Power Station Frank Bankard. Capital stock $85,000; authorized $100,000. Office 11 South Arch Ave. 1 4

ALTON, ILL.—Alton Improvement Association. 3¼ m steam, 4-8½ g, 30 & 40 lb steel T r, 2 Baldwin m. c. Pres. Chas. W. Milnor, Sec. & Treas. H. R Phinney. Office, 305 W. 2d St. Capital $25,000. 4 4

Alton & Upper Alton Horse R. R. & Carrying Co 3 m, 4-8½ g, 40, 66 lb steel T & flat r, 7 c, of which 5 are box and 2 open, 24 h. Pres. C. W. Milnor, Sec Treas. & Supt. H. R. Phinney. Capital, $42,200; authorized, $100,000. Office, 305 W. 2d st. 1 4

ALTOONA, PA.—City Pass. Ry. Co. of Altoona Pa. (Controlled by Altoona & Logan Valley Electric Ry Co., which owns 3,600 shares of its stock) 6¾ m, 5-3 g, 48¾-70 lb. girder r, 25 c, of which 19 are m c and 6 t c. T-H and Westinghouse systems. Brill and Lamokin cars. Altoona Mfg. Co. engines. Pres. J. Lloyd, Sec. & Treas. C. A. Buch, Supt. C. D. Rose, Elecn. W. H. Markland. Capital $200,000; Bonds $50,000. Office, Chestnut av. below First st. 1 4

Altoona & Logan Valley Ry. Co., controls City Pass. Ry of Altoona, 10¾ m, 5 m s, 5-3 g. 56 and 72 lb T and girder r, 26 c, of which 15 are m c, 8 t c and 2 double deck cars. Edison system, Brill cars. Altoona Mfg Co. engines. Pres. John Lloyd, Sec. & Treas. C. A. Buch, Supt. C. L. West, Ch. Engr. A. C. Shand, Elecn. W. H. Markland, Ch Engr. Power Station L. M. Wilson. Capital $320,500; authorized, $500,000. Bonds $300,500. 1 4

AMERICUS, GA.—Americus St. Ry. Co. Elec 5¼ m, 4-8½ g, 35 lb T r, 6 m c. T-H system. Owners T-H Co. Capital $50,000. Bonds $50,000. 8 3

AMES, IA.—Ames & College Ry. Co. 2¼ m. Steam 4-8½ g, 30 lb. T r, 2 c, 2 steam motors. Pres. E. W. Stanton, V. Pres. D. S. Fairchild, Sec., Gen. Man., Supt. & Pur. Agt. M. K. Smith, Treas. B. J. Shelden. Capital $20,000; authorized, $25,000. 1 4

AMESBURY, MASS.—(See Haverhill, Mass and Newburyport, Mass.)

AMSTERDAM, N. Y.—Amsterdam St. Ry. Co Elec. 4 m. 4-8½ g, 48½ lb. girder r., 13 c, of which 6 are m. c. and 7 t. c, 5 h. Edison system. Pres. J H. McClement, V. Pres. F. J. Sprague, Sec. & Treas T. D. Mosscrop, Gen. Man. J. R. Snell, Counsel J. S Wise. Capital, $250,000. Bonds, $150,000, Office of Pres. and V. Pres. 42 and 44 Broad St., N. Y. City Office of Supt. 102 E. Main St., Amsterdam. 8 2

ANACONDA, MONT.—Electric Ry., Light & Power Co. 5½ m, 4-8½, g, 35 & 50 lb. T r, 4 motors, 10 c, of which 4 are m. c. and 6 t. c. T-H system. Pres. M. Daly, Supt. C. R. Holmes. 4 4

ANDERSON, IND.—Anderson Electric St. Ry Co. 8½ m, 4-8½ g, 40, 50, 60 lb T r, 18 c, of which 10 are m c and 8 t c. Westinghouse, Edison & T-H systems. St. Louis cars. Allis engines. Pres., Treas. & Gen. Man. C. L. Henry, V. Pres. J. F. Wild, Sec. L. M. Cox, Supt. L. Cox, Elecn. C. Berry. Capital, $150,000; authorized $200,000. Bonds $100,000; authorized $150,000. Office, Room 2 P. O. Block. 1 4

ANN ARBOR, MICH.—The Ann Arbor St. Ry Co. Elec. 5¾ m, 4-8½ g, 45, 48½, 66 lb girder r, 7 c, of which 6 are m. c. and 1 t. c. Edison system. Brill cars. Taylor and straight line engines. Pres. H. P. Glover, Sec. Gen. Man. & Pur. Agt. H. T. Morton, Treas. C. E. Hiscock. Capital, $93,000; authorized, $93,000. Bonds, $100,000. 4 4

Ann Arbor & Ypsilanti St. Ry. Co. Dummy. 9 m 4-8½ g, 40 lb T r, 11 c, of which 5 are pass. c & 6 gravel c; 2 steam motors. Porter and Baldwin engines. Pres. & Gen. Man. J. E. Beal, V. Pres. H. P. Glover, Sec. J. T. Jacobs, Treas, D. L. Quirk, Supt. W. Parker. Capital $100,000. Bonds $60,000. 1 4

ANNISTON, ALA.—Anniston City St. Ry. Co. 6 m, 35 lb T r, 9 box c, 35 h. Pres. J. W. Bigsby, Sec., Treas. and Gen. Man. O. E. Edwards. 9 1

Oxford Lake Line Ry. Co. Elec. 7½ m. 6.7 m s, 4-8½ g, 40 lb T r, 8 c, of which 6 are m c and 2 t c. T-H system. Stephenson cars. Rent power. Pres. Gen. Man. & Pur. Agt. H. W. Sexton, V. Pres. R. P. Thomason, Sec. & Treas. F. M. Light, Elecn. A. A. Jett, Ch. Engr. of Power Station H. C. Reid. Capital $175,000. Bonds $175,000. Office 915 Wilmer St. 2 4

ANOKA, MINN.—Anoka St. Ry. Co. 3 m, 4-8½ g, 26 lb T r, 3 c, 13 h. Pres. R. Mahany, Sec. J. Mahany Treas. R. Mahany, Jr., Gen. Man. W. W. Mahany Capital, $15,000. 1 3

APPLETON, WIS.—Appleton Edison Electric Co 3.5 m, 4-8½ g, 33, 60 lb tram and girder r, 9 c, of which 5 are m. c. and 4 t. c. Edison system. Pres. & Treas. A. Le Smith, V. Pres. J. H. Van Nortwick, Sec. C. A. Beveridge, Supt. F. G. King. Office College Ave. 11 2

ASBURY PARK, N. J.—Seashore Elec. Ry. Co. 8¼ m, 4 m s, 4-8½ g, 56 lb girder r, 26 m. c. T-H system. Hamilton-Corliss engines. Pres. & Treas. J. C. Shaffer, Sec. H. Shaffer. Gen. Man., Pur. Agt. & Elecn A. S. Hickley. Capital, $200,000; authorized, $500,000. 1 4

ASHEVILLE, N. C.—Asheville St. Ry. Co. Elec 6½ m, 4-8½ g, 30 & 40 lb c. b. & T r, 14 c of which 12 are m. c. and 2 t. c. T-H and Edison systems. Gilbert cars. Armington & Sims engines. Pres. L. Maddux, V. Pres. W. T. Penniman, Sec. & Treas. B. M. Jones. Supt. J. P. Arthur. Capital, $100,000; authorized $250,000. Bonds, $300,000. 2 3

Asheville & Craggy Mountain Ry. Co. Steam 2½ m, 4-8½ g, 40 lb T r, 2 c. Brill cars. Baldwin engines. Pres. & Gen. Man. W. B. Gwyn. Sec. & Treas. W. W. West. Capital $24,700; authorized $500,000. 1 3

Ashville Loan, Construction & Improvement Co. Elec. 1 m, 4-8½ g, 40, 45 lb T & girder r, 2 m c. T-H system. Pres. & Gen Man. G. S. Powell, Sec. M. J. Bender, Treas. W. W. Bonnel. Capital, $296,000; authorized, $300,000. Bonds, $20,000. 1 3

West Asheville & Sulphur Springs Ry. Co. Elec. 6 m, 4-8½ g, 40 lb T & girder r, 6 c, of which 5 are m c and 1 t c. T-H system. Ellis and Stephenson cars. Stilwell-Pierce & Smith-Vaile turbines. Pres. E. G. Carrier, Sec. Treas. Gen. Man. Supt. Pur. Agt. & Ch. Engr. J. D. Carrier. Capital, $50,000; authorized $260,000. Bonds, $35,000. 1 4

ASHLAND, KY.—Ashland & Catlettsburg St Ry. Co. 6 m, 4-8½ g, 45 & 50 lb Johnson girder & T r, 7 c, of which 4 are m. c. and 3 are t. c. Pres. & Man. W. L. Ringo, Sec. & Treas. John Russell, Jr Capital, $25,000, authorized, $200,000. 4 4

AJAX SWITCHES AND LIGHTNING ARRESTERS, **C. S. Van Nuis,** 136 LIBERTY ST., NEW YORK.

ASHLAND, PA.—Schuylkill Traction Co. (See Girardville, Pa.)

ASHLAND, WIS.—Ashland Lighting & St. Ry. Co. Elec. 6 m, 4 m s, 4-8¼ g, 48, 60 lb T r, 12 c of which 6 are m c and 6 t c. T-H system. Stephenson cars. Ide engines. Pres. Gen. Man. & Pur. Agt. G. W. Harrison, Sec. & Treas. G. F. Merrill. Capital $200,000. Bonds authorized $250,000. 1 4

ASHTABULA, O.—Ashtabula City Ry. Co.—4 m 4-8½ g, 40 lb T r, 9 c, 60 h. Prop'r. J. N. Stewart Sec. & Treas. S. C. Stewart, Man. H. H. Stewart. Officers and office at Cleveland, O. 1 3

Ashtabula Rapid Transit Co. Elec. 4½ m, 4-8½ g, 47 & 70 lb Johnson girder r, 9 c, of which 5 are m. c. and 4 t. c. T-H system. Pres. F. B. Wagner, V. Pres. R. A. Brown, Sec. & Supt. T. Fricker, Treas. E. W. Savage. Capital $150,000. 1 4

ASPEN, COLO.—Aspen City Ry. Co. 2 m, 4-8½ g, 16 lb T r, 2 open c, 3 h, 2 mu. Pres. H. A. Tabor, Sec. M. K. Page, Gen. Man. T. J. Flynn. 5 2

ASTORIA, ORE.—Astoria St. Ry. Co. Elec. 3 m, 3-6 g, 30 lb T r, 8 c, of which 4 are m c and 4 t c. T-H system. Brownell cars. Pres. J. W. Conn, V. Pres. W. A. Sherman, Sec. & Supt. F. W. Newell, Treas. F. R. Stokes. Capital, $45,000; authorized, $200,000. 4 4

ATCHISON, KAN.—Atchison Ry. & Light Co. 8½ m, 4-8½ g, 40 lb. T r, 6 m c, Laclede cars. Gen. Man. B. P. Waggener, Supt. J. A. Bendure. Changing to electricity. 4 4

ATHENS, GA.—Athens Ry. Co. Elec. 6 m, 6 m s. 4-8½ g 40 lb T 6 m, c. Detroit and T-H systems. Laclede cars, Ball engines. Receiver, C. A. Mell, Supt. T. P. Hunnicutt 1 4

ATLANTA, GA.—Atlanta Consolidated St. Ry. Co Lines operated, Peachtree st. and North Atlanta, Peachtree st. and Ponce de Leon, Marietta st.—Decatur st., Whitehall st. and West End, Capitol Ave.—North Ave., Wheat st. and Ponce de Leon, Broad st., West End, West View Cemetery and Fulton County St. R. R. 63 m, 4-8½ g, 40, 45 & 56 lb girder & T r, 104 c, of which 94 are m. c. and 10 t. c. T-H system. Brill, Lewis & Fowler, Pullman and Stephenson cars. Cooper-Corliss engines. Pres. J. Hurt, V. Pres. E. Woodruff, Sec. T. K. Glenn, Treas. R. J. Lowry, Gen. Supt. H. N. Hurt, Pur. Agt. W. H. Glenn, Elecn. N. W. L. Brown, Ch. Eng. of Power Station, T. Elliott. Capital, $2,000,000. Bonds, $2,000,000. 1 4

Atlanta Traction Co. Elec. 18¾ m, 4-8½ g. 40 lb T r, 24 c of which 21 are m c and 3 t c. Detroit, Edison and Westinghouse systems. American and Brill cars. Russell engines. Pres. T. B. Felder, V. Pres. E. T. Shubrick, Sec. & Treas. —— Robinson, Supt. J. T. Voss, Elecn. E. M. Green, Ch. Engr. of Power Station W. F. Wooden. Capital $150,000. Office Inman Bldg. 2 4

Collins Park & Belt R. R. Co. Elec. 15 m, 4-8½ g, 56 lb T r, 9 m c. Short system. Brill cars. Allis engines. Receiver & Man. J. W. Darr. P. O. Box 541. 2 4

Lithia Springs Ry. Co. 6 m, 6 m s, 4-8½ g, 60 lb T and girder r, 5 m c. Bain system. Rent power. St. Louis cars. Pres. H. Camp, V. Pres & Gen. Man. B. F. Curtis, Sec, & Treas. T. Camp. Capital, $60,000. Bonds $100,000. 1 4

ATLANTIC CITY, N. J.—Atlantic City Electric Ry. (Operated by Pennsylvania R. R. Co.) 17 m, 4-8½ g, 60 lb T & girder r, 54 c, of which 30 are m c. and 24 t c. Edison and Westinghouse systems. Brill cars. Pres. J. S. Roberts, Gen. Foreman, W. K. McAlister. 1 4

ATTLEBORO, MASS.—Attleboro, N. Attleboro & Wrentham St. Ry. Elec. 6½ m 4-8½ g, 40 lb. T r 17 c, of which 9 are m. c. and 8 are t. c. T-H system. Pres. H. M. Daggett, Jr., Treas. C. T. Guild, Capital, $60,000, bonds $50,000. 1 4

AUBURN, N. Y.—Auburn City Ry. Co. Elec. 5½ m, 5¼ m. s., 4-8½ g, 45-47 lb girder & T r, 14 c, of which 11 are m. c. and 3 t. c. 5 h. T-H system. Jones Rogers and Stephenson cars. McIntosh & Seymour engines. Pres. C. E. Eddy, V. Pres. G. Underwood, Sec. Gen. Man. & Supt. A. H. Underwood, Treas. J. E. Storke, Pur. Agt. Ch. Engr. Elecn. & Ch. Engr. of Power Station, R. A. Rogers, Jr. Capital, $50,000, authorized $150,000. Bonds, 200,000. 1 4

AUGUSTA, GA.—Augusta Ry. Co. Elec. 25 m, 4-8½ g, 35, 54 lb T & girder r, 46 c, of which 35 are m. c. and 11 t. c. Edison and T-H systems. Brill and Stephenson cars. Corliss engines. Pres. D. B. Dyer, V. Pres. R. R. Conklin, Sec. C. B. Reavis, Supt. T. A. Roberts. Capital, $300,000. Bonds, $400,000. Office, Jarvis-Conklin building. 8 3

AUGUSTA, ME.—Augusta, Hallowell & Gardiner R. R. Co. Elec. 8 m, 4-8½ g, 40 & 55 lb. T & Johnson r 13 c, of which 9 are m. c. and 4 t. c. T-H., Edison & Detroit systems. Pres. J. M. Haynes, Sec. H. G. Staples, Treas. G. E. Macomber, Supt. & Elecn. W. G. Meloon. Capital, $120,000; authorized, $150,000. Bonds, $150,000. Office, Hallowell, Me. 1 4

AURORA, ILL.—Aurora St. Ry. Co. Elec. 18 m 12 m. s. 4-8½ g, 67 lb. T and 56 lb girder r, 22 m c. Detroit system. Briggs and Gilbert cars. Straight line engines. Pres. &Treas. R. B. Dodson, V. Pres H. C. Tinker, Gen. Man. & Pur. Agt. D. A. Belden, Ch. Eng. & Ch. Eng. of Power Station, A. S. Hadin. Capital, $300,000. Bonds, $300,000. 1 4

AUSTIN, TEX.—Austin Rapid Transit Ry. Co. Elec. 15 m, 4-8½ g, 40 lb girder & T r, 20 c, of which 12 are m. c. and 8 t. c. T-H system. Pres. F. H. Watriss V. Pres. I. H. Evans. Sec. & Supt. J. K. Urie. Capital $200,000. 1 4

B

BABYLON, N. Y.—Babylon Street Ry. Co. 1.53 m, 4-9 g, 60 lb T r, 4 c, of which 3 are box and 1 is open, 3 h. Pres. W. F. Norton, Sec. Jos. F. Sammis Treas. John R. Reid, Supt. David S. S. Sammis Capital $25,000. 1 4

BAKER CITY, ORE.—Baker City St. Ry. & Motor Co., 2½ m, 3-5½ g, 20 lb. T r, 2 4-wheel box c. 6 h Pres., Gen. Man. & Supt. C. L. Palmer, Sec. M. D Abbott, Treas. L. W. Place. Capital, $50,000. 6 2

BALTIMORE, MD.—Baltimore City Pass. Ry. Co. 59 m, of which 16 are horse, 21 electric and 22 cable, 5-4½ g, 75 lb r, 194 c, of which 50 are m c, 72 g c and 72 t c. Westinghouse system. Brill and Stephenson cars (cable). Allis engines. Pres. & Supt. Oden Bowie, Treas. A. B. Clark, Ch. Engr. A. N. Connett. Capital, $1,000,000; authorized, $2,000,000. Bonds, $2,000,000. Office, Madison Ave., extended. Electric lines in process of change, but considered as completed. 1 4

Baltimore Traction Co. (Includes N. Baltimore Pass. Ry., Baltimore & Curtis Bay St. R. R. Co. and Baltimore & Powhatan Ry.) 75 m, of which 25 are horse, 15 cable and 35 elec, 5-4½ g, 66, 78, 80 lb girder and T r, 225 c, of which 100 are h c, 60 g c, 30 m c and 35 t c, 831 h. Westinghouse system. Brownell and Lewis & Fowler cars. Corliss, McIntosh & Seymour and Westinghouse engines. Pres. F. Brown, V. Pres. J. S. Hagerty, Sec. N. H. Johnson, Treas. F. S. Hambleton, Gen. Man. Wm. A. House, Jr., Ch Engr. F. H. Hambleton, Elecn. T. A. Cross. Office, Druid Hill Ave. Extension, Clifton. 1 4

Central Ry. Co. Elec. 13 m, 5-4½ g, 80 lb tram r, 40 c, of which 30 are m c and 10 t c. T-H system. Brill and Stephenson cars. McIntosh & Seymour engines. Pres. G. Blakistone, Treas. N. H. Bell, Supt. J. Hopps, Ch. Engr. J. Burnett, Elecn. Conway Robinson. Capital, $300,000; authorized $3,000,000. Bonds $700,000. Office 503 E. Preston st. 1 4

City & Suburban Ry. Co. Elec. (Includes Union Pass. Ry., York Road Ry., Baltimore, Catonsville & Ellicott's Mills Ry. and Highlandtown & Point Breeze Ry.) 61 m, 5-4½ g, 25, 45, 65 lb T and girder r, 130 c of which 100 are m c and 30 h c, 300 mu. Gen. Elec. system. Brill, Lewis & Fowler, Laclede and Stephenson cars. McIntosh & Seymour engines. Pres. N. Perin, V. Pres. G. C. Jenkins, Sec. L. Fender, Treas. E. J. Cross, Gen. Man. J. F. Heyward, Ch. Engr. F. H. Sloan. Capital, $3,000,000. Bonds, $1,430,000; authorized $3,000,000. 3 4

Lake Roland Elevated Ry. Co. Elec. 25.68 m 5-4½ g, 52, 66 T and Duplex r, 42 c of which 39 are m c and 3 t c. T-H and Edison systems. Fowler, Lewis & Fowler and Pullman cars. Corliss engines. Pres. J. L. McLane, V. Pres. R. R. Conklin, Sec. E. H. Bouton, Treas. W. C. McHenry, Gen. Man., Supt., Pur. Agt. & Ch. Engr. L. N. Frederick, Elecn. W. A. McClelland, Ch. Engr. of Power Station, E. Van Gorder. Capital, $1,000,000. Bonds, $1,000,000. Office, Roland Park. 1 4

BANGOR, ME.—Bangor St. Ry. (Owned and operated by Public Works Co.) Elec. 8½ m, 4-8½ g, 35 lb tram & T r; 25 c, of which 22 are m c and 3 t c. T-H system. Newburyport cars. Pres. F. M. Laughton, Sec. J. R. Mason, Treas. and Gen. Man. J. H. Cutler, Supt. Ry. Dept. J. G. Carroll, Pur. Agt. J. H. Green, Chief Eng. J. G. Kimball. Capital, $200,000. Bonds, $200,000. 4 4

BANGOR, PA.—Bangor, Pen Argyl & Water Gap Ry. Co.

BATH, ME.—Bath St. Ry. Co. Elec. 4½ m, 4-8½ g. 50 lb. T r. 8 c, of which 6 are m c and 2 t c. Westinghouse system. Lewis & Fowler and Newburyport cars. Ball & Wood engines. Pres. A. H. Shaw, Sec. C. C. Low, Treas. F. H. Twitchell, Gen. Man. A. F. Gerald. Supt. C. E. Gahan, Elecn. F. Lord, Ch. Engr. of Power Station, J. C. Humphries. 1 4

BATON ROUGE, LA.—Baton Rouge Electric Ry Co., 5¾ m. Gen. Elec. system. Pres. B. F. Meyer, O. P. Steell, Treas. W. J. Knox.

BATTLE CREEK, MICH.—Battle Creek Electric Ry. Co. 8.2 m, 4-8½ g, 42 lb tram r; 18 c, of which 8 are m c and 10 t c. Short system. St. Louis cars. Williams engines. Receiver E. C. Hinman. Capital, $100,000. Bonds, $110,000. Office, 15 & 17 Annex Building. 1 4

BAY CITY, MICH.—Bay Cities Consolidated Ry. Co. (Covering Bay City and West Bay City.) 23 m, of which 2 are horse and 21 elec., 19 m s, 4-8½ g, 45, 60 lb tram and T r, 65 c, of which 15 are h c, 32 m c, 14 t c and 4 flat c, 20 h. Edison and Westinghouse systems. Brill, Illinois and Stephenson cars. Corliss engines. Pres. W. B. McKinley, V. Pres. R. S. Hunter, Sec. W. S. Hood, Treas. D. Slack, Gen. Man. & Pur. Agt. C. C. Rush, Supt. & Elecn. C. L. Harry, Ch. Eng. of Power Station L. Rodandsville. Capital $900,000. Bonds $470,000. 1 4

BAY RIDGE, MD.—Arundel on the Bay R. R. (Operated by Chesapeake & Columbia Investment Co.) Steam. 2 m, 4-8½ g, 30 lb T r, 4 c, 1 engine. Brill cars, Rhode Island loc. Pres. T. W. Smith, V. Pres. W. P. C. Hazen, Sec. L. Cavanaugh, Treas. N. H. Shea, Gen. Man. D. D. Stone, Supt. L. Cavanaugh. Capital, $100,000. Office, 1st and Ind. Ave., Washington, D. C. 1 4

BEATRICE, NEB.—Beatrice Rapid Transit & Power Co. Elec. 6 m, 4-8½ g, 38, 52 lb girder & T r, 8 c, of which 4 are m c and 4 t c. Short system Receiver M. C. Steele, Pres. N. N. Brumback, V. Pres. C. L. Schell, Sec. L. E. Spencer, Treas. S. K. Davis, Supt. G. M. Johnston. Capital $250,000. Office Cor Court & 8th Sts. 11 2

BEAUMONT, TEX.—Beaumont St. Ry. Co. 2½ m, 4-8½ g, 25 lb T r, 3 c, 12 mu. Pres. G. W. Carroll V, Pres. W. R. Caswell, Sec., Treas., Gen. Man. & Pur. Agt. J. H. Rachford. Capital, $8,200; authorized $100,000. 1 4

BEAVER FALLS, PA.—Beaver Valley Traction Co. (Includes Central Electric St. R. R Co. and College & Grand View Co.) Elec. 9 m, 5-2 g, 45, 56, 72 lb. girder & T r, 15 c, of which 12 are m c and 3 t c. T-H system. Brill cars. Buckeye engines. Pres. J. M. Buchanan, V. Pres. T. P. Simpson, Sec. & Gen. Man. H. P. Brown, Treas. S. P. Stone. Capital, $300,000. Bonds, $150,000. 1 4

College & Grand View Electric R. R. Co. (Extension of Beaver Valley Traction Co.) 1½ m, 1½ m s, 5-2 g, 52 lb girder r, 2 m c. Westinghouse system. New Castle cars. Hire power from Beaver Valley Traction Co. Pres. C. P. Wallace, V. Pres. G. E. Smith, Sec. A. R. Leyda, Treas. J. B. Sherwood, Gen. Man. & Supt. J. N. Kimmins, Elecn. F. Mason. Capital, $15,000. Office 1011 7th Ave. 1 4

BELLAIRE, O.—Bellaire, Bridgeport & Martin's Ferry St. R. R. Co. (See Bridgeport, O.)

BELLEVILLE, ILL.—Belleville electric R. R. Co.

BENSON, NEB. — Benson & Halcyon Heights Ry. Co. Elec. 2 m, 4-8½ g, 20 lb T r, 2 m c. Westinghouse system. Pres. W. H. Crary, Supt. E. H. Cone 8 3

BEREA, O.—Cleveland & Berea St. Ry. Co. 10¼ m. 10 m s, 4-8½ g, 45, 56 T and girder, r, 6 c, of which 5 are m c and 1 t c. 2 h. Pres. & Pur. Agt. C. W. D. Miller, V. Pres. F. T. Pomeroy, Sec. & Treas. A. H. Pomeroy, Supt. A. W. Bishop. Capital, $90,000 authorized, $150,000. Bonds, $73,000. 1 4

BERKLEY, VA.—The Berkley St. Ry. Co. 2 m, 2 m s, 4-8½ g, 20 & 42 lb c. b., & T. r, 7 c, 11 h, 7 mu. Jones and Stephenson cars. Pres. T. H. Synon, Sec. Treas. & Gen. Man. W. Tillotson. Capital, $8,750; authorized $75,000. Bonds $9,000. 1 4

BIDDEFORD, ME.—Biddeford & Saco R. R. Elec 6 m, 4-8½ g, 35 lb T r, 18 c, of which 4 are 4-wheel box 7 m c and 7 t c. T-H system. Jones cars. Westinghouse engines. Pres. E. H. Banks, Sec. Treas. & Pur. Agt. Chas. H. Prescott, Ch. Engr. of Power Station J. Hunt, Jr. Capital, $40,000. Bonds, $90,000. Office, 154 Main st. 1 4

BINGHAMTON, N. Y.—Binghamton R. R. Co. (Operates all roads in the city) 27 m, of which 2 are horse and 25 elec, 24½ m s, 4-8½ g, 30. 50, 62½, 72½, lb T and girder r, 80 c, of which 6 are h c and 60 m c, 14 t c, 18 h. Edison and T-H systems. Ball & Wood engines. Pres. G. T. Rogers, 1st V. Pres. J. Evans, 2d V. Pres, J. L. Candfield, Sec. C. O. Root, Treas. J. B. Rogers, Gen. Man. Supt. & Pur. Agt. J. P. E. Clark, Ch. Engn. & Ch. Eng. of Power Station H. R. Bowen, Elec'n. W. Merritt. Capital, $324,060; authorized $500,000. Bonds, $340,000. Office, Power Station. 1 4

Court st. & East End R. R. (Operated by Binghamton R. R. Co.)

West Side St. Ry. Co. (Operated by Binghamton R. R. Co.)

BIRMINGHAM, ALA. — Birmingham Ry. & Electric Co. 58 m, of which 43 are steam, and 15 elec 4 8½ g, 40-58 lb T & Johnson girder r, 104 c, of which 32 are h. c. 36 steam, 24 m. c. and 12 t. c, 50 h. T-H system. Pres. T. T. Hillman, V. Pres. & Gen. Man. R. Jemison, Sec. & Treas. Jas. A. Stratton, Supt. J. B. McClary. Capital, $1,900,000; authorized, $3,000,000; Bonds, $927,000. Office, 303 20th St. 1 4

Bessemer & Birmingham R. R. Co. (Owned by Birmingham Ry. & Elec. Co.) 13½ m, 4-8½ g, 40 lb T. r, 15 c. of which 10 are 8 wheel box and 5 8-wheel open, 4 frgt. c, 5 steam motors. Pres. T. T. Hillman, V. Pres. & Gen. Man. R. Jemison, Sec. J. A. Stratton, Supt. J. B. McClary Capital $250,000. 4 4

Birmingham & Forest City Dummy St. R. R.. 4 m, 4-8½ g, 38 lb. r., 2 dummies, 2 coaches. Pres. & Man. E. Eastman. 9

East Birmingham Land & Ry Co., 10 m 7 m s, 4-8½ g, 16 lb T r, 10 c 3 dummies. Pres. E. T. Martin, Sec. P. Barnett, Treas. R. M. Mulford, Supt. J. H. Heineke. Capital $1,022,800. Bonds $50,000.

Highland Ave. & Belt R. R. Co. 29 m, 4-8½ g, 40 lb T r and 14 pass. c, 9 engines. Pres. F. M. Billing Treas. & Gen. Man. J. London, Supt. F. T. Bradford, Aud'r L. F. Worl. Gen. Frt. Agt. J. E. Scott. Capital $1,000,000. Office, 9 N. 20th St. 9 2

North Birmingham St. R. R. Co. 5.75 m, 4 m s, 4-8½ in., 36 lb r 8 c 4 dummies. Pres. E. M. Tutwiler, Sec. & Treas. M. F. Gorman. Capital $65,000.

BLOOMFIELD, N. J.—Newark & Bloomfield R R. (See Newark, N. J.)

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BRANCHES:

BLOOMINGTON, ILL.—The Bloomington City Ry. Co. 11 m, 11 m s, 4-8½ g, 45, 47 lb T r, 25 c, of which 15 are m. c. and 10 t. c. Westinghouse and Short systems. St. Louis cars. Buckeye engines. Pres. John J. Patterson, V. Pres, Sec., Treas. Gen. Man. & Pur. Agt. W. H. Patterson, Elecn. D. Barclay, Ch. Engr. of Power Station C. Maguire. Capital, $600,000. Bonds, $209,000. 8

BLOUNTSVILLE, ALA.—Blountsville & Bangor Dummy Line Co. 12½ m. Pres. A. E. Fields, V. Pres. W. M. Cole, Sec. J. L. Montgomery, Treas. W. M Fennell, Gen. Man. C. Ternen, Supt. J. A. B. Lovett. 1 3

BOISE CITY, IDAHO.—Boise City Rapid Transit Co. Elec. 3 m, 4-8½ g, 35 lb T r, 2 m c. Edison system. Brill cars. Pres. G. Ainslee, V. Pres. D. Arnold, Sec. G. E. Gray, Treas. & Gen. Man. G. D. Ellis. Capital $56,000; authorized $200,000. Office Main St. 9 3

BOONE, IA.—Boone Electric St. Ry. Light & Power Co. 1¾ m, 3 g, 22 lb Tr, 3 c. 9 h. Pres. L. W. Reynolds, V. Pres. D. N. De Tar, Sec. Gen. Man. & Supt. S. T. Stanfield, Treas. C. E. Rice. 1 4

BOSTON, MASS.—Boston & Chelsea R. R. Co. (Leased to West End St. Ry. Co. operated by Lynn & Boston Ry. Co.) 4.154 m, 4-8½ g, 48-56 lb girder r Pres. W. G. Wheilden, Treas. & Clerk, John H. Studley, Jr. Office, 81 Milk st. Capital $121,000. 1 4

Boston & Revere Electric St. Ry. Co. 4-30 m, 4-8½ g, 56 lb T r, 16 c, of which 6 are 4-wheel open m.c. and 10 are 4-wheel open t.c. T-H system. Pres. & Man. Washington G. Benedict, Sec. & Treas. Ellery I. Garfield. Capital $50,000. 11 2

East Middlesex St. R. R. Co. (Controlled by Lynn & Boston R. R. Co.) 18.31 m, of which 12.31 are horse and 6 elec, 4-8½ g, 42, 70 lb r, 48 c. of which 39 are h c and 9 m c, 185 h. T-H system. Pres. A. F. Breed, Sec. L. F. Arnold, Treas. D. H. Sweetser, Supt. J. E. Sewell. Capital, $300,000. Bonds, $225,000. Office, 35 Congress st. 1 4

Lynn & Boston. (See Lynn, Mass.)

Malden & Melrose R. R. Co. (Owned by West End St. Ry. Co.) 3 4

North Shore Traction Co. (See Lynn, Mass.)

Somerville Horse R. R. Co. (Operated by the West End St. Ry. Co.) 5.4 m, 4-8½ g, 56 lb r Boston pattern. Pres. Josiah Q. Bennett, Somerville, Treas & Clerk, J. H. Studley, Jr. Office, 81 Milk st. Capital, $153,000. 1 4

West End St. Ry. Co. (Includes Boston & Chelsea, Malden & Melrose, Somerville), 254 m, of which 71 are horse and 183 are elec., 150 m s, 4-8½ g, 50 to 100 lb. tram & girder r, 2172 c, of which 826 are h c, 1346 m c. 2123 h. T-H system. Brownell, Jones, Pullman, Newburyport, etc. cars, Allis, Armington & Sims and McIntosh & Seymour engines. Pres. S. Little, V. Pres. P. Cummings, Treas. J. H. Goodspeed, Gen. Man. C. S. Sergeant, Auditor, H. L. Wilson, Pur. Agt. H. F. Woods, M. Mech. L. J. Hirt, Elecn. R. C. Brown, Ch. Engr. of Power Station C. F. Baker. Capital, $15,485,000; authorized $16,400,000. Bonds, $6,250,000. Office, 81 Milk St. 1 4

Winnisimmet R. R. Co. Elec. 2.0153 m, 4-8½ g, 70 lb girder r, T-H system. Pres. T. P. Proctor, Boston, Mass., Treas. & Clerk, E. Francis Oliver, Boston. Capital, $50,000; authorized, $75,000. Office 32 Pemberton St. Leased to Lynn & Boston Co. 5 3

BOWLING GREEN, KY.—Park City Ry. Co. 2½ m, 2 m s 5-0½ g, 30 lb T r, 7 c, 10 mu. Brownell and Stephenson cars. Pres. J. D. McGoodwin, V. Pres. & Gen. Man. J. E. Du Bose, Sec. L. R. Porter, Treas. C. G. Smallhouse, Supt. T. J. Smith. Capital $50,000. Bonds $5,000. 5 4

BRADDOCK, PA.—Braddock & Turtle Creek St Ry. Co. Elec. 3.7 m, 5-2½ g, 40, 48½ lb T & Johnson girder r, 6 m c, Westinghouse & T-H systems Pres. J. D. Callery, Pittsburgh, Pa., Sec. J. C. Reilly, Pittsburgh, Pa., Treas. J. W. Taylor. Capital $62,000. Bonds $50,000. 7 2

Braddock Electric Ry. Co. 3¾ m, 5-2½ g, 48½ lb Johnson girder r, 5 m. c. Short system. Pres. A. L Sailor, V. Pres. J. P. McKelvey, Sec., Treas. & Man. C. F. Ellis. Capital, $80,000; authorized, $100,000. Bonds, $40,000. Office, Bell Ave. 1 4

BRADFORD, PA.—Bradford & Kendall Ry. Co 1½ m, 4-8½ g, 35 lb T & flat r, 2 c, 5 h. Pres. & Gen Man. W. S. Wales, Sec. & Supt. M. F. King, Treas G. S. Wales. Capital, $12,000. 9 2

BRANTFORD, CAN.—Brantford St. Ry. Co. 6½ m, 6½ m s, 4-8½ g, 40 lb T r, 10 c, of which 9 are m c and 1 t c. Gen. Elec. system. Patterson & Corbin cars. Waterous engines. Pres. F. Nicholls, V. Pres. H. P. Dwight, Sec. W. S. Andrews, Gen. Man. & Pur. Agt. J. T. Madden, Supt. Elecn. & Ch. Engr. of Power Station J. Mylin. 4 4

BRIDGEPORT, CONN.—Bridgeport Traction Co. (Controls Bridgeport Ry., Bridgeport Horse R. R. and East End Ry. companies.) 19 m, 4 8½ g, 30, 45, 56 lb T, c b & s b r, 84 c, 435 h. Brill, Jones and Stephenson cars. Pres. & Pur. Agt. N. H. Heft, V. Pres. E. S. Ward, Sec. T. L. Watson, Treas. W. Scheerer, Supt. A. Radel. Capital $2,000,000. Bonds authorized $780,000. 4 4

The East End Ry. Co. (Controlled by Bridgeport Traction Co.) 6 m, 4-8½ g, 35 & 45 lb T r, 27 c, of which 15 are 2-h. and 12 1-h, 200 h. Pres. N. H. Heft, Treas. W, H. Scheerer, Supt. T. B. Lashar. Capital $42,550; authorized, $100,000. Bonds, $12,000. 5 3

BRIDGEPORT, O.—Bellaire, Bridgeport & Martin's Ferry St. R. R. Co. 11½ m, 5-2 g, 65, 83 lb girder r, 13 m c 3 h. T-H system. New Castle cars. Buckeye engines. Pres. J. K. Jolly, V. Pres. P. D. Nicols, Sec. R. T. Howell, Treas. A. R. Leyda, Supt. J. G. Ourey. Capital, $250,000. Bonds, $150,000. 9 3

BRISTOL, TENN.—Bristol Belt Line Ry. Co. 7 m, 4-8½ g, 35 lb T r, 7 c, of which 5 are m c and 2 t c. Short & Edison system. Pres. J. L. Stadelman, Sec. & Gen. Man. W. A. Stadelman, Treas. Aaron Ward Morris. Capital, $250,000. Bonds, $75,000. 12 2

BROCKTON, MASS.—Brockton St. Ry. Co. (includes East Side, Brockton & Holbrook and Whitman Rys). 35 m, 31 m s, 4-8½ g, 35 40 & 45 lb T r; 75 c, of which 49 are m c and 26 are t c. T-H system. Briggs, Brill, Jones, Newburyport and Stephenson cars. Ball engines. Pres. G. H. Campbell, Treas. A. A. Glasier, Asst. Treas. H. E. Reynolds, Gen. Man. & Pur. Agt. H. B. Rogers. Elecn. E. J. Rauch, Ch. Engr. of Power Station E. C. Baker. Capital, $250,000. Bonds, $500,000. Office, 203 Main st. 1 4

BROOKLYN, N. Y.—Atlantic Avenue R. R. Co. of Brooklyn. (Operates Brooklyn, Bath & West End R. R. Co. Controlled by Brooklyn Traction Co.) 144 m, 22 m s 4-8½ g, 90 lb girder r, 415 c. Westinghouse system. Brownell and St. Louis cars. Cooper-Corliss engines. Pres. & Gen. Man. B. Norton, Sec. & Treas. W. J. Richardson, Supt. H. R. Newkirk. Pur. Agt. W. M. Tobias. Elecn. F. Silliman, Jr. Capital, $2,000,000. Bonds $4,500,000. Executive office, Franklin Trust Co. Building, Montague St.; Supt's office, cor. Atlantic & Third aves. 4 4

Brooklyn City & Newtown R. R. Co. Elec. 21½ m, 4-8½ g, 58-96 lb girder r, 256 c of which 108 are m c and 148 t c 15 h. Westinghouse system. Brill, Jones and Stephenson cars. Westinghouse, Church, Kerr & Co. engines. Pres. John N. Partridge, V. Pres. L. Fitzgerald, Sec. & Treas. Duncan, B. Cannon, Supt. John L. Heins. Capital, $1,000,000; authorized $2,000,000. Bonds, $1,850,000. General office, 120 Broadway. Executive office, cor. DeKalb & Central aves. 4 4

Brooklyn Elevated R. R. Co. 34.7 m, 16.9 m s, 4-8½ g, 60 lb T r, 242 c, 76 locomotives. Pres. A. Ladenburg, V. Pres. A. Barrett, Sec. & Treas. F. Uhlmann, Gen. Man. & Ch. Eng. O. F. Nichols. Capital $13,283,600. Bonds $12.968,000. Office, 31 Sands st. 1 4

Brooklyn Heights R. R. Co. (Lessee of Brooklyn City R. R. and Brooklyn, Queens Co. & Suburban R. R., and controlled by Long Island Traction Co.) 245 m of which 56.1 are horse, 187.8 elec., and 1.1 cable. 4-8½ g, 50 65 lb tram and girder r, 1,968 c of which 1430 are h c, 421 m c, 109 t c and 8 g c; 4,950 h. Curtis, Gen. Elec. and Westinghouse systems. Brill, Jones, Pullman, St. Louis and Stephenson cars. Pres. D. F. Lewis, V. Pres. E. W. Bliss, Sec. & Treas. C. P. Smith, Gen. Man. W. A. H. Bogardus, Supt. of cable division A. Rogers, Ch. Engr. M. G. Starrett, Ch. Engr. of Power Station C. A. Moore. Capital, $200,000. Bonds, $250,000. Office, 168 Montague St., 4 4

Brooklyn City R. R. Co. (Leased to Brooklyn Heights R. R. Co.) Capital authorized and issued, $6,000,000. Bonds, $3,925,000.

Brooklyn, Queens Co. & Suburban R. R. Co. (includes Broadway Ferry & Metropolitan Ave. R. R. Co., Broadway R. R. Co., Jamaica & Brooklyn R. R. Co. Operated by Brooklyn Heights R. R. Co, and controlled by Long Island Traction Co.) Pres. C. M. Englis, V. Pres. C. M. Wicker, Sec. H. T. Bragg, Asst. Treas. B. J. Mullin, Supt. C. E. Harris, Elecn. T. M. R. Meikleham. Capital $2,000,000. Office 21 Broadway. 2 4

Brooklyn Traction Co. Pres. J. P. Ilsley, Sec. & Treas. C. F. Stevens. Capital $9,000,000. Bonds $3,000,000. 4 4

Coney Island & Bklyn R.R. Co. Elec. 22 m, of which 16 are horse & 6 elec., 45 & 60 lb r, 4-8½ g, 115 c, of which 40 are box, 61 open and 14 m. c., 300 h, T-H and Edison systems. Pres. H. W. Slocum, Sec. & Treas. E. F. Drayton Supt. D. W. Sullivan. Office, cor. Smith & Huntington sts. Capital, $500,000. 4 2

Franklin Ave. R. R. Branch of Brooklyn City & Newtown R. R. Co. Elec. 9 m, 4-8½ g, 98 lb girder r, 72 c, of which 40 are 4-wheel box and 32 are 4-wheel open. Westinghouse system. 8 3

Kings County Elevated R. R. Co. 19½ m, 9 m s, 4-8½ g, 60, 70 lb T r, 138 c, locomotives 43. Pres. J. Jourdan, V. Pres. W. Goodwin, Sec. H. J. Robinson, Treas. J. H. Frothingham, Gen. Man. & Supt. W. T. Goundie. Capital, $3,250,000; authorized, $500,000 per mile. Bonds, $7,188,700. Office, 346 Fulton st. 1 4

Long Island Traction Co., Pres. D. F. Lewis, V. Pres. E. W. Bliss, Sec. & Treas. C. P. Smith, Gen. Man. W. A. H. Bogardus. Capital $30,000,000. 4 4

Prospect Park & Flatbush R. R. Co. 3 m, 4-8½ g, 34 lb r, 4 box c, 10 h. Pres, H. W. Slocum, Sec. & Treas H. W. Slocum, Jr., Supt. D. W. Sullivan. Office, 45 Broadway. Capital $50,000. 4 2

Van Brunt St. & Erie Basin R.R. Co. 2½ m, 4-8½ g, 45 lb s b r, 19 c, 41 h. Pres. Michael Murphy, Sec. & Treas. Wyllys Terry, Supt. T. J. Carey. Capital authorized and issued, $150,000. Bonds, $25,000. Offices, 264 Van Brunt st. 9 2

BROWNSTOWN, IND.—Brownstown & Ewing St. R, R. Co. 2 m, 5-4 g, T r, 1 c, 4 h, 2 mu. Pres. & Supt. F. Falk, V. Pres. & Sec. W. L. Bryatt, Treas. G. H. Hines Capital, $3,500; authorized, $5,000. 5 3

BRUNSWICK, GA.—Brunswick St. R. R. Co. 9 m, 4-8½ g, 48½ lb T and girder r, 15 c, 50 mu, 1½ m on St. Simon's Island, with 2 connecting steamboat lines. Stephenson cars. Owners. A. J. Crovatt, J. E. Dubignon, A. H. Lane, W. O. Allison, Gen. Man. W. E. Recknagel. Office, Newcastle st. Capital, $200,000. 6 3

BUFFALO, ILL.—See Mechanicsburg, Ill.

BUFFALO, N. Y.—Buffalo Railway Co. (Operates Crosstown Ry.) 125 m, of which 22 are horse and 103 elec 75 m s, 4-8½ g, 62 lb girder r, 345 c, of which 60 are h c, 185 m c and 100 t c, 450 h. T-H system. Lake Erie engines. Pres. Henry M. Watson, V. Pres. & Gen. Man. H. H. Littell, Sec. & Treas. Joseph S. Baecher, Supt. F. O. Rusling. Capital, 5,370,500; authorized, $6,000,000. Bonds, $6,500,000. Office, 178 Main st., Buffalo. 1 4

Crosstown St. Ry. Co. (Operated by Buffalo Ry. Co.) Elec. 52 m, 4-8½ g, 67 lb girder r, 60 m c. T-H system. Pres. & Gen. Man. H. H. Littell, Sec. & Treas. J. S. Baecher, Supt. F. O. Rusling. Capital, $1,500,000. Bonds, $1,500,000. 8 3

Buffalo & Tonawanda Electric Ry. Co. 6 m, 4-8½ g, 45 lb T & girder r, 8 c, of which 3 are m c and 5 t c T-H & Edison systems. Pres. E. H. Butler, V. Pres M. Nellany, Sec. & Treas. C. M. Howard, Supt. W. J Voorhees. Capital, $125,000; authorized $250,000. 9 2

Buffalo & Williamsville Electric Ry. Co. (See Williamsville, N. Y.)

Buffalo, Bellevue & Lancaster Ry. Co. (See Lancaster, N. Y.)

Buffalo, Kenmore & Tonawanda Electric Ry. Co. 5.99 m, 5.99 m s, 4-8½ g, 56, 72½ lb T & girder r, 4 m c. T-H system. Brill cars. Noye Engines. Pres. D. F. Callahan, V. Pres. D. F. Mack, Sec. G. H. Frost, Treas. J. L. Donovan, Supt. Pur. Agt. Ch. Engr. Elecn. & Ch. Engr. of Power Station H. E. Heller. Capital $50,000. 1 4

Buffalo, North Main St. & Tonawanda R. R. Co. Elec. 5¾ m, 4-8½ g, 65-90 T r, 3 m c. Edison system. Brill cars. Pres. L. F. W. Arend, V. Pres. D. Gordon, Sec. E. G. Hoag, Treas. B. A. Cook, Supt. & Elecn. J. W. Towle. Capital $60,000. Office 110 Franklin st. 4 4

BURLINGTON, IA.—Burlington Electric Ry. Co. 11 m, 10 m s, 4-8½ g, 40 lb T r, 22 c, of which 15 are m c and 7 t c. Westinghouse system. Stephenson cars. Westinghouse engines. Pres. F. G. Jones, V. Pres., H. C, Garrett, Sec, E. G. McInnes. Treas., J. M. Jones, Supt. & Pur. Agt., C. D. Jones. Capital, $650.000. Bonds, $425,000. 4 4

BURLINGTON, VT.—Winooski & Burlington St. Ry. Co. 6.38 m, of which 1.50 are horse and 4.88 Elec. 4-8½ g, 50 lb T r, 17 c, of which 8 are m c and 9 h c and t c, 24 h. Gen. Elec. system. Gilbert cars. Pres. Elias Lyman, V Pres. J. A. Powers, Sec. & Treas W. F. Hendee, Supt. T. B. Jones. Capital, $135,000; authorized. $200,000. Bonds, $100,000. Office, 186 College st. 8 3

BUTTE, MONT.—Butte Consolidated Ry. Co. 15 m, of which 1½ are cable, 2 steam and 13½ elec, 4-8½ g, 40 and 50 lb T r, 24 c, of which 5 are steam, 4 g c, 10 m c and 5 t c. Edison system. Pres. W. Bennett, Sec. & Gen. Man. J. R. Wharton, Treas. W. A. Clark. Capital, $500,000. Office, Main & Park sts. 5 4

C

CAIRO, ILL.—The Delta Electric Co. 4 m, 4-8½ g 45 lb T r, 6 c, of which 4 are m c and 2 t c. Detroit system. St. Louis cars. Russell engines. Pres. W. Kluge, V. Pres. A. Miller, Sec. & Gen. Man. H. Schulze, Treas, H Hasenjaeger. Capital, $150,000. Bonds, $60,000. Office 1010 Washington av. 8 3

CAMDEN, N. J.—Camden & Atlantic R. R. Co Elec. 6½ m, 4-9 g, 60 lb. r, 18 motor & 19 trail c Pres. G. B. Roberts, V. Pres. Wm. J. Sewell, Sec. J R. McClure, Treas. W. Taylor, Supt. A. O. Dayton Office 233 S. 4th st., Phila. 7 1

Camden, Gloucester & Woodbury Ry. Co. Elec. 15 m, 5 g, 80 lb. girder r, 42 c, of which 12 are m c and 30 t c. Westinghouse system. Lamokin cars. Westinghouse engines. Pres. J. Willard Morgan, Sec. T. P. Curley, Treas. W. J. Tompson, Engr. J. J. de Kinder, Supt. H. M. Royal. Capital, $600,000. Bonds, $250,000. 9 3

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BRANCHES

Camden Horse R. R. Co. Elec. 28¼ m, of which 11½ are horse and 16¾ elec. 5 g., 47, 52, 63½, 80 lb s-b Duplex and girder r, 74 c, of which 28 are h c, 26 m c and 18 t c, 150 h. Edison, T-H and Westinghouse systems. Brill, Lewis & Fowler and Stephenson cars. Westinghouse and Ball engines. Pres. Wm. S. Scull, V. Pres. B. C. Reeve, Sec. Morris W. Hall, Treas. G. G. Browning, Supt. S. J. Fenner. Capital, $250,000. Bonds, $150,000. Office, 307 Market st. 8 3

CANANDAIGUA, N. Y.—Canandaigua Electric Lt. & R. R. Co. 2 m, 4-8½ g, 42 lb girder r, 6 c of which 3 are m c and 3 t c. Gen. Elec. system. Payne engines. Pres. M. D. Munger, Sec. & Treas. H. B. Ferguson, Gen. Supt. & Elecn. C. J. Purdy. Capital, $?0,000. 4 4

CANTON, O.—Canton St. Ry. Co. Elec. 6¾ m 4 g, 40 & 50 girder & T r, 38 c, of which 24 are m. c and 14 t. c. Edison system. Pres. & Treas. W. A Lynch, V Pres. R. A. Miller, Sec. A. J. Underhill, Supt. T. R. Catlin. Capital $300,000. Office, 275 W. Tuscarawas st. 3 4

Lakeside St. R. R. Co. Elec. 2½ m, 4 g, 40 lb T r, 12 c, of which 6 are m. c. and 6 t. c. Summer line. Officers, same as above. 3 4

CAPE MAY, N. J.—Cape May, Delaware Bay & Sewell's Point Electric Ry. Co. 6¼ m, 4-8½ g, 45 lb T r, 16 c. of which 10 are m c and 6 t c. Westinghouse system. Brill and Lamokin cars, Ball engines. Pres. G. G. Browning, Sec. & Gen Man. J. J. Burleigh, Treas. B. C. Reeves, Supt. J. H. Edmunds. Capital, $150,000. Bonds, $150,000. Office, Camden. 8 3

CARBONDALE, PA.—Carbondale Traction Co. Elec. 9.4 m, 5-2 g, 48, 50 lb T & girder r, 9 m c. Curtis and T-H systems. Brill and New Castle cars. Frick engines. Pres. J. W. Aitken, Sec. Treas. & Pur. Agt. M. F. Thompson, Gen. Man. & Elecn. W. F. Sadler, Jr., Supt. & Ch. Engr. of Power Station J. Dempsey. Capital, $150,000. Bonds, $150,000. 1 4

CARTERVILLE, MO.—Southwest Missouri Electric Ry. Co. (See Webb City.)

CARTHAGE, MO.—Carthage Horse Ry. Co. 4½ m, 3-6 g, 16-30 lb T r, 5c, of which 4 are box and 1 open, 2h, 18 mu. Pres. J. Guinney, Sec. J. W. Halliburton, Gen. Man. & Supt. E. A. Sexton. Capital $30,000. Bonds $10,000. Office, 19 S. Grant st. 1 4

CEDAR RAPIDS, IA.—Cedar Rapids & Marion Ry. Elec. 14 m, 4-8½ g, 45, 58 lb T & girder r, 25c, of which 18 are m c and 7 t c. T-H system. American and St. Louis cars. Allis engines. Pres P. E. Hall, V. Pres. W. D. Douglas, Sec. J. S. Ely, Treas. C. H. Clark, Supt. F. L. Diserens. 1 4

CENTERVILLE, IA.—People's St. Ry. Co. 1.6 m, 3-8 g, 20 lb. T r, 2 4-wheel box c, 14 mu. Robinson & Hitt cars. Pres. J. R. Wooden, Sec. & Treas. C. R. Wooden. Capital $12,(00; authorized, $25,000. 1 4

CENTRALIA, ILL.—Centralia & Central City St. Ry. Co. 3¼ m, 4-8½ g, 25 lb T r, 8 c, 14 mu. Pres. S. N. Pierce, V. Pres. J. Grush, Sec. G. P. Duncan, Treas. A. Dunker, Supt H. M. Johnson. Capital, $7,950; authorized, $10,000. 8 3

CHAMPAIGN, ILL.—Urbana & Champaign St Ry.Co. (Lessee of Champaign Rapid Transit.) Elec. 9 m, 4-8½ g, 40-48 lb T r, 12 c. of which 6 are m. c. and 6 t c. Westinghouse system. Pres.,Treas. & Gen. Man. B. F Harris, Jr., Gen. Supt. H. J. Pepper. Capital, $150,000. Bonds, $50,000. 11 2

Champaign Rapid Transit Co. Leased to Urbana & Champaign St. Ry. Co. Elec. 3 m, 4-8½ g 50 lb. T r, 3 m. c. Westinghouse system. Capital, $50,000. 11 2

CHARLESTON, S. C.—Charleston City Ry. Co. 14½ m, 4-8½ g, 38 & 42 lb c. b. r, 37 c, 153 h and mu. Stephenson cars. Pres. & Pur. Agt. Jno. S. Riggs, Sec. & Treas. Frank F. Whilden, Supt. John Mohlenhoff. Office, 4 Broad st. 1 4

Enterprise R. R. Co. 16 m, 5 g, 30 & 40 lb c b & T r 35 c, 87 h, 16 mu. Brill and Jones cars. Pres. and Gen. Man. T. W. Passallaigue, Sec. & Treas. P. J. Balaguer. Capital, $250,000; authorized, $500,000. Bonds, $47,000. Office, Cor. Shepard and Meeting Sts. 2 4

Middle Street Sullivan's Island Ry. Co. 2¼ m, 4-8¼ g, 20 & 30 lb T r, 7 c, 14 mu. Pres. B. Callaghan, Sec & Treas. Frank F. Whilden, Supt. B. Buckley Capital $15,000. Office 4 Broad st. 1 4

CHARLESTON, W. VA.—Charleston St. Ry. Co 4 m, 4-8½ g, 35 lb. s. b. r, 6 open c, 7 h, 12 mu. Sec E. W. Bridge, Treas. & Gen. Man. J. D. Campbell Supt. W. B. Carder. Capital, $50,000. Bonds, $10,000 Office, 215 Kanawha st. 3 2

CHARLOTTE, N. C.—Charlotte St. Ry. Co. Elec 5½ m, 4-8½ g, 40-45 lb T & girder r, 9 c, of which 6 are m c and 3 t c. Edison system. Brill cars. Armington & Sims engines. Pres. & Treas. E. D. Latta, V. Pres. E. B. Springs, Supt., Pur. Agt. & Elecn. L. O. Williams, Auditor, F. A. Savin. Capital, $60,000. Bonds $100,000 1 4

CHARLOTTESVILLE, VA.—Charlottesville & University St. Ry. Co. 1¾ m, 4-8½ g, 16 lb T r, 6 c, 2 h, 13 mu. Lewis & Fowler cars. Pres., Treas. & Gen. Man. R. P. Valentine, Sec. Geo. Perkins, Supt. H. D. Porter. Capital, $10,000; authorized, $100,000. Bonds, $22,000. 8 3

CHATTANOOGA, TENN.—Chattanooga & North Side St. Ry. Co. (Operates North Chattanooga St. Car line) 6¼ m, 3 m s, 4-8½ g, 56 lb. girder & T r. 9 c of which 3 are h c and 6 t c. T-H system. Stephenson cars. Armington & Sims engines. Pres. & Gen. Man. S. R. Read, V. Pres. N. E. Barker, Sec. & Treas. W. H. Hart, Gen. Man. S. R. Read, Supt. Pur. Agt. Elecn. & Ch. Engr. of Power Station W. C. Teas, Ch. Engr. of Power Station R. C. Henry. Capital, $40,000. Bonds, $60,000. Office Read Home. 2 4

North Chattanooga St. Car Co. (Operated by Chattanooga & North Side St. Ry. Co). 3 m, 3 m s, 4-8½ g, 56 lb T r, 3 m c. Edison system. Stephenson cars. Pres. T. D. Young, Sec. H. C. Beck, Treas. J. Orr, Gen. Man. & Ch. Engr. T. J. Nicholl, Supt. Pur. Agt. Elecn. & Ch. Engr. of Power Station W. T. Teas. 2 4

Chattanooga & Lookout Mountain Ry. Steam 9 m 4-8½ g, 50 lb T r. Supt. W. T. Corby. 2 4

Chattanooga Electric Ry. Co. 40 m, 4-8½ g, 40, 63 lb T & girder r, 36 c, of which 32 are m c and 4 t c T-H, Detroit & Edison systems. Brill and Stephenson cars. Armington & Sims and Taylor engines. Pres. Sec. & Treas. W. T. Adams, V. Pres. E. Watkins Supt. C. J. Gustaison, Ch. Engr. of Power Station R. G. Williams. Capital $1,500,000; authorized $1,500,000. Bonds, $1,200,000. Office Richardson Block. 2 4

Chattanooga Union Ry. Co. dummy line, 44 m 4-8½ g, 56 lb. r, 59 c, of which 17 are pass. c. and 42 freight c. Gilbert and Chattanooga Car & Foundry Co. cars. Baldwin and Rhode Island engines. Pres. H. S. Chamberlain, Sec. & Treas. O. L. Hurlbut, Supt. J. R. Shaler. Capital, $1,000,000. 5 3

Incline & Narrow Gauge Ry. Co. 3¾ m, of which 3 are steam and ¾ incline cable, 3 g, 35 lb T r. Pres D. Woodworth, V. Pres. H. F. Temple. Gen. Man. H C. Evans, Supt. T. M. Derickson. Capital $200,000. Office Lookout Mountain. 2 4

CHESTER, PA.—Chester Traction Co. (controls all lines in the city.) Pres. S. Dyer.

Union Ry. Co. (Operates Chester St. Ry. and Chester, Darby & Philadelphia St. Ry.) 30 m 30 m s, 5-2½ g, 60-90 lb T and girder r, 40 m c. Westinghouse system. Brill and Lamokin cars. Wetherill engines. Pres. S. A. Dyer. Sec. Treas. & Pur. Agt. J. G. Dyer. Gen. Man. & Supt. J. MacFayden, Ch. Engr. & Ch. Engr. of Power Station J. Rostrom, Elecn. M. McDowell. Capital, $450,000. Bonds, $400,000. 1 4

Chester St. Ry. Co. (Leased to Union Ry. Co.) 7½ m, 7½ m s, 5-2¾ g, 60,90 lb girder r. Capital $150,000. 1 4

Chester, Darby & Philadelphia St. Ry. Co. (Leased to Union Ry. Co.) Elec, 8 m, 4-8½ g, 20 m c. Pres. G. C. Hetzel, Consulting Engr. W. E. Clemens, Wakefield, Mass. 5 3

CHICAGO, ILL.—Chicago City Ry. Co. 159.74 m, of which 98.21 are horse, 34.97 cable and 26.56 elec, 79.87 m s, 4-8½ g, 45-100 lb girder r, 1,763 c, of which 700 are open c, 322 g c, 61 m c and 680 box c, 2,000 h. Own cars. Westinghouse system. Pres. Geo. H. Wheeler, 1st V. Pres. J. C. King, 2d V. Pres. E. M. Phelps, Sec. F. R. Greene, Treas. T. C. Pennington, Supt. M. K. Bowen, Pur. Agt. R. L. Garth, Elecn. G. W. Knox, Ch. Engr. of Power Station, R. G. Hill. Capital, $9,000,000. Bonds, $4,619,500. Office, 2,020 State St. 3 4

Calumet Electric St. Ry. Co. Elec. 53 m, 20 m s, 4-8½ g, 78, 80 lb girder r, 106 c, of which 50 are m c and 56 t c. T-H and Detroit systems. American, Lamokin, Pullman and St. Louis cars. Ball and Armington & Sims engines. Pres. R Berger, Sec. & Treas H. B. White, Gen. Supt. J. Oliphant, Jr. Pur. Agt. F. D. Rusling. Ch. Engr. R. H. Yeats, Elecn. H. McNulta, Ch. Engr. of Power Station W. E. Bevington. Capital, $500,000. Office, Burnside crossing. 4 4

Chicago North Shore St. Ry. Co 17 m, 8½ m s. 4-8½ g, 85 lb Johnson girder r, 25 m c. Gen. Electric system. Pullman cars. Wheelock engines. Pres. D. H. Louderbach, V. Pres. J. L. Cochran, Sec. Howard Abel. 8 3

Chicago General St. Ry. Co. (Includes West & South Towns St. Ry. Co). Elec. 11½ m, 4-8½ g, 80 lb girder r, 5 m c. Sperry system. Pullman cars. Siemens & Halske generators. Pres. L. E. McGann, V. Pres. C. L. Bonney, Sec. & Treas. L. C. Bonney. Capital $500,000; authorized $3,000,000. Bonds $200,000. Office 1032 Lawndale Ave. 1 4

Chicago Pass. Ry. Co. 27 m, 4-8½ g, 52 & 60 lb r, 113 c, 480 h. Pres. & Gen. Man. J. B. Parsons, Sec. & Treas. Geo. L. Webb. Leased to West Chicago St R. R. Co. Office, 89 W. Washington St. 1 4

Cicero & Proviso St. Ry. Elec. 27 m, 4-8½ g, 60 lb Johnson girder r, 54 c, of which 43 are m c and 11 t c. Edison system. American, Pullman and St. Charles cars. Armington & Sims, Bullock and Frick engines. Pres. & Gen. Man. G. Butters, V. Pres. E. A. Cummings, Sec. F. E. Ballard, Treas. H. Coombs, Supt. J. T. Hughes, Pur. Agt. D. W. Coan, Elecn. W. C. Fuchs, Ch. Engr. of Power Station, P. Miller. Capital stock, $1,000,000. Bonds, $800,000. Office, Oak Park. 1 4

Lake Street Elevated R. R. Co. 16½ m, 8 m s, 5.8½ g, 71 lb T r, 125 c, 25 loc. Gilbert cars. Rhode Island locomotives. Pres. J. A. Roche, V. Pres. H. P. Thompson, Sec. O. W. Brewer, Treas. I. H. Witbeck. Gen. Man. M. H. Alberger, Supt. F. Hedley, Pur. Agt. H. V. De Hart, Ch. Engr. R. J. Sloan. Capital $10,000,000. Bonds $4,000,000. Office Security Building. 1 4

North Chicago St. R. R. Co. 88 m, of which 65 are horse, 17 cable and 1 elec., 4-8½ g, 66½ lb girder r, 749 c, of which 570 are h c and t c, 177 g c and 2 m c. 1,300 h. Love system. American, Brownell, and Stephenson cars. Fraser & Chalmers engines. Pres. Chas. T. Yerkes, 1st V. Pres. W. F. Furbeck, 2d V. Pres. Gen Man. & Pur. Agt. J. M. Roach, Sec. & Treas. J. W. Helm, Supt. Fred L. Threedy, Asst. Supt. E. W. Sherman, Ch. Engr. S. Potis, Ch. Engr. of Power Station W. W. Roach. Capital, $5,500,000; authorized, $10,000,000. Bonds, $3,000,000. Office, 444 N. Clark st. 1 4

South Chicago City Ry. Co. Elec. 30 m, 16 m s, 4-8½ g, 75, 85 lb girder r, 91 c, of which 51 are m c and 40 t c. Edison and Westinghouse systems. Brownell, Pullman and St. Louis cars. Allis engines. Pres. D. F. Cameron, V. Pres. D. M. Cummings, Sec., Treas. & Pur. Agt. O. S. Gaither, Supt. R. D. Rowe, Ch. Engr. C. W. Thiel. Capital, $1,200,000. Bonds, $1,200,000. Office, Chicago. 1 4

West Chicago St. R. R. Co. (includes Chicago Pass. Ry.) 185 m, of which 151 are horse and 34 cable, 4-8½ g, 43-90 lb flat & girder r, 1,815 c, of which 1,475 are h c, 225 t c and 200 g c, 4,025 h. Pres. Chas. T. Yerkes, V. Pres. & Gen. Man. John B. Parsons. Sec. & Treas. G. A. Yuille, Asst. Sec. & Treas. L. S. Owsley, Supt. C. F. Nagel, Pur. Agt. E. A. Blodgett. Capital, $12,000,000. Office of Pres. & Supt. 89 W. Washington st. 9 3

CHILLICOTHE, ILL.— People's Street Ry. Co 3½ m, 4-8½ g, 16, 20, 25 lb T r, 6 c, 12 mu. Lessee & Gen. Man. J. Kinloch. Capital, $8,000. 1 4

CHILLICOTHE, O.—Chillicothe Electric Ry. & Lighting Co. 4¼ m, 4-8½ g, 60 lb T r, 13 c, of which 8 are m c and 5 t c. T-H and Edison systems. Pres. M. Cahil, Treas. William Poland, Receiver & Gen. Man. A. H. Reutinger. Capital $100,000. Bonds, $100,000. 8 3

CINCINNATI, O.—Cincinnati Inclined Plane Ry Co. Elec. 16 m. 1920 ft. of which are cable and 16 m elec, 5-2½ g, 56, 58½, 63 lb. girder r, 42 c, of which 40 are m. c. and 2 incline plane cable, 5 h. Edison system. Pres. H. H. Littell, V. Pres. St. John Boyle, Sec. J. M. Doherty, Gen. Man. H. P. Bradford. Capital, $725,000; authorized, $1,000,000. Bonds, $500,000. 4 4

Cincinnati St. Ry. Co. Elec., cable and horse. 139½ m, 8 m cable, 60 electric, 5-2 g, 42-52 lb tram and Johnson r, 370 c of which 91 are m c, 36 grip, 72 t c, 70 open. T-H system. 1,200 to 1,500 h. Pres. & Gen. Man. John Kilgour, Sec. Jas. A. Collins, Treas. R. A. Dunlap, Gen. Supt. Jno. Harris, Pur. Agt. A. G. Starr, Elec. Engr. B. L. Kilgour. Mech. Engr. B. L. Baldwin, Supt. of Machinery H. C. Rolf, Audr. W. R. Avery. Office, 2d floor Apollo bldg. 1 4

Mt. Adams & Eden Park Inclined Ry. Elec. 25 m of which 8 are cable and 17 elec, 5-2½ g, 52-100 lb r 160 c, of which 32 are g c, 50 m c and 78 t c. T-H system. Brill, Laciede, Pullman and Stephenson cars. Pres. John Kilgour, Sec. & Treas. James A. Collins, Pur. Agt. & Auditor, A. G. Starr, Supt. John C. Weaver. Office, 5th & Walnut, sts. 3 3

Mt. Auburn Cable Ry. Co. 8½ m, cable, 5-2 g, 56 lb girder r, 42 c, of which 21 are g c. & 21 tc. Pres Henry Martin, V. Pres. R. Wurlitzer, Sec. and Treas A. Hill Supt. G. Levins. Capital $300,000; authorized, $600,000. Bonds, $370,000. Office, Highland ave. & Saunders st. 8 3

Pendleton, Mt. Lookout & E. Walnut Hill Ry. Co 2 m, 5.2 g, 40 lb T r, 7 c., of which 2 are dummy, 2 m. c. and 3 t. c. T-H system. Pres. & Gen. Man. C. H. Kilgour, Sec. Supt. & Pur. Agt. A. H. Meier, Treas. C. G. Gove, Elecn. B. Kilgour. Capital authorized $150,000. Office Station C. 4 4

Price Hill Inclined Planes, 2 planes, each 800 ft 5-6 g, 60 & 85 lb T r, 2 c on each plane. Pres. M. W Oliver, Gen. Man. Rees E. McDuffie, Sec. & Treas Geo. T. McDuffie. Capital, $400,000. Office, Price Hill 4 4

So. Covington & Cincinnati. (See Covington, Ky.)

CITY ISLAND, N. Y.—Pelham Park R. R. Co 3½ m, 3-6 g, 30-57 lb T and s b r, 8 c, of which 6 are 4-wheel box and 2 4-wheel open, 15 h. Pres. H. D. Carey, V. Pres. W. R. Lamberton, Sec. & Treas. E. N Anable, Supt. Jesse Titus. Capital $50,000. Office, City Island, N. Y., and 16 & 18 Exchange Place, New York City. 1 4

CLARKSVILLE, TENN.—Clarksville St. Ry Co. 4.2 m, 4-8 g, 18 lb T r, 7 c, 32 mu. Pres. W. M Danial, V. Pres. F. P. Gracey. Sec. J. P. Polk, Supt. T. A. Small. Brownell and Stephenson cars. Capital $16,500. Bonds, $11,000. Office, 211 S. 10th St. 4 4

CLEVELAND, O.—Cleveland City Ry. Co. (Includes Woodland Ave. & West Side R. R., Superior St., Payne & Lexington Ave. and St. Clair st. lines.) 72 m, of which 19 are cable and 53 elec. 82-98 lb. girder r, 346 c, of which 47 are g. c. 140 m. c. and 159 t c. Westinghouse and Short systems. Brill and Jones cars. Globe engines. Pres. M. A. Hanna, V. Pres. F. De H. Robison, Sec. & Pur. Agt. J. B. Hanna, Gen. Supt. George G. Mulhern. Capital, $7,000,000. Bonds $2,000,000. Office, Western Reserve Bldg. 4 4

Cleveland Electric Ry. Co. 120 m, 4-8½ g, 62-98 lb girder r, 482 c, of which 240 are m c and 242 t c. General Electric and Steel Motor systems. Brill and Jones cars. Allis engines. Pres. H. E. Andrews, V. Pres. H. A. Everett, Sec. R. A. Harman, Asst. Sec. L. E. Bellstein, Treas. J. Parmelee, Elecn. & Pur. Agt. C. W. Wason, Gen. Supt. J. J. Stanley. Capital $12,000,000. 4 4

USE ONLY



HIGHEST GRADE MANUFACTURED.

Submarine and Aerial Feeders for Street Railway and Power Service.

W. R. BRIXEY. MFR., - 203 BROADWAY, NEW YORK.

East Cleveland, Euclid & Wickliffe St. Ry. Co. Elec. 3 m, 4-8½ g, 52 lb girder r, 4 c of which 2 are m c and 2 t c. Edison system. (Same officers as Cleveland Elec. Ry. Co.) 4 4

Lake View & East Cleveland St. Ry. Co. Elec. 12.68 m, 4-8½ g, 52 lb girder r, 8 c, of which 4 are m c and 4 t c. Edison system. (Same officers as Cleveland Elec. Ry. Co.) 4 4

CLEVELAND, TENN.—Cleveland St Ry. Co. 2 m, 4-9 g, 32 lb. T r, 2 4-wheel box c, 4 mu. Pres. L D. Campbell, Sec. & Treas. L. L. Harle, Supt. J. T Johnston. Capital $4,000. 6 2

CLINTON, IA.—Lyons & Clinton Horse R. R. Co. (See Lyons.)

State Electric Co. 14 m, of which 2 are horse and 12 elec. 4-8½ g, 45, 54 lb girder & T r, 20 c, of which 2 are h c 12 m c and 6 t c, 6 h, 4 mu. T-H and Westinghouse systems. Pullman cars. Ideal engines. Pres. E. C. Walsh, V. Pres. D. Langan, Sec. C. C. Coan, Treas. A. L. Stone, Gen. Man. J. P. Calman, Supt. W. H. Calnan. Capital, $500,000. 9 3

CLINTON, MASS.—Clinton St. Ry. Co. Elec. 2½ m, 4-8½ g, 58 lb T r, 2 m c. Pres. H. Parker, V. Pres. H. A. Wallis, Sec. W. R. Dane. Treas. A. J. Witherall, Auditor, B. F. Wallace. Capital $30,000. 9 3

CLINTON, MO.—Clinton St. Ry. Co. 3 m, 4 g Z T & crescent r, 5 c, 8 mu. Pres. A. P. Frowein, V. Pres. J. T. Ruffin, Sec. & Treas. H. P. Faris, Supt. G. C. Haysler. Capital, $12,000. 4 4

COLORADO SPRINGS, COLO.—Colorado Springs Rapid Transit Ry. Co. Elec 28 m, 4-8½ g, 30 lb T r, 42 c, of which 25 are m. c and 17 t. c. Edison system. Pullman and Woeber cars. Frick and Reynolds Corliss engines. Pres. F. L. Martin, V. Pres. E. J. Eaton, Sec. & Treas. A. L. Lawton, Gen. Man. & Auditor, A. A. McGovney, Supt., Pur. Agt. & Elecn. D. L. Macaffree, Ch. Engr, of Power Station C. Bibb. Capital, $500,000. Bonds, $350,000. 4 4

COLUMBIA, PA.—Columbia & Ironville St. Ry. Pass. Co. (Operated by Columbia Traction Co.) 8 m, 4 m s, 5-2½ g, 56 lb girder r, 4 m c. Westinghouse system. Brill cars. Ball & Wood and Westinghouse engines. Pres. W. B. Given, Sec. Gen. Man. Supt. & Pur. Agt. F. S. Given, Treas. J. Janson, Ch. Engr. E. N. Smith, Elecn. J. Cramen. Ch. Engrs. of Power Station F. Lawlor and J. Hughes. Capital, $75,000; authorized, $100,000. Bonds, $75,000. Office 224 Locust ave. 1 4

Columbia & Donegal Ry. Co. (Operated by Columbia Traction Co.) 7 m, 5-2½ g, 56 lb T & girder r, 4 m c. Westinghouse system. Lamokin cars. Westinghouse engines. Pres. W. B. Given, Sec. & Gen. Man. F. S. Given, Treas. H. L. Haldeman. Capital, $75,000. 9 3

COLUMBIA, S. C.—Columbia Electric St. Ry. Light & Power Co. Elec. 21 m, 4-8½ g, 48 lb T r, 6 m c. Short system. Pres. & Gen. Man. J. Q. Marshall, V. Pres. W. A. Clark, Sec. W. G. Childs, Supt. A. Wallace. Capital, $50,000. Office, 35 Gervais st. Changing to elec. 6 3

COLUMBUS, GA.—Columbus R. R. Co. 17 m, of which 5 are horse and 12 steam, 4-8½ & 4-9 g, 25 & 40 lb T r, 27 c, of which 9 are dummy and 18 h. c, 10 h 50 mu. Brill cars. Porter engines. Pres. & Ch. Engr. J. F. Flournoy, Sec. & Treas. Cliff B. Grimes, Supt. J. H. Henderson. Capital, $25,000. Bonds $100,000. 4 4

North Highlands R. R. Co. Elec. 3¼ m, 4-8½ g, 45 lb T r, 6 c, of which 3 are m c. and 3 t c. T-H system. Brill and Ellis cars. Armington & Sims engines. Pres. & Gen. Man. S. A. Carter, V. Pres. E. J. Rankin, Sec. & Treas, R. Browne, Supt. F. E. Knapp. Capital $31,000; authorized, $200,000. Office, Front St. 4 4

COLUMBUS, IND.—Crump's St. Ry. 7 m, of which ½ m is horse and 6½ elec, 4-8½ g, 30 lb T r, 9 c of which 1 is h c, 4 m c and 4 t c. American Car Co. and Brownell cars. Ide engines. John S. Crump, proprietor; Man. R. F. Gottschalk, Supt. J. W. Crump, Jr. 1 4

COLUMBUS, MISS.—Columbus St. Ry. & Power Co. Dummy. 2 m, 4-½ g, 40 lb T r, 2 c. Pres E. Cahn, Sec. & Gen. Man. C. E. Rodenburg, Treas. R T. Williams. Capital, $25,000. 9 2

COLUMBUS, O.—Columbus St. Ry. Co. (Operates Glenwood & Greenlawn St. Ry.) Elec. 55 m, 34 m s, 5-2 g, 52-93 lb T & girder r, 150 c, of which 120 are m c and 30 t c. T-H system. Brill, Brownell and Stephenson cars. Buckeye and McIntosh & Seymour engines. Pres. E. McMillin, 1st V, Pres. Treas. & Gen. Man. E. K. Stewart, 2d V. Pres. R. E. Sheldon, Sec. P. V. Burington, Gen. Supt. Pur. Agt. & Elecn. W. F. Kelly. Ch. Engr. of Power station F. Nusbaum. Capital, $3,000,000. Bonds $3,000,000. Office 12 N. High St. 1 4

Glenwood & Greenlawn St. Ry. Co. (Operated by Columbus St. Ry. Co.) Elec. 5 m, 5-2 g, 5-2 g, 45 lb girder & T r, 14 c, of which 8 are m. c. and 6 t. c Edison and Westinghouse systems. 8 3

Worthington, Clintonville & Columbus St. Ry, Co. 4 m, 5-4 g, 45 lb. T r, 2 m c. Westinghouse system. Brill cars. Pres. O. W. Aldrich, V. Pres. D. H. Welling, Sec. Supt. & Pur. Agt. R. M. Weaver. Treas. H. C. Cooke. Capital, $22,000; authorized $40,000. Office 11 Wesley Block 2 4

CONCORD, N. C.—Concord Ry. Co. Steam. 2.65 m, 48½ g, 40 lb T r, 3 c. Owned by J. P. Allison, A. B. Young and W. M. Smith.

CONCORD, N. H.—Concord St. Ry. Co. Elec 10½ m. 3 g, 35, 45 & 50 lb T r, 24 c, of which 18 are m c and 6 t. c. T-H. system. Rollins and Swampscott engines. Pres. J. H. Albin, Sec. N. E. Martin, Treas. A. B. Cross, Supt. H. E. Chamberlin, Elecn. D. W. White. Capital, $100,000; authorized $150,000. Bonds $85,000. Office, Main st. 4 4

CONEY ISLAND, N. Y.—Sea View R. R. Co Elevated. 2.3 m, 1 m s, 4-8½ g, 56 lb T r, 7 c, 7 locomotives. Brill and Feigel cars. Baldwin engines. Pres. F. A. Schroeder, Sec. Gen. Supt. & Pur Agt. W. Finley, Treas. I. M. Bonn. Capital, $191,000; authorized $250,000. Bonds $27,500. Office, Flatbush. 1 4

CONNELLSVILLE, PA.—Connellsville, New Haven & Leisenring St. Ry. Co. Elec. 4¾m. 4¾ m s, 5 2¼g, 52 lb. girder r 7 m. c. Edison & Westinghouse systems. Brill cars. Taylor engines. Pres J. D. Frisbee, Sec. J. K. Ewing, Jr., Treas. E. T. Norton, Supt. Pur. Agt. Ch. Engr. & Elecn. J. L. Gans, Ch. Engr. of Power Station D. S. Farnwalt. Capital, $70,000; authorized, $100,000. Bonds, $30,000. 1 4

CORPUS CHRISTI, TEX.—Corpus Christi mprovement Co. Dummy. 6½ m, 4-8½ g, 30 lb T r 4 c, 2 steam motors. Pres. E. H. Ropes, V. Pres J. M. Ropes, Sec. W. B. Newkirk, Treas. & Supt H. Keller. Capital, $100,000. 2 3

Gussett St. Ry. 4 m, 4-8½ g, 25-30 lb T r, 6 c, 16 mu. Proprietor, N. Gussett. Capital $25,000, 9 1

CORSICANA, TEX.—Corsicana St. Ry. Co. 4½ m, 4-8½ g, 16 lb T r, 6 c, 28 mu. Pres. & Gen. Man B. G. McKie, V. Pres. J. E. Whiteside, Sec. & Treas W. J. McKie. Capital, $50,000. 5 3

CORTLAND, N. Y.—Cortland & Homer Horse R. R Co. 4.1 m, 4-8½ g, 25-30 lb flat & T r, 8 c, of which 4 are box and 4 open, 26 h. Pres. C. H. Garrison, V. Pres. S. E. Welch, Sec., Treas., Gen. Man. & Supt. L. D. Garrison. Capital, $40,000. Office, 19 Main St. 1 4

CORVALLIS, ORE.—The Corvallis St. Ry. Co. 2 m, 2 m s, 3-6 g, 30 lb. steel T r, 2 box c, 2 h. Pres. Gen. Man. Supt. & Pur. Agt. M. W. Wikins, Sec. M. O. Wilkins, Treas. M. G. Wilkins. Capital. $50,000; authorized. $60,000. Bonds, $10,000. 1 4

COTTAGE CITY, MASS.—Cottage City St. Ry Co. 5 m, 4-8½ g, 40 lb T r, 10 c. Briggs and Ellis cars. Pres. W. C. Van Derlip, V. Pres., Sec. & Gen. Man. W. A. Boland, Supt. H. S. Kemp. Capital, $15,000; authorized, $25,000. Office of Gen. Man. 610 Exchange Bldg, Boston. 9 3

COTTONWOOD FALLS, KAN.—Consolidated St. Ry. Co. 1½ m, 3-6 g, 36 T lb steel T r, 2 4-wheel box c, 5 h, 3 mu. Pres. H. S. F. Davis, V. Pres. W. Adare, Sec. E. W. Tanner, Treas. C. J. Lantry, Supt. N. P. Martin. Capital $10,000. 4 4

COUNCIL BLUFFS, IA.—Omaha & Council Bluffs Ry. & Bridge Co. Elec. High steel bridge spans the Missouri river. 20 m, 20 m s, 4-8½ g, 40, 45 & 56 lb girder & T r, 56 c, of which 36 are m c & 20 t c. T-H & Edison systems. Pullman cars. Westinghouse engines. Pres. G. C. Barton, V. Pres. J. J. Brown, Sec. C. T. Stewart, Treas. J. H. Millard, Gen. Supt. W. S. Dimmock, Elecn. I. Lovett, Ch. Engr. of Power Station W. B. Tarkington. 4 4

COVINGTON, GA.—Covington & Oxford St. R. R Co. 6 m, 4-8½ g, 25 lb. T r, 6 c, 8 mu. Pres. I. W. Brown Sec. & Treas. J. G. Lester, Gen. Man. & Supt. R. O Usher. Capital, $16,000, authorized $20,000. 1 4

COVINGTON, KY.—South Covington & Cincinnati St. Ry. Co, Elec. 45 m, 35 m s, 5-2½ g, 65, 80 lb T & girder r. 120 m c, 40 h. Westinghouse system. Brownell, Jones, Laclede and Stephenson cars. Cleveland Ship Bldg Co. and Lane & Bodley engines. Pres. J. J. Shipherd, V. Pres. & Gen. Man. S. Bigstaff, Sec. & Treas. G. M. Abbott, Supt. T. M. Jenkins, Elecn. C. C. Benson, Ch. Engr. of Power Station M. Kelly. Capital, $500,000; Bonds $500,000. Office, 402 Scott st. 1 4

CUMBERLAND, MD.—Cumberland Electric Ry Co. 6 m, 4-8½ g, 54 lb girder r; 14 c, of which 9 are m c and 5 t c. Edison and Westinghouse systems. Brill cars. Pres. G. L. Wellington, V. Pres. L. Lowndes, Sec. & Treas. J. H. Holzshu, Supt. W. Milnor Roberts, Jr. Capital $70,000; authorized $100,000. Bonds $30,000. Office North Centre St 3 4

CUYAHOGA FALLS, O.—Akron & Cuyahoga Falls Rapid Transit Co. Elec. 8 m, 4-8½ g, 52, 66 lb T r, 11 m. c. Gen. Elec. system. Capital, $300,000. Address, R. J. Randolph, Cuyahoga Falls. 6 3

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DALLAS, TEX.—Dallas Consolidated Traction Ry. Co. Elec. 26 3-16 of which 16 1-16 are horse and 10 2-16 elec, 4-8½ g, 30-40 lb. girder & T r, 82 c, of which 67 are h. c. and 15 m. c, 3 h. 200 mu. T-H & Edison systems. Laclede, St. Louis and Stephenson cars. Receiver, S. P. Cochran, Gen. Man. for Receiver K. Kurtz. Capital, $1,000,000. Office, 135 Main St. 5 3

Dallas & Oak Cliff Ry. Co. Steam. 11 m, 4-8½ g, 35 & 65 lb T r, 4 m, 15 c. Pres. & Man. T. L. Marsalis, V. Pres. J. T. Elliott, Sec. & Treas. E. L. Snodgrass. Capital $460,000. Room 5 Knepply Bldg. 11 2

Dallas Rapid Transit Ry. Co. Elec. 13 m, 13 m s, 4-8½ g, 35 & 45 lb steel T r, 10 m. c. Edison system. Receiver, C. F. Freeman, Supt. Geo. D. Hartson, Ch. Engr. of Power Station. Capital, $200,000. Office, 303 North Texas Bank B'ld'g. 1 4

North Dallas Circuit Ry. Co. Elec. 4 m, 4-8½ g 40 lb T r, 4 m c. T-H system. St. Louis cars. Pres. J. C. Schneider, V. Pres. & Gen. Man. Royal A. Ferris, Sec. E. T. Moore. Treas. N. A. McMillin. Capital, $100,000. Bonds, $100,000. 2 3

Queen City Ry. Co. 10.02 m, 7.54 m s, 4-8½ g. 45 lb T r, 18 m c. T-H system. American and St. Louis cars. Pres. & Gen. Man. A. W. Childress, V. Pres. J. S. Armstrong, Sec. Treas & Pur. Agt. C. L. Wakefield. Supt. R. S. Wakefield, Elecn. W. C. Ure. Office 263 Elm st. 4 4

DANBURY, CONN.—Danbury & Bethel Horse Ry. Co. 6½ m, 4-8½ g, 25 lb T, s. and c. b. r, 20 c, of which 13 are 4-wheel box and 7 4-wheel open, 130 h Pres. S. C. Holly, V. Pres. S. H. Wagner, Sec. & Treas M. H. Griffing, Gen. Supt. G. H. Klinzing. Office 23 South st. Capital, $100,000. 1 4

DANVILLE, ILL.—Danville Gas, Elec. Light & St. Ry. Co. 8 m, 4-8½ g, 50 lb. T r, 21 c, of which 11 are m. c. and 10 t. c. T-H system. St. Louis cars. Ide engines. Pres. F. W. Penwell, V. Pres. A. C. Daniel, Sec & Treas. W. P. Cannon, Supt. M. Connor. Capital, $250,000. 6 3

DANVILLE, VA.—Danville St. Car Co. Elec 2.06 m, 4-8½ g, 38 lb girder r, 5 m. c. T-H system. Lamokin cars. Taylor engines. Pres. P. R. Jones, V. Pres. L. C. Berkeley Jr., Sec. & Treas. H. S. Lanier Gen Man. & Supt. N. W. Berkeley, Jr. Capital. $50,000 authorized $300,000. Office, 320 Craighead st. 1 3

DAVENPORT, IA.—Davenport & Rock Island Ry. Co. Elec. 43 m, of which 5 are horse and 38 elec. 4-8½ g, 52 lb girder r, 111 c, of which 7 are h c, 54 m c and 50 t c. T-H system. St. Louis cars. "Ideal" engines. Pres. D. H. Louderback, V. Pres. J. J. Mitchel, Sec. & Treas. J. F. Lardner, Supt. H. Schnitger, Ch. Engr. of Power Station T. Gowling. Capital, $835,000; authorized, $1,500,000. Bonds $600,000. Office, 2d & Rock Island sts., Davenport, Ia. 1 4

DAYTON, KY.—Cincinnati, Newport & Covington St. Ry. Co., Dayton Division (See Covington, Ky.)

DAYTON, O.—City Ry. Co. (Owns and operates Dayton St. R. R, Third St., Fifth St., Green and Dayton & Soldiers' Home lines) 18½ m, of which 14½ are horse and 4 elec, 9½ m s, 4-8½ g 70, 90 lb girder r, 66 c, of which 60 are horse, 4 m c and 2 t c, 212 h, 48 mu. Gen. Elec. and Westinghouse systems. Pres. D. B. Corwin, V. Pres. C. B. Clegg, Sec. W. H. Sims, Supts. A. W. Anderson, T. C. Howel. Capital, $1,500,000. Office, W. 3d st. 4 4

Dayton St. R. R. Co. (Owned and operated by City Ry. Co.)

Dayton & Soldiers' Home Electric R. R. Co. Extension of west end of Fifth st. R. R. (Owned and operated by City Ry. Co.)

Fifth St. R. R. Co. (Owned and operated by City Ry. Co.)

Home Avenue R. R. Co. Steam 3 m, 4-8½ g, 40 lb T r, 6 c, 3 motors. Barney, Smith & Co. cars. Porter engines. Pres. J. Applegate, V. Pres. W. P. Callahan, Sec. & Treas. C. W. Dustin, Gen Man. & Supt. W. F. Stark. Capital, $100,000. Office, N. Main St. 4 4

Oakwood St. Ry. Co. 8 m, 4-8½ g, 60, 72 lb girder r, 18 box c, 80 h. Pres. Charles B. Clegg, V. Pres. A L. Stout, Sec. V. Winters, Treas. 4th Nat. Bank, Gen Man. H. P. Clegg, Supt. William Jones. Capital $300,000. Office, cor. Brown & Fairground av. 1 4

Wayne & Fifth St. R. R. Co. 7 m, 3½ m s, 4-8½ g, 60, 70, 90 lb girder r, 13 c, 80 h. St. Louis cars. Pres. Geo. W. Shaw, V. Pres., Gen. Man. & Pur. Agt. Ezra Bimm, Sec. & Treas. Eugene Wuichet, Supt. N. Routzahn. Capital $100,000. Office 29 Wayne av. 4 4

White Line St. R. R. Co. Elec. 11½ m, 4-8½ g 42 lb steel girder r, 34 c, of which 22 are m c and 12 t c T-H and Westinghouse systems. Pres. J. A. McMahon, V. Pres. A. G. Clark, Sec. J. E. Lowes, Treas. & Gen. Man. M. A. Nipgen, Supt. & Pur. Agt. W. Beach, Ch. Engr. & Ch. Engr. of Power Station, C. Orain, Elecn, J. Cook. Capital, $300,000. 4 4

DECATUR, ALA.—Decatur St. Ry. Co. 4 m, 3½ m s, 4-8½ g, 20 lb T r, 5 c, 31 mu. Pres. W. W. Hedges, V. Pres. A. C. Hartshorne, Sec. & Gen. Man. A. Bibb. Capital $100,000. 1 4

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BRANCHES:
BOSTON, ELECTRIC GAS LIGHTING CO.

DECATUR, ILL.—City Electric Ry Co. 13½ m 12 m s, 4-8½ g, 40, 42, 48, 50 lb T & girder r, 25 c, of which 19 are m c and 6 t c. T-H and Westinghouse systems. Pullman, St. Louis and Stephenson cars. Ide engines. Pres. D. S. Shellabarger, Sec., Treas. & Pur. Agt. W. L. Shellabarger, Gen. Man. W. L. Ferguson, Ch. Engr. & Ch. Engr. of Power Station S. Ray, Elecn. G. I. Nitsche. Capital $300,000. Bonds $175,000. 4 4

DEERFIELD, N. Y.—Deerfield & Utica R. R. Co 2 m, 2 m s, 4-8½ g, 42 lb flat and T r, 3 box c, 9 h. Stephenson cars. Pres. & Gen. Man. F. G. Weaver, Sec. & Treas. J. R. Swan. Capital $12,000. Bonds, $12,000. 1 4

DEFIANCE, O.—The Defiance Light & Power Co. Elec. 3½ m, 60 lb T r. 6 c, of which 3 are m c and 3 t c. Westinghouse system. Brownell and Pullman cars. Russell engines. Receiver G. W. Bechel, Pres. W. B. McKinley, Elecn. C. Miller, Ch. Engr. of Power Station G. Butler. Capital stock, $100,000. 4 4

DELAWARE, O.—Delaware Electric St. Ry. Co. 5½ m, 4-8½ g, 45 lb girder r, 7 m c. Westinghouse system. Brill cars. Pres. J. K. Newcomer, V. Pres. J. D. Van Deman, Sec. L. L. Hudson, Treas. V. T. Hills, Supt. F. P. Welch. Capital, $60,000. 1 4

DENISON, TEX.—Denison Rapid Transit Ry. Co. 6½ m, 4-8½ g, 35 lb T r, 6 c, 2 dummies. Pres. & Man. B. J. Derby, Sec. C. F. Rose, Treas. S. Star. Owned and operated by the Denison Land & Improvement Co. 4 1

Denison Street & Belt Line Ry. Co. 13 m, of which 5½ are horse and 7½ steam, 4-8½ g, 16, 35 lb. T r, 17 c of which 11 are h. c. and 6 steam, 2 engines, 42 mu. Baldwin engines. Pres. F. C. Churchill, V. Pres. A. H. Coffin, Sec. A. Zintgraf, Treas. E. H. Hanna, Gen. Man. B. J. Derby. Capital, $150,000. Bonds, $75,600. 1 4

DENNISON, O.—The United Electric Co. 2 m, 4-8½ g, 45 lb girder r, 3 m c. T-H system. Lamokin cars. Russell and Westinghouse engines. Pres. T. H. Wilson, Sec. E. E. Elvin, Treas. W. H. Smith, Gen. Man. R. F. Gardner. Capital $28,000; authorized $100,000. Office Grant St. 8 3

DENVER, COL.—Colfax Electric Ry. Co 10¼ m 3-6 g, 30 lb T r, 32 c, of which 12 are m. c. and 20 t. c Edison system. Pres. D. Fletcher, V. Pres. Sec. & Gen. Man. S. M. Perry, Treas. T. S. Hayden, Supt. F. A. Perry. Capital, $150,000. Office, 1738 Curtis st. 4 4

Denver & Westminster Ry. Co. Elec. 18 m, 4-8½ g. Pres. H. J. Mayham, V. Pres. R. W. Woodbury, Sec. J. Downing, Engr. F. H. Whiting. Capital, $1,000,000. Office, 1649 Curtis St. 2 3

Denver, Lakewood & Golden R. R. Co. Elec. and Steam. 20 m, of which 15 are steam and 5 elec, 4-8½ g, 60, 76 lb T r, 12 c, of which 4 are m c, 4 t c and 4 steam c. T-H system. Woeber cars. Sioux City engines. Pres. C. C. Welch. V. Pres. W. F. R. Mills, Sec. J. Q. Adams, Treas. W. A. H. Loveland, Supt. T. E. Mitten. Capital, $1,000,000. Bonds, $250,000. Offices, 1427 Arapahoe St. 8 3

Denver Consolidated Tramway Co. (Includes Denver Cable, Denver & Berkeley Park, So. Denver Cable, University Park and Metropolitan.) 96½ m, 3-6 g, 48 lb T r, 266c, of which 128 are m c and 138 t c. T-H, Westinghouse and Edison systems. Brill, St. Louis and Woeber cars. Hamilton-Corliss and Wetherill engines. Pres. Rodney Curtis, V. Pres. Jno. J. Riethman, Sec. Wm. G. Evans, Treas. F. A. Keener, Gen. Supt. C. K. Durbin. Pur. Agt. J. C. Curtis, Elecn. A. M. Ballou. Capital, $3,000,000. Bonds $3,400,000. Gen. Offices, Broadway and Colfax and Railroad Bldg. 1 4

Denver City Cable Ry. Co. 45 m, of which 5 are horse, 30 cable and 10 elec., 23 m s, 3-6 and 4-8 g, 50 lb T r, 200 c of which 8 are h c, 62 g c, 17 m c and 113 t c, 30 h. Laclede and Woeber cars. Allis, Armington & Sims and Wright engines. Pres. Geo. H. Holt, Sec. & Treas. G. D. L'Hullier, Gen. Man. Supt. & Pur. Agt. G. E. Randolph. Ch. Engr. of Power Station, W. F. Smith. Capital, $3,000,000. Bonds, $3,000,000. Office, 18th & Lawrence Sts. 1 4

Thirty-fourth Ave. Ry. 1¼ m, 3-6 g, 25 lb T r, 1 c, 6 h. Owner, J. Cook, Jr., P. O. Box 528. 1 4

West End St. Ry. Co. Elec. 10¼ m, 4-8½ g, 50 lb r, 17 m c. Edison system. Laclede and Woeber cars. Armington & Sims engines. Pres. J. Wilbour, V. Pres. & Gen. Man. D. F. Longstreet, Sec. E. M. Dexter, Supt. & Pur. Agt. S. R. Wright. Capital, $500,000. Bonds, $300,000. Office Prospect Ave. 8 3

DEPTFORD, TENN.—Deptford & South Pittsburg St. Ry. Co. Dummy. 2½ m, 4-8½ g, 40 lb T r 3 c, 8 mu. Stephenson cars. Pres. L. W. Barringer, V. Pres. J. G. Kelly, Sec. Treas. & Gen. Man. J. Bright. Capital, $12,000. Office, Deptford. 4 4

DERBY, CONN.—Derby Street Ry. Co. Elec. 4 m, 4-8½ g, 45 lb girder and flat r; 11 c, of which 6 are m c and 5 t c. T-H system. Pres. H. Holton Wood, V. Pres. Chas. F. Bliss, Sec. Geo. O. Schneller, Treas. Chas. E. Clark, Supt. B. W. Porter, Elecn. G. N. Kennedy, Ch. Engr. of Power Station H. Schmitz. Capital stock $50,000; authorized $200,000. Bonds $5,000 1 4

DES MOINES, IA.—Des Moines City Ry. Co. Elec. 35 m, 27 m s, 4-8½ g, 45, 50, 62 lb T girder & r, 51 c, of which 49 are m c. and two t c. T-H system. St. Louis cars. Lane & Bodley engines. Pres. J. S. Polk, V. Pres. G. M. Hippee, Sec. G. H. Huttonlocker, Treas. & Gen. Man. Geo. B. Hippee, Ch. Engr. J. S. Goodsell, Elecn. W. G. Owens. Capital $1,000,000; authorized, $3,000,000. Bonds, $1,150,000. Office, 201 5th St. 1 4

DETROIT, MICH.—Fort Wayne & Belle Isle Ry Co. Elec. 23½ m, 4-8½ g, 48-90 s b girder & grooved r, 86 c, of which 29 are m. c. and 57 t. c. Gen. Elec. system. Brill cars. Allis engines. Pres. E. H. Butler, Sec. N. W. Goodwin, Treas. E. S. Heineman, Supt. G. S. Hazard. Capital $250,000. Bonds $324,000. Office, Room 12 Kanten Bldg. 1 4

Detroit Citizens' St. Ry. Co. (Includes Grand River St. Ry. and Hamtramck & Grosse Point Ry. Leases Highland Park Ry.) Elec. 67 m. of which 37 are horse and 30 elec, 4-8½ g, 45, 66, 78 lb tram and girder r, 245 c, of which 174 are h c, 59 m c and 12 t c, 1,575 h. T-H, Detroit and Westinghouse systems. Brownell, Jones, Lewis & Fowler, Pullman and Stephenson cars. Westinghouse, Church, Kerr & Co. engines. Pres. D. M. Ferry, V. Pres. W. C. Colburn, Sec. J. R. Stirling, Treas. G. H. Russel, Gen. Man. J. D. Hawks, Supt. J. H. Fry. Elecn. J. C. Liggett, Ch. Engr. of Power Station C. Mery. Office 12 Woodward Ave. 4 4

Detroit, Rouge River & Dearborn St. Ry. Co. Elec 1½ m, 4-8½ g, 56 lb. T r, 1 m c. Edison system. Pres. E. J. Owen, V. Pres. J. R. McLoughlin, Sec. S. Hendrie, Treas. R. J. McLoughlin. Office, Moffat Building. 9 3

Detroit Suburban Ry. Co. (Leased to Detroit Citizens' St. Ry. Co.) 3.75 m, 3 m s, 4-8½ g, 60 lb T r, 3 m c. Detroit system. Pres. W. C. McMillan, Sec. H. M. Campbell, Treas. G. H. Russell, Gen. Man. J. D. Hawks. Capital, $50,000. Office, 904 Hammond Building. 1 4

DOVER, N. H.—Union St. Ry. Co. Elec. 14 m 4-8½ g, 40 lb T r, 19 c, of which 10 are m c and 9 t c T-H system. Pres. H. Haley, V. Pres. & Treas. H. W Burgett, Sec. R. W. Burwell, Supt. F. A. Christy. Capital $150,000. Leased by Consolidated Light & Power Co. 1 4

DUBLIN, TEX.—Dublin St. R. R. Co. 5 m, (1½ in operation), 4 g, 20 lb T r, 3 c, 20 mu. Pres. H. A Smith, V. Pres. R. H. McCain, Sec. & Gen. Man. J. E. Chapman, Treas. A. A. Chapman. Capital stock $10,000. 1 4

DU BOIS, PA.—Du Bois Traction Passenger Ry. Co. 3 m, 2½ m s, 4-8½ g, 50 lb. girder r, 5 m. c. Wightman and Gen. Electric systems. Brill and Stephenson cars. McEwen and Ball engines. Pres. M. D. Wayman, V. Pres. & Sec. A. C. Bailey, Pur. Agt., Gen. Man. & Supt. S. R. Smith, Treas. G. E. Grier, Ch. Eng. Power Station, W. L. Shawkey. Capital authorized, $85,000. Bonds, $45,000. 1 4

DU QUOIN, ILL.—Du Quoin St. R. R. Co. 3 m 4-8½ g, 57 lb. T r, 3 c, 3 h. Pres. & Gen. Man. P. D. Mifflen, V. Pres. C. Horn, Sec. D. White, Treas. P. N. Pope. Capital, $5,375. 1 3

DUBUQUE, IA.—Dubuque St. R. R. Elec. 15 m 4-8½ g, 52 lb girder r, 25 c, of which 15 are m. c. and 10 t. c. Gen. Elec. System. Brill cars. Sioux City engines. Pres. & Gen. Man. J. A. Rhomberg, Sec. C. H. Meyer, Treas. & Supt. J. H. Rhomberg. Capital $375,000; authorized $500,000. Bonds $250,000. 9 3

Dubuque Light & Traction Co. 12 m. 4-8½ g, 50 lb Johnson girder r, 16 c, of which 12 are m c. and 4 t c. Edison system. St. Louis cars. Pres. G. K. Wheeler, V. Pres. W. J. Ballard, Sec. E. W. Duncan, Treas. P. H. Anderson. Capital, $500,000. 4 4

Eighth St. & West Dubuque St. Ry. Co. Elec. 2½ m, 4-8½ g, 52 lb girder r, 6 c, of which 4 are m c and 2 t c. Edison system. Northern Car Co. cars. Fairbanks, Morse & Co. engines. Pres. L. H. Bigelow, V. Pres. E. P. Griswold, Treas. W. H. Doane, Supt. H. J. Dressel. Capital, $100,000. Office, foot of 8th st. 5 3

DULUTH, MINN.—Duluth St. Ry. Co. 42 m, of which 1.13 are cable and 40.87 elec, 21 m s, 4-8½ g 45, 60 lb girder & T, r, 71 c, of which 2 are g c, 66 m. c. and 3 t. c. T-H system. Laclede and Northern cars. Allis engines. Pres. L. Mendenhall, V. Pres. G. G. Hartley, Sec. & Treas. T. W. Hoopes, Gen. Man. Supt. & Pur. Agt. H. Warren. Ch. Engr. & Ch. Engr. of Power Station M. Noble, Elecns. L. E. Fairchild, T. Armstrong, Gen. Man. A. W. M. Dimont, Asst. Gen. Man. H. A. Douglas. Capital, $300,000; authorized, $1,500,000. Bonds, $750,000. Office, 209 First Nat. Bank Bldg. 4 4

Lakeside Ry. Co. Elec. 4 m, 4-8½ g, 45 lb T r, Pres. D. G. Cash, Sec., Treas. & Man. W. C. Sargent Capital, $100,000. Operated by Duluth St. Ry. Co 8 2

Minnesota Point St. Ry. 3¾ m, 3-6 g, 28 lb T r, 8 c 16 h. Pres. J. J. Hibbard, V. Pres. R. P. Edson, Sec., Gen. Man. & Supt. W. Warner, Treas. B. Silberstein, Capital $60,000; authorized $100,000 9 3

Motor Line Improvement Co. Elec. 6 m, 4-8½ g 45 lb T r, 4 m c. T-H system. Laciede cars. Pres. G. G. Hartley, V. Pres. J. D. Stryker, Sec. T. W. Hoopes, Treas. A. R. Macfarlane, Gen. Mans. Mendenhall & Hoopes. Capital, $150,000; authorized $300,000. Bonds, $200,000. Office 12 3d Ave. W. 4 4

DURANGO, COLO.—Durango Ry. & Realty Co. 2 m, 2 m s, 4 c, of which 2 are m c and 2 t c. 3 g, 30 lb T r. Westingnouse system. Woeber cars. Ide engines. Pres. T. C. Graden, V. Pres. C. M. Williams, Sec. W. S. Pickerll. Treas. & Supt. H. J. Arnold. Capital, $250,000. 1 4

DURHAM, N. C.—Durham St. Ry. Co. 2 m, 4-8½ g, 16 lb T r, 4 box c, 4 mu. Pres. J. S. Carr, V. Pres A. B. Anderson, Sec. R. H. Wright. 8 3

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EAST LIVERPOOL, O.—East Liverpool & Wellsville R. R. Co. Elec. 8½ m, 4-8½ g, 56 lb T and 81 lb girder r, 20 m. c. Short and Westinghouse systems. Brill and Stephenson cars. Pres. & Gen. Man. A. L. Johnson, Sec. & Treas. C. H. J. Davis, Supt. R. L. Andrews. 4 4

EAST WAREHAM, MASS.—East Wareham Onset Bay & Point Independence St. Ry. Co. 2.779 m 4-8½ g, 25 & 35 lb. T r, 14 c, 15 h. Pres. T. B. Griffith, Sec. B. F Gibbs, Treas. & Supt. I. B. Eldridge. Capital, $20,600; authorized, $26,000. 4 4

EASTON, PA.—Easton Transit Co. Elec. 10 m, of which 3 are horse and 7 elec, 5-2½ g, 68 lb girder r, 20 c, of which 10 are h c and 10 m c, 26 h. Westinghouse system. Brill cars. Pres. H. Ruick Sec & Treas. A. D. Chidsey, Gen Man. F. Knight. Supt. W. M. Williams. Capital, $150,000; authorized $500,000. Office, 60 Centre sq. 1 4

Easton & Bangor Electric Ry. Co. 16 m, 5-2½ g, 48 lb r. Pres. J. M. Young, Sec. & Treas. D. W. Nevin. Capital, $100,000. 9 3

Pennsylvania Motor Co. 2¾ m, elec. 5-2½ g, 36-56 lb flat & T r, 8 m c. Wightman system. Pres. H. E. Hand, Sec., Treas. & Gen. Man. D. W. Nevin, Supt. L. Richter. Capital, $120,000. Bonds, $60,000 1 3

EAU CLAIRE, WIS.—Eau Claire St. Ry. Lt. & Power Co. 8 m, 4-8½ g, 35, 42 & 45 lb c & s b r, 13 m c Edison and Detroit systems. Pres. & Gen. Man. G. B. Wheeler, V. Pres. E. Horan, Treas. W. G. Maxcy Supt. D. E. Pepin. Capital, $100,000. 1 4

EL PASO DE ROBLES, CAL.—El Paso de Robles St. Ry. 5 m, 3 g, 16 lb T r, 2 box c, 6 h Proprietors, Putnam & Hord. Cost, $10,000. Office Adams Block, cor Spring & 12th sts. 4 4

EL PASO, TEX.—El Paso & Juarez Ave. St. Ry. Co. 6½ m, 6½ m s, 4-8½ g, 30 lb. T r, 14 c, 40 mu. Pres. Z. T. White, Sec. J. J. Bruck, Supt. & Pur. Agt. A. Larmour. 4 4

San Antonio & Magoffin St. Ry. Co. 4 m, 4-8½ g, 30 lb T r, 3 c, 9 mu. Pres. J. Magoffin, Treas. H. B. Stcavens, Supt. & Pur. Agt. A. Larmour. 4 4

ELGIN, ILL.—Elgin City Ry. Elec. 13 m, 4-8½ g 40 & 45 lb T & girder r, 22 c, of which 13 are m c and 9 t c. Edison system. Pres. W. Grote, V. Pres. J. B Lane, Sec. & Treas. A. B. Church, Gen. Man. C Wuestenfeld. Capital, $250,000. 1 3

ELIZABETH, N. J.—Elizabeth St. Ry. Co. 3½ m, 5-2½ g, 38 & 52 lb Johnson girder r, 13 box c, 42 h. Pres. F. L. Heidritter, V. Pres. A. Heidritter, Sec. & Treas. E. C. Woodruff, Supt. J. C. Husbands. Capital $50,000. Office, foot of East Jersey st. 1 4

ELKHART, IND.—Elkhart Electric & Ry. Co. Elec. 7 m, 4-8½ g, 35 lb T & tram r, 11 c, of which 7 are m c & 4 t c. Detroit system. Pres. L. Warfield, V. Pres. J. McNaughton, Sec. J. W. Ellis, Treas. T. Muir, Supt. C. T. Goodrich. Capital, $99,000; authorized, $100,000. Bonds, $65,000. 9 2

ELMIRA, N. Y.—Elmira & Horseheads Ry. Co. Elec. 15.7 m, of which .7 is horse and 15 elec. 4-8½ g, 45-78 lb. T & girder r, 49 c, of which 18 are h. c. 19 m. c. and 12 t. c, 8 h. Gen. Elec. and Westinghouse systems. Brill and Stephenson cars. McIntosh & Seymour engines. Pres. R. Leland, Sec. E. Spencer, Treas., Gen. Man. & Pur. Agt. C. H. Baldwin, Elecn. I. Mack, Ch. Engr. of Power Station F. A. Cheney. Capital, $400,000. Bonds, $400,000. 4 4

West Side R. R. Co. Elec. 7½ m, 6 m s, 4-8½ g, 70 lb girder r, 22 c, of which 21 are m c and 1 t c. T-H system. Brill and Stepnenson cars. Bates-Corliss engines. Pres. C. M. Tompkins, V. Pres. A. E. Ockley, Sec. & Treas. H. H. Hallock, Gen. Man. W. W. Cole, Asst. Supt. W. J. Jones, Ch. Engr. & Ch. Engr. of Power Station P. Kaufelt, Elecn. J. Hendricks. Capital $100,000; authorized $300,000. Office 123 Baldwin st. 4 4

EMPORIA, KAN.—Emporia City Ry. Co. 3½ m, 3-6 g, 20 lb r, 8 c, 24 h. Pres. Van R. Holmes, Treas. A. F. Crowe, Sec. & Man. J. D. Holden. 11 2

ENSLEY, ALA.—Ensley Ry. Co. (Consolidated with Birmingham Ry. & Elec. Co.)

STAMPED & ENGRAVED METAL PLATES for Electrical Apparatus. BADGES FOR CONDUCTORS, MOTORMEN, Etc. SEND FOR CATALOGUE. JAS. A. ALLEN, 244 ARCH ST., PHILADELPHIA.

ERIE, PA.—Erie City Passenger Ry. Elec. (Operated by Erie Elec. Motor Co.)

Erie Elec. Motor Co. 25 m, 4-8½ g, 52 lb Johnson girder r, 174c, of which 87 are h c, 77 m c and 10 t c, 4 h and mu. Edison system. Pres. J. S. Casement, V. Pres. J. C. Brady, Sec. & Treas. J. L. Sternberg, Supt. H. F. Wilbur. Capital $700,000. Bonds $350,000. Office 202 State st. 5 3

ESSEX, MASS.—(See Salem, Mass.)

EUREKA, CAL.—Eureka St. R.R. Co. 4½ m, 4-8½ g, 14 & 36 lb T & flat r, 6 box c, 13 h, 7 mu. Holt and N. B. & M. Ry. cars. Pres. & Gen. Man. R. M. Fernald, Supt. J. A. Clark. Capital $60,000. 9 3

EUREKA SPRINGS, ARK.—Eureka Springs Elec. Lt. & St. Ry. Co. 2½ m, 4-8½ g, 35 lb T r, 5 c, 17 mu. St. Louis cars. Pres., Sec. & Gen. Man. J. D. Jordan, V. Pres. C. F. Ellis, Treas. T. N. Cloflin, Supt. W. J. Wallace. Capital $17,000; authorized, $20,000. Bonds $3,700. 8 3

EVANSVILLE, IND.—Evansville St. Ry. Co 25 m, 15 m s, 4-8½ g, 60 lb T r, 77 c, of which 35 are m c and 42 t c. Westinghouse system. Brownell and St. Louis cars. Westinghouse engines. Pres. J. J. Shipherd, V. Pres. G. H. Stockwell, Sec. H. D. Moran, Treas. S. Krutz, Supt. & Pur. Agt. ——— Elecn. W. L. Stockton, Ch. Engr. Power Station G. Wilson. Capital $500,000. Bonds, $850,000. Office, 102 Main St. 12 3

EVERETT, WASH.—Everett Ry. & Electric Co. 7.42 m, 7.42 m s, 4-8½ g, 40 lb girder r, 5 m c. Westinghouse system. American cars. Ball engines. Pres. S. Duryee, V. Pres. G. Colby, Sec. H. A. Schenck, Treas., Gen. Man. & Elecn. A. R. Whitney, Jr. Capital, $200,000. P. O. Box 118. 4 4

F

FAIRHAVEN, WASH.—Fairhaven & New Whatcom Ry. Co. Elec. 18½ m, 4-8½ g, 40, 56 lb T r, 16 m c. T-H system. Brill cars. Ide engines. Pres. H. Eldridge, V. Pres., Gen. Man. & Supt. E. Cosgrove, Sec J. A. Kerr, Treas. C. C. Fisher. Capital, 500,000; authorized, $600,000. 6 3

FALL RIVER, MASS.—Globe St. Ry. Co. Elec. 26¾ m, 4-8½ g, 45, 48½, 75 lb girder & s b r, 88 c, of which 72 are m c and 16 t c. T-H system. Feigel, Jones, Newburyport and Stephenson cars. McIntosh & Seymour engines. Pres. Frank S. Stevens, Sec. M. G. B. Swift, Treas. R. S. Goff, Supt. John H. Bowker, Ch. Engr. & Ch. Engr. Power Station G. B. Esterly, Elecn. G. W. Palmer, Jr. Capital $650,000. Bonds $1,425,000. Office, 182 N. Main st. 4 4

FINDLAY, O.—Findlay St. Ry. Co. (Operated by Northern Ohio & Lake Erie Ry., Lt. & Power Co.) Elec. 12½ m, of which 4 are horse and 8½ elec., 8 m s 4-8½ g, 35 & 60 lb T r, 22 c, of which 7 are h c, 10 m c and 5 t c, 4 h, 32 mu. Westinghouse system. Laclede cars. Buckeye engines. Pres. G. B. Kerper, V. Pres. J. N. Kinney, Sec. J. Strader, Treas. C. D. Kinney, Gen. Man. & Pur. Agt. C. Smith, Ch. Engr. W. Nusbaum, Elecn. W. Twining. Capital, $200,000; Bonds, $100,000. Office N. Main St. 1 4

Northern Ohio & Lake Erie Ry., Lt. & Pow. Co. (Operates Findlay St. Ry. and Tiffin Elec. Ry.)

FISHKILL-ON-HUDSON, N. Y.—Citizens' St R. R. Co. 3¼ m, 3 m s, 4-8½ g, 45, 54 lb T & girder r, 9 m c. T-H system. Gilbert cars. Fishkill Landing engines. Pres. Gen. Man. & Pur. Agt. J. T. Smith, V. Pres. H. G. Wolcott, Sec. S. K. Phillips, Treas. W. H. Southard, Supt. W. E. Havens. Ch. Engr. of Power Station, W. E. Blakney Capital $75,000. Bonds, $75,000. 1 4

FITCHBURG, MASS.—Fitchburg & Leominster St. Ry. Co. 13.214 m, of which 2.47 are horse and 10.10 elec., 11.70 m s, 4-8½ g, 58 lb T r, 30 c, of which 16 are h c and 14 m c, 42 h. Westinghouse system. Brill, Jones & Newburyport cars. Pres. H. A. Willis, V. Pres. H. I. Wallace, Sec. C. F. Baker, Treas. B. F. Wallis, Gen. Man. & Pur. Agt. W. W. Sargent. Capital $185,000; authorized $250,000. Bonds $30,000. 1 4

FLUSHING, N. Y.—Flushing & College Point St. Ry. Co. 4 m, 4 m s, 4-8½ g, 47 lb s. b. r, 9 c, of which 5 are m c and 4 t c. Westinghouse system. Brill, Jones and Stephenson cars. N. Y. Safety engines. Pres. D. Master, V. Pres. G. Rople, Sec. H. Clement, Treas. J. Hepburn, Supt. W. G. Rock, Elecn. C. Banghart, Ch. Engr. of Power Station W. F. Russell. Capital $60,000. 1 4

FOND DU LAC, WIS.—Fond du Lac St. Ry. Co Elec. 5 m, 4-8½ g, 35 lb T & tram r, 8 c, of which 6 are m c and 2 t c. Westinghouse system. Pullman cars. Ball engines. Pres. & Gen. Man. W. G. De Celle, Treas. W. H. Cole, Asst. Gen. Man. G. A. Voorhees, Supt. L. Marion. Capital, $125,000. 8 3

FORT MADISON, IA.—Fort Madison St. Ry. Co. 4 m, 4-8½ g, 20 & 40 lb T & tram r, 8 c, 5 h 28 mu. Pres. & Gen. Man. D. A. Morrison, V. Pres. R S. Johnson, Sec. H. Jones, Treas. J. C. Brewster, Supt. F. H. Weber. Capital, $100,000. Office, Santa Fe Ave. 1 4

FORT MEADE, FLA.—Fort Meade St. Ry. Co. 2 m, 2 m s, 3 g, 25 lb T r, 2 c, 2 mu. Pres. F. N. Varn, V-Pres. H. L. Rockner, Sec. W. Jackson, Treas. & Pur. Agt. M. Reif. Capital $6,000. 1 4

FORT SCOTT, KAN.—Fort Scott Rapid Transit Co. Elec. 8½ m, of which 1½ are horse & 7 elec. 4 g, 35 lb T r, 16 c, of which 8 are h c and 8 m c. Edison system. Operated by Davenport & Fort Scott Investment Co. Pres. H. H. Anderson, Sec. F. H. Griggs, Supt. W. D. Mitchell. Elecn. L. R. Harris, Ch. Engr. of Power Station J. Hunt. Capital, $250,000; authorized $500,000. Bonds $100,000. Office Katzung & Malin Block. 1 4

FORT SMITH, ARK.—Fort Smith St. Ry. Co. 8½ m, 3-6 g, 38 & 45 lb girder r, 22 c, 80 mu. Brownell and Laclede cars. Pres. Gen. Man. & Supt. Sam'l McLoud, V. Pres. Benj. T. Duval, Sec. & Treas. Geo. T. Sparks. Capital, $150,000. Bonds, $35,000. Office, Cor. Third & A sts. 4 4

FORT WAYNE, IND.—C. L. Centilivre St. Ry. Co 2 m, 4-8½ g, 18 lb. T r, 6 c, of which 2 are 4 wheel box and 4 4-wheel open, 24 h. Pres. L. A. Centilivre V. Pres. & Sec. C. F. Centilivre. Treas. J. B. Reuss, Gen. Man. Le Meyers. Capital, $30,000. d 3 2

Fort Wayne Electric Ry. 18¾ m, 4-8½ g, 40, 60 lb T & tram r, 67 c, of which 57 are m c and 10 t c, 5 h. Own system. Jones cars. Pres. J. H. Bass, V. Pres. & Treas. M. S. Robison, Jr., Sec. J. M. Barrett, Supt. L. D. McNutt. 8 3

Lakeside Electric Ry. 1 m, 52 lb s b Duplex & T r. Gen. Elec, system. Gen. Man. J. D. McDonald. 8 3

FORT WORTH, TEX.—North Side St. R. R. Co. Elec. 14 m, of which 1½ are horse and 12½ elec, 12½ m s, 4 g, 30 lb T & girder r, 19 c of which 15 are m c and 4 t c. T-H system. Brownell cars. Hamilton-Corliss engines. Receiver, N. Harding, Sec. J. Vanarsdell, Gen. Man. & Pur. Agt. G. B. Hendricks, Supt. J. W. Renfro, Ch. Engr. & Ch. Engr. of Power Station C. Bode, Elecn. W. Godfrey. Capital, $200,000. Bonds, 150,000. Office, 409½ Main St. 1 4

Fort Worth & Arlington Heights St. Ry. Co. Elec. 6½ m, 4 g, 35 lb T r, 5m. c. Edison system Pres. H. W. Tallant, V. Pres. A. W. Chamberlin Supt. S. Horn. Capital, $300,000. 9 3

City Ry. Co. Elec. 7½ m, 4 g, 30, 35 lb T r, 16 c, of which 14 are m c and 2 t c. Detroit system. Pullman cars. Ide engines. Pres. L. Warfield, V. Pres. & Sec. J. C. Terrall, Jr., Treas. J. C. Harrison, Gen Man., Supt. & Pur. Agt. W. P. Quigg, Ch. Engr. of Power Station W. A. Andrew. Capital stock, $400,000. 4 4

Polytechnic St. Ry. Co. 2¾ m, 4 g, 20 lb T r, 2 c, 10 mu. Pres. W. D. Hall, V. Pres. R. Vickery, Sec. M. F. Lomer, Treas. G. E. Tandy. 4 2

FRAMINGHAM, MASS.—Framingham Union St. Ry. Co. 7.35 m, 4-8½ g, 30 & 35 lb. T & s. b. r, 17 c 40 h. Pres. Jas. R. Entwistle, Sec. I. B. Forbes, Treas. F. E. Gregory, Supt. J. J. Hennessy. Capital $60,000 & $50,000 bonds. Office, S. Framingham. 5 3

FRANKFORT, N. Y.—Frankfort & Ilion St. Ry. Co. 2¾ m, 5 g, 25 lb T r, 5 c, of which 4 are box and 1 open. 6 h. Pres. J. H. Hoard, V. Pres. P. A Skiff, Sec. W. I. Piper, Treas. W. W. Crosby, Supt J. Myers. Capital, $20,000. Office, Frankfort. 1 4

FREDONIA, N. Y.—Dunkirk & Fredonia R. R. Co. 3¾ m, 3½ m s, 4-8½ g, 42-48 lb c. b. and girder r, 9 c, of which 3 are m c and 6 t c. Edison and Westinghouse systems. Pres. W. McKinstry, Sec., Treas Pur. Agt. & Man. M. M. Fenner. Ch. Eng. Power Station John Kresniska. Capital, $73,450; authorized, $75,000. Bonds, $36,000; authorized, $40,000. 1 4

FREEPORT, ILL.—Freeport St. Ry. Co. 4 m, 4-8½ g, 30 lb. s. b. r, 6 4-wheel box c, 24 h. Pres. Jacob Krohn, V. Pres. F. C. Platt, Sec. W. G. Barnes, Treas & Gen Man. John B. Taylor. Capital, $45,000. 1 2

FREMONT, NEB.—City St. Ry. Co. 6½ m, 4-8½ g, 16-40 lb T r, 7 c, 24 h. Pres. F. Fowler, V. Pres. F. Meyer, Sec., Treas. & Gen. Man, E. N. Morse. Capital $45,000. 1 4

FREMONT, O.—Fremont St. Ry. Co. 1½ m 4-8½ g, 40 lb flat r, 2 4-wheel box c, 8 h. Pres. F. N. Carter, 29 Euclid ave., Cleveland, O., Treas. T. M Irvine, Cleveland, O., Supt. E. J. Carter. Capital $125,000. Office, 807 Croghan st. 1 4

FRESNO, CAL.—Fresno R. R. Co. 4½ m, 4-8½ g, 20 lb r, 7 c, 7 h. Pres. Dr. L. Leach, V. Pres. R. E. Hughes, Sec. N. I. Baldwin, Treas. L. Einstein. Capital, $200,000. 11 0

Fresno, Belmont & Yosemite R. R. Co. 4 m. 4-8½ g, 20 lb steel T r, 6 c, 12 h, 6 mu. Stockton cars. Pres. T. C. White, V. Pres. H. P. Hedges, Sec. J. P. Vincent, Gen. Man. C. L. Walter. Capital, $500,000. Leased to C. L. Walter. 9 3

FRYEBURG, ME.—Fryeburg Horse R. R. Co. 3 m, 4 8½ g, 16 lb steel T r, 5 c, 1 h. Pres, Freeman Hatch, Clerk, Gen. Man. & Supt. Seth W. Fife, Treas. John Locke. Capital $5,075, authorized $10,000. 1 4

FULTON, N. Y.—Fulton & Oswego Falls St. Ry. Co. 1.14 m, 1.14 m s, 4-8½ g, 42½ lb. r, 4 c, of which 3 are box and 1 open, 8 h. Pres. Joseph Walker, Jr., V. Pres. N. N. Stranahan, Sec. & Treas. Charles Lyman, Supt. E. Quirk. Capital, $15,000. Bonds $15,000. Office, 15 Broad st., New York. 1 4

G

GADSDEN, ALA.—Gadsden & Attalla Union Ry. Co. Dummy. 13½ m, of which 2 are horse and 11½ steam, 4-8½ g, 40 lb T r, 14 c, 6 motors, 6 h. Brill cars, Baldwin engines. Pres. J. M. Elliott, Jr., V. Pres. C. A. Lyerly, Sec., Treas., Gen. Man. Supt. & Pur. Agt. M. L. Foster, Engr. & M. M. J. L. Curry. Capital, $2,000. Office 123 N. 4th st. 1 4

GAINESVILLE, GA.—Gainesville & Hall Co. St. R. R. Co. 5 m, 4-8½ g, 20 lb crescent r, 3 c, 3 h, 4 mu. Pres. Sec. & Treas. H. H. Dean, V. Pres. A. D. Candler. Capital, $15,000. Leased to G. P. Boone for three years from Oct. 1, 1891. Office, 10 Spring st. 4 4

GAINESVILLE, TEX.—Gainesville St. Ry. Co. 3½ m, 4-8½ g, 36 lb T r, 8 c, 16 mu. Pres. J. M. Lindsay Gen. Man. & Supt. G. W. Lindsay. Capital $40,000. Office, Fort Worth. 2 3

GALESBURG, ILL.—Galesburg Electric Motor & Power Co. 8 m, 7 m s, 4-8½ g, 50 lb T r, 19 c, of which 6 are h c, 8 m c and 5 t c. Westinghouse system. Pullman cars. Westinghouse engines. Pres. W. Seacord, V. Pres. & Treas. R. Chappell, Sec. & Pur. Agt. H. F. Arnold, Ch. Engr. of Power Station R. W. Whipple. Capital $210,000. Bonds $111,000. Office 540 Main St. 1 4

GALLIPOLIS, O.—Gallipolis St. Ry. Co. Elec 3 m c, T-H system. 10 2

GALVESTON, TEX.—Galveston City R. R. Co (Controls and operates Gulf City Ry. & Real Estate Co.) 33 m, 4-8½ g, 40, 52 lb T r, 84 c, of which 22 are h c, 52 m c and 10 t c. T-H and Westinghouse systems. Laclede and St. Louis cars. Buckeye and Cooper engines. Pres. & Gen. Man. Wm. H. Sinclair, Sec. & Treas. H. Kellner, Supt. W. H. Griffen, Pur. Agt. M. Dwyer, Ch. Engr. & Ch. Engr. of Power Station F. Gwartney. Capital, $318,673.50; authorized, $1,000,000. Bonds, $750,000. Office, I and Center Sts. 1 4

Gulf City St. Ry. & Real Estate Co. (Operated by Galveston City R. R. Co.) 11 m, of which 8 are horse & 3 elec. 4-8½ g, 25-40 lb T r, 22 c, 32 mu. Westinghouse system. Own cars. Pres. J. H. Burnett, V. Pres. & Sec. P. S. Wren. Capital $100,000. Bonds $80.000. Office Ave. 1 & 21st St. 1 4

GEORGETOWN, KY.—Georgetown St. Ry. Co 1¼ m, 4-8½ g, 20 lb T r, 2 c, 6 mu. Pres. S. M. Davis Sec. W. Z. Thomson, Treas. A. H. Sinclair. Capital $6.000. Leased to John Cole. 1 4

GETTYSBURG, PA.—Gettysburg Electric Ry. Co. 8 m, 4-8½ g, 56 lb T r, 6 c, of which 3 are m c and 3 t c. Brill cars. Pres. Gen. Man. & Supt. E. M. Hoffer, Sec. H. G. Walmer, Treas. G. P. Hoffer. 9 3

GIRARDVILLE, PA.—Schuylkill Traction Co. (Lessee of Mahanoy, Shenandoah Girardville & Ashland St. Ry.). 22 m, 10 m s, 4-8½ g, 50, 60, 70 lb T r, 22 m c. Westinghouse system. Lamokin cars. Frick engines. Pres. W. F. Harrity, Sec. & Treas. J. A. Johann, Gen. Man. & Pur. Agt. E. W. Ash. 4 4

GLENS FALLS, N. Y.—Glens Falls, Sandy Hill & Fort Edward St. R. R. Co. Elec. 8 m, 4-8½ g, 40 lb T r, 14 c, of which 10 are m c and 4 t c. Westinghouse system. Pres. J. M. Coolidge, V. Pres. L Allen, Sec. & Treas. B. B. Fowler, Supt. J. A. Powers. Capital authorized $150,000. Bonds $150,000. 1 4

GLOUCESTER, MASS.—Gloucester St. Ry. Co. Elec. 9 m, 4-8½ g, 40-60 lb T & Johnson r, 13 m c T-H and Detroit systems. Pres. W. B. Ferguson, V Pres. J. H. Cunningham, Sec. D. S. Presson, Treas. A. D. Bosson, Supt. A. R. Hallowell. Capital, $180,000. Bonds, $60,000. Office, Gloucester st. 1 3

GLOVERSVILLE, N. Y.—Cayadutta Electric R. R. Co. (Leases Johnstown, Gloversville & Kingsboro Horse R. R.) 20 m, 10½ m s, 4-8½ g, 56, 80 lb T & girder r, 21 c of which 14 are m c and 7 t c. Gen. Elec. and Westinghouse systems. Brill, Ellis and Gilbert cars. Russell Engines. Pres. J. H. Decker, V. Pres. R. Wemple, Sec. H. Dudley, Treas. J. E. Ashe, Gen. Man. R. T. McKeever, Supt. T. C. Frenyear, Mast. Mech. F. D. Havens, Ch. Engr. of Power Station T. H. Ciperly. Capital $335,000; authorized $350,000. Bonds $266,000. Office 1 S. Main St. 4 4

Johnstown, Gloversville & Kingsboro Horse R. R. Co. (Leased to Cayudutta Electric R. R. Co.) 4.1 m, 3.9 m s, 4-8½ g, 45 lb T & girder r, 7 c, of which 4 are m c and 3 t c. Gilbert cars. Gen. Elec. system. Pres. G. C. Burr, V. Pres. J. Hees, Sec. J. M. Russel, Treas. J. H. Place. Capital $50,000. Bonds $50,000. 1 4

GRAND ISLAND, NEB.—Grand Island St. Ry. Co. 7 m, 4-6 g, 16 & 20 lb T r, 11 c, 52 h & mu. St. Louis cars. Pres. A. H. Baker, V. Pres. H. A, Koenig Sec. O. B. Thomson, Treas. W. A. Hagge, Gen. Man. & Supt. W. C. Lamon. Capital, $50,000. 2 3

GRAND JUNCTION, COL.—Grand Junction St. Car Co. 2 m, 3 g, 22 lb. T r, 2 4-wheel box c, 4 & Pres. G. Wheeler, V. Pres. B. Cannon, Sec. h. Treas. T. B. Crawford, Gen. Man. & Supt. B. K. Kennedy. Capital $25,000. h 3 1

General Incandescent Arc Light Co., S. BERGMAN, President. **BEST RAILWAY LAMPS,** 572 to 578 First Ave., NEW YORK.

GRAND RAPIDS, MICH.—Consolidated St. Ry Co. 44 m, 25.7 m s, 4-8½ g, 45, 66 & 78 lb girder r; 183 c, of which 138 are m c and 45 t c. Edison and Detroit systems. Hamilton and Wheelock engines. Pres. A. J. Bowne, V. Pres. & Gen. Man. J. R. Chapman, Sec. J. M. Hagar, Asst. Sec. & Treas. B. S. Hanchett, Jr., Supt. D. Campbell, Gen. Elecn. S. Barnes, Ch. Engr. of Power Station J. Cooper. Capital $1,500,000; authorized $2,000,000. Bonds $2,380,000; authorized $3,000,000. 1 4

GREAT FALLS, MONT.—Great Falls St. Ry Co. 10.8 m, 10.4 m s. 4-8½ g, 45 lb T & girder r, 11 c, of which 7 are m. c. and 4 t. c. T-H system. Water power. Pres. A. S. Bigelow. V. Pres. L. Lewesohn, Sec. & Treas. T. Nelson, Supt. & Pur. Agt. W. D. Dickinson, Ch. Engr. of Power Station G. H. Jay. Capital, $200,000. Bonds $120,000. 1 4

GREENBUSH, N. Y.—North & East Greenbush St. Ry. Co. 1.7 m, 4-8½ g, 6 c, 22 h. Pres. & Treas. A Bleecker Banks. Capital $50,000. Office, 473 Broadway, Albany. 3 2

GREEN CASTLE, IND.—Green Castle City St. Ry. Co. 3 m, 4-8½ g, 40 lb T r, 3 c, 10 mu, Pres. J. W. Welk, V. Pres. J. S. Dowling, Sec. & Treas. F. G. Gilmore, Pur. Agt. J. H. Deitrick. Capital $32,000; authorized $50,000. Office Crystal Palace cor. Vine and Walnut sts. 4 4

GREENSBURG, PA.—Greensburg & Hempfield Electric St, Ry. 2.4 m elec., 4-8½ g, 35 & 45 lb. girder & T r, 3 m c. Westinghouse system. Lamokin cars. Phœnix Iron Works engines. Pres. W. W. Jamison, Sec. & Treas, J. E. Keenan, Gen Man. F. Y. Clopper, Supt. Pur. Agt. & Elecn. R. C. Reamer. Capital. $59.250; authorized, $60,000. Bonds, $59,250. Office, Huff Building. 1 4

GREENVILLE, S. C.—St. Ry. Co. of the City of Greenville. 2¾ m, 5 g, 16 lb crescent r, 6 c, 3 mu T. C. Gower & Son, proprs. Pres. T. C. Gower, Sec G. G. Wells, Supt. A. G. Gower. Capital $10,000. Office, 104 Washington st. 1 4

GREENVILLE, MISS.—Greenville St. Ry. Co. 6 m, 4-8½ g, 25-30 lb T r, 9 c, 15 mu. Pres. J. M Jayne, Sec. & Treas. J. E. Negus, Supt. C. H. Wheat. Capital, $35,000; authorized, $100,000. 1 4

Suburban St. Ry. of Greenville. 2 m, 4-8½ g, T r 2 c, 4 mu. Pres. & Man. H. Wilczinski, V. Pres. N Wilczinski, Sec. & Treas. L. Wilczinski. Capital $25,000. 3 2

H

HALIFAX, N. S.—Nova Scotia Power Co. (Lim.) 7 m, 4-8½ g, 45-60 lb T r, 25 c, 100 h. Pres. John White, Sec. & Treas. H. Freeman, Supt. J. Adams. Office, 138 Hollis st. Halifax, N. S. Office of Supt. Richmond. 11 0

HAMILTON, O.—Hamilton & Lindenwald Electric Transit Co. 9 m, 4-8½ g, 40, 45 lb T and girder r, 23 c, of which 15 are m. c. and 8 t. c. Edison system. Stephenson cars. Hamilton engines. Pres. Thos. Millikin, V. Pres. C. Benninghofen, Sec. & Gen. Man. Ira S. Millikin, Treas. P. Benninghofen. Capital, $100,000. Bonds $100,000 1 4

HAMILTON, ONT.—Hamilton St. Ry. Co. 22 m, 11 m s, 4-8½ g, 62, 69 lb girder r, 75 c. Westinghouse system. Jones Cars. Corliss and Wheelock engines Pres. B. E. Charlton, V. Pres. E. Martin, Sec. Gen. Man. & Pur. Agt. J. B. Griffith, Elecn. W. W. Dean. Capital $205,000. Office 6 James St., South. 1 4

HAMMOND, IND.—Hammond, Whiting & East Chicago Electric Ry. Co., 8 m, 8 m s, 4-8½ g, 62 lb. girder r, 6 m c. Westinghouse system. Pullman cars. Ball engines. Pres. C. F. Griffin, V. Pres. N. M. Kaufman, Sec. & Treas. A. M. Turner, Supt. J. S. Ward Capital, $100.000. 2 4

HAMPTON, VA.—Hampton & Old Point Ry. Co 4 m. 1½ m s, 4-8½ g, 50-69 lb T & girder r, 14 c, of which 7 are m c and 7 t c. Edison system. Brill cars. Frick engines. Pres. Gen. Man. Supt. & Pur. Agt. F. W. Darling, V. Pres. J. McMenamin, Sec. & Treas. H. L. Schmelz, Elecn. J. B. Crankshaw. Ch. Engr. of Power Station F. L. Small. Capital, $37,500 authorized $100,000. Bonds $140,000. 1 4

HANNIBAL, MO.—Hannibal Ry. Co. Elec 2½ m 4-8½ g, 36,40 lb T & c b r, 5 c, of which 3 are m. c. and 2 t. c. T-H system. Pres. & Supt. M. Doyle Sec. & Treas. James O'Hern. Capital $25,000. Office 300 Market st. 1 4

HARRISBURG, PA.—Harrisburg City Passenger Ry. Co. (Leased to East Harrisburg Pass. Ry. Co.) Elec. 5½ m, 5-2½ g, 70 lb girder r. T-H system. Pres. H. A. Kelker, V. Pres. G. R. Fleming, Sec. A. Roberts, Treas. W. L. Gorgas. Capital $125,000. Office, 27 South 2d st. 9 3

Citizens' Passenger Ry. Co. Elec. 9 m, 5-2½ g, 75 lb girder r, 16 m. c. Baxter, Curtis and Westinghouse systems. Ide engines. Pres. B. F. Meyers, V. Pres. J. A. Dunkle, Sec. & Treas. A. W. Dunkle, Supt. F. H. Alleman. Capital, $200.000. 6 3

East Harrisburg Pass. Ry. Co. 30 m, 8 m s, 5-2½ g 52, 78, 92 lb girder and T r, 63 c, of which 48 are m c and 15 t. c. Gen. Elec. system. Brill and Lamokin cars. Wetherill engines. Pres. John Q. Denney, V. Pres. T. G. Greenawalt, Sec. & Treas. W. J. Calder, Supt., Pur. Agt. & Elecn. F. B. Musser. Capital $500,000; authorized $1,000,000. Office, 5 Market square. 4 4

HARTFORD, CONN.—Hartford St. Ry. Co. Elec. 35 m, of which 20 are horse and 15 elec, 4-8½ g, 45-60 lb T, & girder r, 127 c, of which 108 are m c and 19 t c, 468 h. Gen. Elec. and Westinghouse, systems. Pres. E. S. Goodrich, Sec. & Treas. Dan'l R. Howe. Capital $200,000; authorized $2,000,000. Bonds $500,000. Office, 346 Main st. 4 4

East Hartford & Glastonbury Horse R. R. Co. Elec 5 m, 4-8½ g, 50 lb T r, 4 m c. Short system. Pres D. R. Howe, V. Pres. I. Broadhead, Sec. G. D. Curtis Treas. E. M. White, Gen. Man. E. S. Goodrich. 11 2

HARVEY, ILL.—Harvey Transit Co. Elec. 3 m c, 4-8½ g, T r, 3 m c. Short system. Laclede cars. Ide engines. Pres. A. G. Spalding, V. Pres. A. C. Badger, Gen. Man. W. J. McCorkindale, Supt. H. E. Geyer. Capital $150,000. Bonds $150,000 4 4

HASTINGS, NEB.—Citizens' St. Ry. Co. 5½ m, 4-8½ g, 16 & 32 lb T & flat r, 6 box c, 8 h. Pres. Gen. Man. & Supt. R. A. Batty, Sec. Rose E. Shedd, Treas. J. Hornshaw. Capital $65,000; authorized, $100,000. 9 3

HAVERHILL, MASS.—Lowell, Lawrence & Haverhill St. Ry. Co. (See Lawrence, Mass.)

Haverhill & Amesbury St. Ry. Co. Elec. 32 m, of which 8½ are horse, 5½ steam & 18 elec, 4-8½ g, 35 50, 70 lb T & girder r, 65 c, of which 20 are h c, 32 m c and 13 t c. T.H and Westinghouse systems. Briggs, Ellis and Newburyport cars. Pres. & Gen. Man. E. P. Shaw, Treas. A. C. Pond, Supt. W. Wentworth. Capital, $150,000; authorized, $250,000. Bonds, $300,000. 1 3

HAZLETON, PA.—Lehigh Traction Co. 14 m, 4 m s, 4-8½ g, 60 lb T r, 20 c, of which 11 are m c, 4 t c, and 4 coal c. Westinghouse system. Brill and Lamokin cars. Westinghouse engines. Pres. C. W. Kline, V. Pres. H. Dryfoos, Sec. E. S. Doud, Treas. N. C. Yost, Supt. & Elecn. J. E. Giles. Ch. Engr. A. E. Hess. Capital $500,000; authorized, $1,000.000. Bonds, $350,000. 2 4

HELENA, ARK.—Citizens' St. Ry. Co. 2½ m. ½ m s, 4-8½ g, 20 & 40 lb T & Johnson r, 7 c, of which 4 are 4-wheel box & 3 truck c, 12 mu. St. Louis cars, Pres. H. S. Hornor, V. Pres. D. T. Hargraves, Sec. Gen Man. & Pur. Agt. J. H. Thompson, Treas. S. H. Hornor. Capital $30,000. 1 4

HELENA, MONT.—Helena Electric Ry. Co. 9 m, 4-8½ g, 38-48 lb girder & T r, 16 c, of which 8 are m c and 8 t c. T-H & Westinghouse systems. Pullman and Stephenson cars. Corliss engines. Pres. H. M. Parchen, V. Pres. W. A. Chessman, Sec. & Treas. H. L. Walker. Capital, 250.000. Office, Main St. & 6th Ave. 4 4

Helena Rapid Transit R.R. Elec. 15 m, 15 m s, 4-8½ g, 35,45, 50 lb T & girder r, 9 m c. T-H. system. Northern cars. Russell engines. Pres. & Gen. Man. R. Lockey, V. Pres. P. Winne, Sec. J. T. Hoag, Foreman F. G. Montgomery, Elecn. A. H. Noyes, Ch. Eng. of Power Station, N. B. Nason. Capital, $500,000. Office, Lockey Bldg, 6th ave. 1 4

HENDERSON, KY.—Henderson St. Ry. Co. 6½ m, 4-8½ g, 20 lb steel T r, 12 c, 2 h, 44 mu. St. Louis cars. Pres. & Gen. Man. E. G. Sebree, Jr., Sec. & Treas. D. Bank, Jr., Supt. J. W. O'Brien. Authorized capital, $100,000. 4 4

HENDERSONVILLE, N. C.—Hendersonville St. Ry. Co. 3 m, 4-8½ g, 30 lb T r, 3 c, of which 1 is 4-wheel box and 2 4-wheel open, 1 h, 2 mu. Stephenson cars. Owner & Gen. Man. S. V. Pickens. Capital, $6,000. Office, 1 S. End Main st. 4 4

HOBOKEN, N. J.—North Hudson County Ry Co. (Includes Pavonia Horse R. R.) 60 m, of which 28 are horse and 32 elec, 4 6¾, 4-8½ g. 56, 67, 78 lb c. b. girder and T r, 250 c, of which 171 are h c, and 179 m c, 930 h. T-H system. Brill, Gilbert and Stephenson cars. Ball, Phila-Corliss and Watts-Campbell engines. Pres. M. Tierny, V. Pres. H. J. Bonn, Sec. T. J. Mallory, Treas. J. F. W. Mangels, Gen. Man. E. W. Starr, Supt. Nicholas Goelz, Elecn. A. K. Bonta, Ch. Engr. of Power Station C. A. Dennis. Capital $1,000,000. Bonds $3,000,000. Office, 21 Hudson Place. 2 3

HOLYOKE, MASS.—Holyoke St. Ry. Co. Elec 8 m, 4-8½ g, 56 lb. T r, 32 c. of which 20 are m c and 12 t c. T-H and Westinghouse systems. Pres. Levi Perkins, Treas. & Gen. Man. Wm. S. Loomis, Supt. G. Hunter. Capital $250,000. Office 23 Canal St. 1 4

HORNELLSVILLE, N. Y.—Hornellsville Electric Ry. Co. 4 m, 4-8½ g, 56 lb girder r, 10 c of which 5 are m c and 5 t c. Edison system. Pres. C. Adsit, V. Pres. F. D, Sherwood, Sec. D. M. Page, Treas. G. T. Rehn, Supt. & Ch. Engr. C. H. Wickham, Elecn. Dr. Haven. Capital $50,000. Bonds $50,000. Office, 119 Main St. 4 4

Hornellsville & Canisteo Ry. Co. Elec. 5 m, 4-8½ g, 40 lb T r. 4 c, of which 3 are m c and 1 t c. Edison system. Brill cars. Pres. D. M. Page, V. Pres. F. D. Sherwood, Sec. C. Adsit, Treas. G. T. Rehn, Supt. & Ch. Engr. C. H. Wickham, Elecn. Dr. Haven. Capital $50,000. Bonds $50,000. Office 119 Main st. 4 4

HOT SPRINGS, ARK.—Hot Springs Electric St Ry. Co. 15.4 m, of which 2 are horse and 13.4 elec, 4-8½ g, 48 lb T r, 35 c, of which 10 are h c 10 m c and 15 t c. T-H system. American cars. Pres. S. W. Fordyce, Sec. C. E. Maurice, Treas., Man. & Pur. Agent C. G. Convers. Capital, $500,000. Office, 615 Park Ave. 9 3

Fountain & Suburban R. R. Co. Elec. 4½ m, 4 g 35 lb T r R. Murray, owner & manager, Williamson Block, Valley st., at Malvern Crossing. Capital $20,000. 8 2

HOT SPRINGS, S. DAK.—Hot Springs & Chautauqua R. R. Co. Elec. 1¼ m, 2 m. c. Short system 10 1

HOUSTON, TEX.—Houston City St. Ry. Co. (Operates Bayou City and Houston Heights Rys.) Elec. 35 m, 4-8½ g, 40, 45 lb T & flat r, 55 c, of which 45 are m c and 10 t c, Edison and T-H systems. Brill, Brownell, St Louis and Stephenson cars. Allis engines. Pres. O. M. Carter, V. Pres. & Gen. Man. H. F. MacGregor, Sec. & Tres. C. A. McKinney, Supt. F. Mundes. Capital, $1,000,000. Office, 502-4 Travis st. 3 4

HUDSON, N. Y.—Hudson Elec. Ry. Co. 1¾ m elec, 4-8½ g, 35 lb T r, 5 m. c. T-H system. Pres. H Mc Gonegal, Vice-Pres. A. J. Rowles, Sec. E. J Hodge, Treas. S. D. Lake. Capital stock $50,000. 5 3

HULL, MASS.—Hull St. Ry. Co. 2 m, 2 m s, 4-8½ g, 40 lb. T r, 8 c, 4 of which are m c and 4 t c. Gen. Elec. system. Newburyport cars. Pres. E. P. Shaw, Treas. J. W. Hobart, Supt. W. A. Larrabee. Capital, $20,000. Bonds, $20,000. Office, 53 State St., Boston. 2 4

HUNTINGTON, L. I., N. Y.—Huntington R. R Co. 3 m, 4-8½ g, 30 lb. T r, 3 c, 10 h. Pres. E. D. Davidson, V. Pres. Temple Prime, Sec. Geo. M. Tileston Treas. D. Conklin, Gen. Man. I. Rogers. Capital $30,000. Bonds, $26,000. 4 4

HUNTINGTON, W. VA.—Consolidated Light & Ry. Co. Elec. 11 m, of which 4 are horse and 7 Elec. 4-8½ g, 42, 52 lb girder & T r, 13 c, of which 7 are m c and 6 t c. Short system. Laclede and Jones cars. Taylor and Buckeye engines. Pres. J. L. Caldwell, V. Pres. T. T. McCullough, Sec. & Gen. Man. F. L. Doolittle, Treas. C. L. Hafner, Sr. Capital, $250,000. Bonds, $100,000. Office, 919 2d Ave. 9 3

HUNTSVILLE, ALA.—Huntsville Belt Line & Monte Sano Ry. Co. 12 m steam, 4-8½g, 60 lb. T r, 20 c. Pres. J. F. O'Shaughnessy, 36 Wall st. New York Capital, $200,000. Bonds, $150,000. Office, Jefferson st. 2 2

HUTCHINSON, KAN.—Hutchinson St. Ry. Co. 12 m, 4-6 g, 20 lb T r, 6 c, 30 h, 20 mu. Brownell and Laclede cars. Pres. & Gen. Man. L. A. Bigger, V. Pres. J. B. Brown, Sec. L. Taylor, Treas. & Supt. S. Bigger. Capital, $50,000. Office, 8 E. Sherman St. 9 3

I

INDEPENDENCE, MO.—Kansas City, Independence & Park Dummy Line. (See Kansas City.)

INDIANAPOLIS, IND.—Citizens' St. R. R. Co. 100 m, 4-8½ g, 38 to 95 lb Johnson girder r, 160 c, Gen. Elec. and Westinghouse systems. Pres. A. L. Mason, V. Pres. W. L. Elder, Sec. & Treas. W. F. Milholland, Pur. Agt. S. F. Hazelrigg, Gen. Man. T. H. McLean. Capital $5,000,000. Bonds $4,000,000. Room 11 Fair Block. 4 4

IRONTON, O.—The Ironton & Petersburg St. Ry. Co. 8 m, 4-8 g, 32 lb T & flat r, 13 c, 42 h. Pres. C. H. Harman, Sec. & Treas. Wm. M. Kerr, Supt. T. T. Johnson. Capital, $100,000. Bonds, $65,000. Office, 32 Nassau St., New York. 1 3

IRONWOOD, MICH.—Twin City Ry. Co. 5½ m, 5½ m s, 4-8½ g, 45 lb T r, 4 m. c. T-H system. Allis engines. Pres. & Gen. Man. E. D. Nelson, V. Pres. H. M. Byllesby, Sec. & Treas. H. F. Jahn, Supt. and Pur. Agt. M. Kinch. 4 4

ITHACA, N. Y.—Ithaca St. Ry. Co. Elec. 6 m, 4-8½ g, 45, 60 lb T r, 18 c, of which 12 are m c and 6 t c. T-H system. Brill and Gilbert cars. Ball engines. Water power. Pres. H. E. Hand, V. Pres. A. Hand, Sec., Treas. & Gen. Man. H. Bergholtz. Supt. J. A. Maxwell. Capital, $175,000; authorized, $250,000. Office 16 East State st. 4 4

J

JACKSON, MICH.—Jackson Street Ry. Co. Elec 7 m, 4-8½ g, 45 T & lb girder r, 16 c, of which 8 are m c and 8 t c. Edison system. Brill cars. Pres. H. H. Smith, V. Pres. D. S. Smith, Sec. J. B. Corliss, Treas. & Gen. Man. H. H. Smith, Jr. Capital, $140,000; authorized, $150,000. Office, Main and Horton Sts. 9 3

JACKSON, MISS.—Jackson City R.R. 1½m 4-8½ g, 4 4-wheel box c, 10 h. Pres. P. W. Peoples of Jackson Bank. Capital, $5,000. 3 2

JACKSON, TENN.—Jackson & Suburban St. R. R. Co. 7, m, 4 g, 30 lb tram r, 9 4-wheel box c, 30 mu Pres. & Gen. Man. J. L. Wisdom, V. Pres. J. H. Duke Sec. C. G. Bond, Supt. T. F. Dalbey, Treas. 1st Nat Bank. Capital, $50,000. Office, Royal St. at Five Points. 5 3

JACKSONVILLE, FLA.—Main St. R. R. Co. Elec. 3 m, 3 m s, 5 g, 40 lb T r, 4 c of which 2 are m c and 2 t c. General Electric system. Stephenson cars. Pres. S. B. Hubbard; V. Pres. J. M. Schumacher, Sec. & Treas. A. F. Perry. Elecn. C. S. Hammatt, Ch. Engr. of Power Station C. O. Patterson. Capital, $15,000. Bonds $4,400. Office, 26 Main st. 1 4

Jacksonville St. R. R. Co. 12 m, 5 g, 25 & 30 lb T & 35 lb c b r, 33 c, 137 mu. Pres. H. S. Haines, Savannah, Ga.; V. Pres. Geo. R. Foster, Jacksonville, Fla.; Treas. J. M. Lee, Savannah; Supt. G. W. Haines, Brunswick, Ga.; Agent & Eng. M. H. Motte, Jacksonville. Office, Commercial st. c 9 0

JACKSONVILLE, ILL.—Jacksonville Ry. Co. Elec., 5 m, 4-8½ g, 25-45 lb r, 21 c, of which 9 are m c, 12 t c, 5 h. T-H. & Detroit systems. Pres. Wm. S Hook, Sec. Marcus Hook, Treas. Fannie Hook, Supt B. F. Sibert. Capital $50,000. 6 2

JAMAICA, N. Y.—Jamaica & Brooklyn Road Co. (See Brooklyn, Queens Co. & Suburban R. R. Co., Brooklyn, N. Y.)

JAMESTOWN, N. Y.—Jamestown St. Ry. Co Elec. 20 m, 4-8½ g, 30-70 lb T & girder r, 32 c, of which 27 are m c and 5 t c, 7 h. Short and Westinghouse systems. Brill cars. Noye and Phœnix engines. Pres. A. N. Broadhead, V. Pres. L. B. Warner, Sec. W. S. Cameron, Treas. S. B. Broadhead, Supt. & Pur. Agt. G. E. Maltby. Capital $250,000. Bonds $300,000. 9 3

JANESVILLE, WIS.—Janesville St. Ry. Co 7 m, 5 m s, 4-8½ g, 35 lb T r, 9 c, of which 5 are m c and 4 t c. Short system. Calumet and St. Louis cars. Armington & Sims engines. Pres. George W. Blabon, V. Pres. A. Graham, Sec., Treas. & Gen. Man. W. R. Proudfoot, Elecn. R. W. Bryan. Ch. Engr. of Power Station A. Gibson. Capital $125,000. Bonds $75,000. Office, Power House, Academy st. 4 4

JEFFERSONVILLE, IND.—Jeffersonville City Ry. Co. 5 m, 4-8½ g, 20 & 35 lb steel T r, 11 c, 35 mu. Pres., Sec. & Treas. E. J. Howard, V. Pres. G. J. Long, Supt. E. Frazer. Capital stock, $50,000. Office, 57-59 Spring st. 1 3

JERSEY CITY, N. J.—Jersey City & Bergen R. R. Co. (Controlled by Consolidated Traction Co. of New Jersey.) 40 m, of which 30 are horse and 10 elec. 4-10½ g, 50 & 78 lb c. b. & girder r, 163 c, of which 136 are h c and 27 m c, 819 h, 56 mu. Curtis and Westinghouse systems. Stephenson and Trimble cars. Pres. Chas. B. Thurston, 1st V. Pres. G. F. Perkins, 2d V. Pres. & Gen. Man. D. Young, Sec. H. C. Ross, Treas. Joseph S. Vanzandt, Supt. Thos. M. Sayre. Capital $1,000,000. Bonds, $258,000. Office, No. 1 Exchange Pl. 9 3

Consolidated Traction Co., of New Jersey. (See Newark, N. J.)

JOHNSON CITY, TENN.—Johnson City & Carnegie St. Ry. Co. Elec. 4 m, 4-8½ g, 45 lb T r, 4 m c. T-H. system. Ellis cars. Power rented. Pres. E. Day, V. Pres, F. A. Stratton, Sec., Treas. & Gen. Man. E. H. Stevens. Capital $50,000. 1 4

JOHNSTOWN, PA.—Johnstown Pass. Ry. Co. 15 m, 4-8½ g, 78 lb girder r, 31 c. of which 19 are m c and 12 t c. Westinghouse motors. Ball and Westinghouse engines. Stephenson cars. Pres. Tom. L. Johnson, V. Pres. & Man. John B. Hoefgen, Sec. S. E. Young. Capital. $250,000. Office Johnstown. 4 4

JOLIET, ILL.—Joliet St. Ry. Co. Elec. 16 m 4-8½ g, 38, 40, 58 lb. girder & T r; 30 c, of which 16 are m c & 14 t c. T-H system. Pres. & Gen. Man. J A. Henry, V. Pres. & Supt. J W. Folk, Sec. & Treas. J. Hulsizer. Capital, $150,000; authorized, $300,000. Bonds, $75,000. Office, S. W. corner Jefferson & Ottawa Sts. 1 3

JOPLIN, MO.—Joplin Electric Ry. & Motor Co 5 m, 5 m s, 4-8½ g, 56 lb girder r, 10 c, of which 8 are m c and 2 t c. T-H system. St. Louis cars. Ide engines. Pres. John N. Boffinger, V. Prests. B. F. Hammett, J. C. Stewart, Sec. & Treas. D. R. Powell, Gen. Man. H. L. Newman, Supt., Pur. Agt. & Elecn. C. H. Belden, Ch. Engr. of Power Station C. Knowles. Capital, $150,000. Office, East Broadway. 4 4

Southwest Missouri Electric Ry. Co. (See Webb City, Mo.)

K

KALAMAZOO, MICH.—Citizens' St. Ry. Co. Elec. 12 m, 4-8½ g, 50 lb. T r, 25 c, of which 14 are m. c. and 11 t. c. General Electric system. Pres. T. P. Bailey, V. Pres. G. J. Kobusch, Sec. & Supt. E. E. Downs, Treas. J. W. Johnson, Gen. Man. G. K. Wheeler. 1 4

KANKAKEE, ILL.—Kankakee Electric Ry. Co. 6 m, 4-8½ g, 50 lb T, girder & T r, 4 m c. Westinghouse system. Pullman cars. Pres. & Gen. Man. C. H. Cobb, V. Pres. H. K. Wheeler Sec. & Treas. T. W. Adams. Capital, $50,000; authorized, $60,000. 9 3

North Kankakee Elec. Lt. & Ry. Co. 4.2 m, 4-8½ g, 40, 57 lb T & girder r, 3 m. c. Detroit and T-H Systems. St. Louis cars. Phœnix engines. Pres. B. F. Uran, Sec. E. E. Day, Treas. A. D. Ehrich, Gen. Man. & Supt. E. Powell. Capital $70,000: Bonds, $25,000. 9 3

KANSAS CITY, KAN.—Kansas City Elevated Ry. Co. (Operates Kensington Ry.) Elec. 20 m, 4-8½ g, 40, 50, 62 lb T & Duplex r, 34 m c. T-H, Edison and Westinghouse systems. Pullman and St. Louis cars. Corliss engines. Pres. C. W. Blair, V. Pres. & Gen. Man. R. Gillham, Sec. D. D. Hoag, Treas. A. H. Calif. Capital, $2,600,000. 1 4

West Side R. R. Co. Elec. 10 m, 4-8½ g, 45, 54 lb T & girder r, 16 c, of which 12 are m. c. and 4 t. c. Westinghouse system. St. Louis cars. Sioux City Corliss engines. Pres. W. N. Coler, Jr., Sec. C. F. Hutchings, Supt. J. P. Clark. Capital, $500,000. Bonds $150,000. 6 3

KANSAS CITY, MO.—Kansas City Cable Ry. Co. 20½ m cable, 4-8½ g, 42, 56 & 63 lb flat & Johnson girder r, 190 c, of which 119 are open and 71 g. c Brownell, Laclede and Stephenson cars. Pres. & Gen. Man. Wm. J. Smith, V. Pres. Jas. A. Blair, Sec. W. H. Lucas, Treas. J. T. Thornton, Asst. Gen. Man. F. C. Peck, Pur. Agt. W. A. Satterlee, Elecn. T. Griffin. Capital, $1,575,000 Bonds $1,350,000. Office, 433 E. Ninth st. 4 4

Grand Ave. Ry. Co. 22.518 m, of which 3.500 are horse, 17.144 cable & 1.874 steam, 12.129 m s, 56 lb T & c b r, 89 c, of which 7 are h c, 80 cable comb'n and 2 steam c, 40 h. Brownell cars. Allis engines. Pres. W. H. Holmes, V. Pres. V. B. Buck, Sec. D. B. Holmes, Treas. W. B. Clarke, Gen. Man. C. F. Holmes, Supt. T. Barratt, Auditor, T. J. Fry, Ch. Engr. of Power Station D. W. Dozier. Capital, $1,200,00. Bonds, $1,200,000. Office, 1500 Grand ave. 1 4

Kansas City & Independence Rapid Transit Ry. Co. 18 m steam, 4-8½ g, 40 lb T r, 28 c, of which 18 are pass. c, 9 flat c and 1 express c, 6 steam motors. Laclede cars, Baldwin engines. Pres. W. H. Holmes, V. Pres. C. L. Hutchinson, Sec. D. B. Holmes, Treas. W. B. Clarke, Gen. Man. C. F. Holmes, Auditor, T. J. Fry, Pur. Agt. V. W. Flowerree. Capital, $1,000,000. Office 1,500 Grand Ave. 1 4

Kensington Ry. Co. (Operated by Kansas City Elevated Ry. Co.) Steam. 4 m, 4-8½ g, 50 lb T r. Pres. A. P. Smith, V. Pres. R. S. Miner, Sec. J. E Brady, Treas. W. A. Bunker. Capital $50,000. Bonds $50,000. 4 4

Metropolitan St. Ry. Co. 42.387 m, of which 24.814 are cable, 9.345 horse and 8.228 elec., 4-8½ g, 60 lb c b r, 289 c of which 42 are h. c, 76 g c, 20 m c and 151 t. c, 175 h and mu. T-H system. Laclede and Pullman cars. Armington & Sims and Hooven, Owens & Rentschler engines. Pres. & Treas. C. F. Morse, V. Pres. G. H. Nettleton, Sec. J. A. Harder, Gen. Man. & Ch. Eng. R. J. McCarty, Asst. Gen. Man. F. M. Bernardin, Ch. Engr. of Power Station A. E. Deibert. Capital $2,800,000; authorized $3,600,000. Bonds $2,000,000. Office, 9th & Broadway. 4 4

North East St. Ry. Co. Elec. 7 m, 3½ m s, 4-8½ g, 52 lb girder r; 20 c of which 10 are h c and 10 m c. T-H and Westinghouse systems. Centropolis cars. Pres. E. A. Phillips, Sec. W. C. Scarritt, Gen. Man. R. Gillham, Supt. J. Houlehan, Pur. Agt. A. J. McDonald. Capital $260,000. Bonds $260,000. Office, St. John and Elmwood Aves. 1 4

People's Cable Ry. Co. 6.8 m, 4-8½ g, 58½ lb r, 35 c, of which 15 are g. c. and 20 t. c. Auditor & Cashier, W. C. Philips, Supt. F. Philips. Capital $750,000. 3 2

South Suburban Ry. Co. Elec. 3.25 m, 4-8½ g, 35-56 lb. flat & girder r, 6 m. c. T-H system. St. Louis cars. Pres. G. K. Wheeler, V. Pres. & Gen. Man. D. J. Haff, Sec. C. A. Ross, Treas. I. C. Hubbell, Supt. C. Grover. Capital, $150,000. Bonds $100,000. Office, 829 N. Y. Life Ins. Bldg. 6 3

KEARNEY, NEB.—Kearney Electric Co. 5½ m Elec. 4-8½ g, 40 lb T r, 6c, of which 4 are m. c. and t. c. T-H & Edison systems. Pres. Geo. W. Frank Sec. & Treas. C. M. Rice, Supt. G. W. Frank Jr. Capital $250,000. 1 4

KENOSHA, WIS.—Kenosha Electric St. Ry. Co Pres. & Gen. Man. J. W. Munson. Capital $100,000. (Not in operation) 4 4

KEOKUK, IA.—Gate City Electric St. Ry. Co. 6½ m, 4-8½ g, 38-45 lb T & girder r, 14 c, of which 8 are m c and 6 t c. Edison and Westinghouse systems. Receiver H. C. Reiner. Capital authorized, $130,000. Bonds $85,000. 1 4

KEY WEST, FLA.—Key West Street Car Association. 5 m, 4-8½ g, 50 lb r, 12 c, 75 mu. Brill cars. Pres. J. Albertas, Sec. G. B. Paterson, Treas. Key West St. Car Co., Supt. A. Orchuela. Capital, $150,000. 6 3

KEYPORT, N. J.—Keyport & Matawan St. Ry Co. 3½ m, 4-8½ g, 38 lb girder s-b r, 6 4-wheel box c 24 h. Pres. R. R. Brown, Sec. & Treas. A. M. Brown, Supt. W. C. Smith. Capital, $30,000. 4 4

KINGSTON, N. Y.—Colonial City Electric Ry. Co, 6 m, 6 m s, 4-8½ g, 80 lb girder r, 12 c, of which 6 are m c, and 6 t c. United Columbian system. St. Louis cars. Ball & Wood engines. Pres. E. H. Loughran, V. Pres. W. Goodwin, Sec. & Gen. Man. N. C. Powelson, Treas. F Swift. Ch. Engr. E. B. Codwise, Ch. Engr. of Power Station F. Brown. Capital, $175,000. Bonds $150,000. Office 29 Wall St. 2 4

Kingston City R. R Co. (See Rondout. N. Y.)

KINGSTON, ONT., CAN.—Kingston St. Ry Co. 8 m, 3 g, 44 lb r, 15 c, 45 h. Pres. & Gen. Man B. W. Folger, V. Pres. M. H. Folger, Sec. F. R. Sargent, Treas. B. W. Folger, Jr., Supt A. Beacance Capital $60,000. Bonds $60,000. 6 2

KNOXVILLE, TENN.—Knoxville Electric Ry. Co. 17 m, of which 13 are electric, 4 8½ g, 45 lb girder & T & 25 lb tram r, 26 c, 12 m. c. T-H system Receiver, J. C. Duncan, Supt. W. B. Palmer. 7 3

Fountain Head Ry. Co. 6 m, 4-8½ g, 45 lb T r, 11 c of which 7 are passenger and 4 freight, 3 dummies Pres. G. Borgfeldt, V. Pres. G. F. Pfeiffer, Treas. J Kahle, Gen. Man. M. O. French, Supt. R. T. Baker Capital $200,000. Office, 91 W. Depot st. 4 4

West End St. Ry. Co. 4 m. 4 m s, 4-8½ g, 20 24 lb c. b. and T r, 3 m c. T-H System. Stephenson cars. Pres. R. M. Rhea, V-Pres. W. P. Chamberlain, Sec. Treas. Gen. Man. & Pur. Agt. T. J. Thomas, Elecn. W. P. Hickman. Capital $25,000; authorized $50,000. Bonds $9,600. 1 4

KOKOMO, IND.—Kokomo City St. Ry. Co. Elec 4⅞ m, 4-8½ g, 35 lb T r, 13 c, of which 9 are m c, and 4 t c. Detroit system. Brownell cars. Dick & Church engines. Pres. F. E. Snow, V. Pres W. A. Jackson, Sec. & Treas. F. Woodruff, Supt. & Elecn. F H. Allen. Capital $100,000. 1 4

L

LACONIA, N. H.—Laconia & Lakeport St. Ry. 3.62 m, 3 g, 35 lb T r, 11 c, 25 h. Pres. J. C. Moore, V. Pres. & Gen. Man. Henry Tucker, Treas. Edmund Little, Supt. B. S. Kenniston. Capital $50,000. 1 4

LA CROSSE, WIS.—La Crosse City Ry. Co. 10¾ m, of which ⅓ is horse and 10¼ elec., 4-8½ g, 40-66 lb girder & T r, 30 c, of which 5 are h c, 11 m c and 14 t c, 20 h. Gen. Elec. system. St. Louis cars. Allis engines. Pres. B. E. Edwards, V. Pres. W. W. Cargill, Sec. H. E. West, Treas. Geo. H. Clark, Supt. Peter Valier, Ch. Engr. C. C. Smith. Elecn. J. Johnson, Ch. Eng. of Power Station S. J. Prentiss. Capital $200,000. Bonds $125,000. Office, 3d and La Crosse Sts. 1 4

LA SALLE, ILL.—City Electric Ry. Co. 9¼ m, elec, 4-8½ g, 51½ lb s b & girder r, 9 c, of which 6 are m c and 3 t c. Edison system. Pres. ——— Sec. F. X. Kilduff, Treas. L. B. Merrifield, Supt. E. S. Enyart. Capital $125,000. 3 2

LAKE CHARLES, LA.—Lake Charles St. Ry Co. 1¾ m. 1¾ m s, 4-8½ g, 30 lb T r, 4 c, 14 mu. Pres. P. Crowley, V. Pres. J. Ryan, Sec., Treas. & Gen. Man. W. Meyer, Treas. A. Meyer. Capital, $10,000; authorized $50,000. 4 4

LAFAYETTE, IND.—Lafayette St. Ry. Elec 10 m, 4-8½ g, 56 lb T & girder r, 21 c, of which 19 are m c and 2 t c, Edison system. Brill cars. Hamilton-Corliss engines. Pres. Frank M. Riter, V. Pres. T. J. Levering, Sec. & Treas. J. T. Henderson, Gen. Man. & Elecn, J. S. Hill. Capital $150,000. 1 4

LAMPASAS SPRINGS, TEX.—Lampasas Springs St. R. R. Co. 3 m, 3 m s, 4-8½ g, 35 lb. T r, 6 c, 16 mu. Pres. R. E. Maddox, V. Pres. E. R. Maddox, Sec. W. Little, Treas. Gen. Man. Supt. & Pur. Agt. E. P. Maddox, Ch. Engr. E. Day. Capital $20,000; authorized, $20,000 Office, Elm st. 1 4

LANCASTER, N. Y.—Buffalo, Bellevue & Lancaster Ry. Co. 14 m, 13½ m s, 4-8½ g, 45, 54, 66 T and girder r, 24 c of which 10 are m c and 14 t c. T-H system. Brill and Stephenson cars. Ball engines. Pres. H. W. Box, Sec. J. A. Roberts, Treas. J. L. Williams, Supt. & Pur. Agt. R. E. Danforth, Elecn. F. D. Jackson, Ch. Engr. of Power Station, W. A. Davison. Capital $90,000; authorized $100,000. Bonds $200,000. 1 4

LANCASTER, O.—Lancaster Electric Ry. Co. 4 m, bonded for elec. service, 4-8½ g, 52 lb girder r, 7 c, 16 h. Pres. Wm. Duffy, V. Pres. G. Mussee, Sec. C. F. Nestor, Treas. & Gen. Man. A. Baumann. 9 3

LANCASTER, PA.—Pennsylvania Traction Co. (Operates Columbia & Donegal, Columbia & Ironville, Lancaster & Columbia and Lancaster City railways.) 50 m, 5-2½ g, 52, 60 lb girder & T r, 50 c, of which 40 are m c and 10 t c, 7 h. Gen. Elec. system. Brill cars. Ball & Wood and Reynolds engines. Pres. J. J. Patterson, Sec. & Treas. J. Hertzler. 2 4

Lancaster & Lititz Ry. Co. Elec. 8 m, 5-2½ g, Pres. J. A. Coyle, Sec. & Treas. J. E. Ackley. 8 2

ROUND LEATHER "BELL CORD." Jas. Lyon's Superior Quality in Coils. Send for Samples and Prices. CHAS. L. McCLURE, Manufacturer's Agent, 415 Broadway, Room 522, New York.

LANSING, MICH.—Lansing City Ry. Co. Elec 8 m, 4-8½ g, 35 & 45 lb s b & T r, 17 c, of which 12 are m. c. and 5 t. c. Westinghouse system. Pres. G. Macdonald, V. Pres. C. Osbund, Sec. J. P. Lee, Gen. Man. S. L. Keighley. Capital $50,000. Office, 1 106 Washington Ave., South Lansing. 9 3

LARCHMONT, N. Y.—Larchmont Horse R. R Co. 1½ m, 4-8½ g, 25 & 38 lb T & girder r, 3 box c, 12 h. Stephenson cars. Pres. C. H. Murray, V. Pres. E. E. Flint, Sec. Treas. & Supt. W. H. Campbell. Capital $25,000. 1 4

LAREDO, TEX.—International Bridge & Tramway Co. 2 m, 3-9 g, 20 lb T r, 2 c, 10 mu. Brill cars. Pres. P. Ornelas, Sec. T. W. Smith, Supt. K. Varela. 4 4

Laredo Electric & Ry. Co. 3⅞ m, 4 g, 25 lb T r, 6 m c. Edison system. Brill cars. Armington & Sims engines. Pres. B. M. Hammond, V. Pres., Treas. & Gen. Man. C. F. Drake, Sec. Supt. & Pur. Agt. C. F. Yaeger, Ch. Engr. and Ch. Engr. of Power Station J. E. Emly, Elecn. G. D. Hand. Capital, $100,000. Office, Salinas & Farragut sts. 4 4

LAWRENCE, KAN.—Lawrence Transportation Co. 5½ m, 4-1 g, 38 lb Johnson girder r, 9 c, of which 6 are 4-wheel box and 3 4-wheel open, 54 h. Pres & Treas. H. Tisdale. V. Pres. J. W. Parker, Sec. H. B Lawton, Supt. W. McElheny. Capital $35,000. 4 4

LAWRENCE, MASS.—Lowell, Lawrence & Haverhill St. Ry. Co. 53 m, 4-8½ g, 60, 70 lb T and girder r, 94 c, of which 6 are h c, 71 m c and 17 t c. Gen. Elec. system. Brill, Jones, Lewis & Fowler and Newburyport cars. McIntosh & Seymour and Providence engines. Pres. G. H. Campbell, Treas. C. A. Stone, Asst. Treas. W. A. Fisher, Audr. G. E. Tripp, Supts. (Lawrence division) N. E. Morton, (Haverhill division) F. Woodman. Offices 104 Ames Bldg., Boston, 246 Essex st., Lawrence. 4 4

LEAVENWORTH, KAN.—Leavenworth Electric Ry. Co. 15 m, of which 5 are horse and 10 elec, 4-8½ g, 56 lb. T r, 28 c, of which 14 are h. c. 9 steam c. 3 m. c. and 2 t. c. 15 h 32 mu. Stephenson cars. Baldwin and Porter engines. Receiver & Pur. Agt. L. M Erb, Atty. W. Dill, Elecn. C. W. White. Capital, $300,000. 1 4

LEBANON, MO.—Lebanon Light & Water Co. Elec. ¾ m, 4-8½ g, 48 lb T r, 1 m. c. Westinghouse system. Pres. B. F. Hobart, V. Pres. E. B. Loveland Sec. & Treas. W. P. Heath, Gen. Man. & Supt. J. E. Fulkerson. Capital $250,000. Bonds, $100,000. 9 3

LEBANON, PA.—Lebanon & Annville St. Ry. Co Elec. 20m, 5-2½ g, 40-80 lb girder & T r, 14 m c Edison system. Lebanon Mfg. Co., Lewis & Fowler and Stephenson cars. Ball and Ide engines. Pres & Gen. Man. J. M. Shenk, V. Pres. S. P. Light, Sec. H. H. Light, Treas. F. H. Reineohl, Supt. C. H. Smith Capital $100,000. Bonds $100,000. 1 4

Lebanon & Myerstown St. Ry. Co. Pres. J. N. Shenk. Sec. S. L. Brightbill. Treas. G. D. Rice. 3 4

LEWISTON, ME.—Lewiston & Auburn Horse R. R. Co. 14 m, 4-8½ g, 35, 45, 50 lb T and c b r, 15 c, 80 h. Jones and Stephenson cars. Pres. C. F. Woodward. Treas. H. C. Little, Gen. Man. E. W. Gross, Supt. H. Yates, Pur. Agt. E E. Proctor. Capital $97,000; authorized $100,000. Bonds $85,000. 4 4

LEXINGTON, KY.—Passenger & Belt Ry. Co Elec. 13 m, 12 m s, 4-8½ g 50 lb T r; 33 c, of which 25 are m c and 8 t c. Edison and T-H systems. Ohio Falls and Pullman cars. Armington & Sims and Lane & Bodley engines. Pres. & Gen. Man. C. H. Stoll, V. Pres. W. J. Longbridge, Sec. T. D. Murray, Treas. R. P. Stoll, Supt. Pur. Agt. & Elecn. E. J. Richards, Ch. Eng. of Power Station J. McKeever. Capital $1,000,000. Office, Main and Cheapside sts. 1 4

LEXINGTON, MO.—Lexington & Kansas City Land & Investment Co. 2½ m, 4-4 g, 30 lb r, 2 c, 8 h. Pres. R. G. Estell, V. Pres. W. Z. Hickman, Sec. & Treas. Jas. Wentworth. 5 3

LIMA, O.—The Lima Electric Ry. Co. 7 m, 4-8½ g 66 lb girder r, 10 c, of which 7 are m c and 3 t c T-H system. New Castle cars. Pres. A. E. Townsend, V. Pres. & Treas. W. W. Hazzard, Sec. Miss M. L. Hill, Supt. H. M. Ingold, Elecn. J. C. Huffer. Capital, $200,000. Bonds, $100,000. 1 4

LINCOLN, NEB.—Lincoln St. Ry. Co. Elec. 50 m, 4-8½ g, 40, 56, 70 lb T & girder r, 80 c, of which 40 are m c and 40 t c. T-H generators, Westinghouse and Short motors. Pres. F.W. Little, Sec. W. H.Clark Treas & Gen. Man. C. C. Upham. Capital, $1,200,000; authorized, $2,000,000. Bonds, $600,000. Office 9 and K sts 4 4

LITTLE ROCK, ARK.—Capital St. Ry. Co. (Leased and operated by City Electric Ry. Co.

The City Electric Ry. Co. (Operates Capital St. Ry.) 19.51 m, of which 1.30 is horse and 18.21 elec. 4-8½ g, 35, 38 & 48 lb T & girder r, 72 c, of which 4 are h c 28 m c and 40 t c. T-H system. Various cars. Hamilton-Corliss engines. Receivers T. W. Fordyce and A. N. Johnson, Gen. Man. Pur Agt. & Ch. Engr. H. G. Fleming, Supt. A. S. Grooms, Ch. Engr. of Power Station R. F. Baise. Capital $500,000. Bonds, $600,000. 1 4

LOCKPORT, N. Y.—Lock City Electric R. R. Co. 7 m, 4-8½ g, 77 lb s b r, 12 c, of which 6 are m. c. and 6 t. c. Brill and St. Louis cars. Pres. W. Goodwin, Sec. W. Spalding, Treas. F. Swift. Capital, $150,000. 9 3

LOGANSPORT, IND.—Logansport Ry. Co. Elec 5½ m, 4 g, 40 lb T r, 8 m. c. Edison and T-H systems. St. Louis cars. McIntosh & Seymour engines. Pres. S. Spencer, Sec. & Treas. R. D. Lankford, Gen. Man. & Pur. Agt. J. T. McNary, Ch. Engr. of Power Station C. A. Herring. Office 414½ Broadway. 1 4

LONDON, ONT.—London St. Ry. Co. 11½ m, of which 1 is horse and 10½ elec. 7 m s, 4-8½g, 35, 36 lb flat r, 36 c, of which 35 are h c and 1 m c. Westinghouse system. Toronto Ry. cars. Pres. H. A. Everett, V. Pres. E. M. Moore, Sec., Treas. & Gen. Man. S. R. Break, Supt. H. T. Smith. Capital $100.000. Office Dundas st. East. 4 4

LONG ISLAND CITY, N. Y.—Steinway Ry Co. of Long Island City. 32.25 m, of which 12 are horse and 20.25 elec. 4-8½ g, 47, 66, 70 lb Duplex r 100 c, of which 48 horse and 52 m c, 200 h. Pres. R. T. McCabe, V. Pres. Stephen Peabody, Sec. & Treas. H. D. Babcock, Asst. Treas. W. A, Pease, Gen. Man. G. Chambers. Capital, $2,500,000. Bonds $1,300,000; authorized $1,500,000. 29 Broadway, New York. 1 4

Long Island City & Newtown Ry. Co. Elec. 6¾ m, 4-8½ g, 45-55 lb r, 27 c, 7 m c. Edison system. Pres Isaac Buchanan, N. Y. City, Sec. Geo. S. Crawford Brooklyn, N. Y., Treas. Patrick J. Gleason, Sec Thomas Burke, Supt. Michael Conway. Capital $150,000. Offices, 112 Front st. 3 1

LONGVIEW, TEX.—Longview & Junction St. Ry. 5¼ m, of which 1¼ are horse and 4 cable; 3-6 g 16 lb r, 2 c, 4 mu. Pres. W. S. Mayfield, Sec. & Treas W. D. Stallings, Gen. Man. T. H. Huffman. Capital $4,500. 3 2

LOS ANGELES, CAL.—Los Angeles Consolidated Electric Railway Co. (Controls all roads in Pasadena except Pasadena & Mt. Wilson Ry.) 87 m, of which 21 are horse and 21 cable, 3-6 and 4-8½ g, 40, 45 lb girder r, 209 c, of which 34 are h c, 50 g c, 65 m c and 60 t c, 125 h, 82 mu. Westinghouse and Edison systems. Brill and Stockton C. H. & A. cars. Golden State & Miners' Iron Works engines. Pres. M. H. Sherman, V. Pres. & Gen. Man. E. P. Clark, Sec. F. V. McDonald, Supt. J. J. Akin. Office, Central ave. and Wilde st. 4 4

Main St. & Agricultural Park R. R. Co. 9.72 m, 3-6 g, 16 lb. T. r, 31 c, 105 h. Pres. W. J. Brodrick, V Pres. T. E. Rowan, Sec. A. C. Taylor, Treas. Farmers' & Merchants' Bank, Supt. Wm. Hawks, Capital $200,000, Office, 234 N. Main St. 4 4

Temple St. Cable Ry. Co. 4¼ m, 3-6 g, 38 lb Johnson girder r, 10 c. 10 dummies Pres. & Gen. Man. F. W. Wood, V. Pres., O. Morgan. Sec. W. N. Hamaker, Treas. Frank A. Gibson, Supt. J. Fowler. Capital $400,000. Bonds $100,000. Office, 129 Temple St. 4 4

LOUISVILLE, KY.—Louisville Ry. Co (includes all lines in the city). Elec. 150 m, of which 50 are horse and 100 elec, 5 g, 58¾, 78, 100 lb girder r, 490 c, of which 200 are h. c, 175 m c and 115 t c, 1300 mu. Gen. Elec. system. Allis, Ball and Williams engines. Pres. J. B. Speed, V. Pres. St. John Boyle, Sec. & Treas. R. H. Watts, Gen. Man. T. J. Minary, Supt. J. O. Haddox, Ch. Engr. and Elecn. H. B. DuPont. Capital $6,000,000. Bonds $6,000,000. Office, 500 Twelfth st. 4 4

Louisville Terminal Ry. Co. 2¼ m, 4-9 g, 56 lb T r, 2 c, of which 1 is m c and 1 t c. Pullman cars. Pres. G. L. Danforth, Sec & Treas. C. C. McClarty, Receiver H. V. Harris. Capital $60,000. Office, Columbia Bldg. 3 4

LOWELL, MASS.—Lowell & Suburban Ry. Co Elec. 49 m, 4-8½ g, 45, 50, 60, 90 lb T, girder and tram r, 105 c, of which 53 are m c and 52 t c Bentley Knight, T-H & Westinghouse systems. Brill Jones, Newburyport and Stephenson cars. Pres. E. M. Tucke, V. Pres. A. Fels, Sec. & Gen. Man, P. F Sullivan, Treas. P. Parker, Elecn. G. F. Wells. Capital, $500,000. Bonds $1,000,000. 4 4

Lowell, Lawrence & Haverhill. (See Lawrence, Msss.)

LYNCHBURG, VA.—Lynchburg Electric Co. 5½ m, 2⅞ m s, 4-8½ g, 35-42 lb T & tram r, 8 m c Eickemeyer and Westinghouse systems. Lewis & Fowler cars. Ball engines. Pres. Stephen Adams, Sec. & Treas. J. F. Lewis, Gen. Man. & Pur. Agt. C. H. Harman, Supt. B. Flannagan, Ch. Engr. & Ch. Engr. of Power Station H. S. Hall, Elecns. S Cochran C. P. Poole. Capital $100,000. Office, Park ave. 4 4

Lynchburg & Rivermont Electric Ry. Co. 4½ m, 1¼ m s, 4-8½ g, 31, 56 lb T and girder r, 7 m c. Edison and Westinghouse systems. Brill and Lewis & Fowler cars. Green and Russell engines. Pres. J. P. Pettyjohn, V. Pres. W. I. Owen, Supt. & Pur. Agt. J. A. Humphries. Ch. Engr. of Power Station J. Barnard. Capital, $20,000. 4 4

LYNN, MASS.—Lynn & Boston R. R. Co. (Includes Essex, Naumkeag & Lynn Belt Line Rys., and controls East Middlesex Ry Co. under a 99 year lease. Controlled by North Shore Traction Co.) 150 m, 4-8½ g, 35, 45, 50, 58, 90 lb tram, T & girder r, 475 c, of which 45 are h c, 450 h. T-H system. Pres. Amos F. Breed, V. Pres. & Clerk, E. Francis Oliver, Treas. C. Williams, Gen. Man. Elwin C. Foster, Auditor, A. S. Palfray, Pur. Agt. H. Grover, Elecn, M. Hoopes. Capital, $1,000,000. Bonds, $1,890,500; authorized $4,000,000. Office, 333 Union st. 4 4

North Shore Traction Co. (Controls Lynn & Boston Ry. Co.) Pres. John P. Ilsley, Sec. Wm. Stiles, Treas. C. Ford Stevens. Capital, $6,000,000. Bonds, $2,445,000. Office, Camden, N. J. 1 4

M

MACON, GA.—Consolidated St. Ry. Co. Elec. 25¾ m, 4-8½ g, 20, 30, 40 lb T r, 37 c, of which 21 are m c and 16 t c, T-H system. 5 3

Macon & Indian Spring Electric Ry. Co. 6½ m, 4-8½ g, 30, 40 lb T r, 8 m c. T-H system. American and Lamokin cars. Ball engines. Pres. & Gen. Man. T. J. Carling, Sec. & Treas. J. H. Herley, Supt. & Elecn. J. T. Nyhan, Pur. Agt. G. Margen. Capital $60,000. 4 4

McKEESPORT, PA.—McKeesport & Reynoldton Pass. Ry. Co. Elec. 9 m, 5-2½ g, 38 & 52 lb Johnson girder r, 16 c, of which 13 are m c and 3 t c. Gen. Elec. and Westinghouse systems. Russell engines. Pres. J. C. Smith, V. Pres. W. P. Wampler, Sec. W. B. Peters, Treas. E. F. Woods, Supt. W. L. Osborne, Pur. Agt. J. C. Smith. Capital $180,000; authorized $300,000. Office, 105 5th ave. 4 4

MADISON, IND.—Madison St. Ry. Co. 2½ m, 4 g, 15 lb tram r, 8 c, 4 h, 16 mu. Pres. & Treas. J. W. Thomas, Sec. J. A. Mercer, Supt. J. Wendel. Capital $13,000; authorized $15,000. Office 301 Front st. 5 3

MADISON, WIS.—Madison City Ry. Co. Elec. 8 m, 4-8½ g, 40, 50 lb T r, 13 c, of which 9 are m c and 4 t c. T-H system. St. Louis cars. Pres. W. Lamprecht, Sec. & Treas. H. C. Welch, Gen. Man. G. H. Shaw. Capital $100,000. Bonds $150,000. Office Main & Baldwin sts. 2 4

MALDEN, MASS.—East Middlesex St. Ry. Co. 16.13 m, 4-8½ g, 35 & 40 lb T & tram & Richards r, 58 c, of which 23 are box and 35 open, 204 h. Pres Amos F. Breed, Treas. D. H. Sweetser, Supt. J. Sewall. Capital, $300,000. Office, 35 Congress st., Boston. 1½ 2

MANCHESTER, N. H.—Manchester Street Ry Co. 12 m, 3 g, 35 lb tram r, 39 c, 189 h. Pres. C. Williams, Treas. C. H. Bartlett, Gen. Man. N. H. Walker. Capital, $25,000. Office Depot St. 9 3

MANISTEE, MICH.—Manistee, Filer City & East Lake Ry. Co. Elec. 11 m, 4-8½ g, 45 lb. T r, 16 c, of which 8 are m c and 8 t c. Gen. Elec. system. St. Louis cars. Ide engines. Pres. & Treas. G. A. Hart, V. Pres. F. F. Davidson, Sec. W. F. Davidson, Supt. F. J. Huntoon, Pur. Agt. G. A. Hart. Capital, $150,000. Office, 418 River St. 1 4

MANKATO, MINN.—Mankato St. Ry. Co. 3½ m, 3-6 g, 27 lb steel r, 5 c, of which 3 are m. c, 16 h Brownell cars. Pres. S. Lamm, Sec. & Treas. John C. Noe, Gen. Man. W. M. Farr. Capital, $50,000. Office, 121 Hickory st., Mankato. 1 4

MANSFIELD, O.—Citizens' Elec. Ry., Lt. & Power Co. 7½ m, 4-8½ g, 45, 50, 60 lb girder & T r, 13 m. c. Westinghouse system. Akron, Brill and Laciede cars. Buckeye and Cooper engines. Pres. S. N. Ford, V. Pres. M. D. Harter, Sec. S. G. Cummings, Treas. & Gen. Man. R. Carpenter, Supt. S. Hennesfauth. Capital $80,000; authorized $125,000. Office, Power Station, N. Main st. 4 4

MARINETTE, WIS.—Marinette Gas, Elec. Lt. & St. Ry. Co. 5 m, 4-3½ g, 32, 35, 52 lb T & tram r 15 c, of which 6 are h c, 7 m c and 2 t c. T-H system. St. Louis cars. Hoffman-Billings Co. engines. Pres. & Gen. Man. H. C. Higgins, V. Pres. A. C. Merryman, Sec. G. W. Hanley, Treas. J. F. Hancock Capital $100,000. Bonds $50.000. Office 1511 Main St. 2 3

MARION, IND.—Marion St. Ry. Co. Elec. 10½ m, 4-8½ g, 35, 38 lb T and girder r, 11 c, of which 6 are m c and 5 t c. T-H system. Pres. Eli Halderman, V. Pres. J. A. Halderman, Sec. & Treas. C. W. Halderman, Supt. W. C. Whinney. Capital, $80,000. 5 3

Queen City Electric Ry. Co. 5 m, 4-8½ g, 45, 52 lb T & girder r, 16 c, of which 14 are m c and 2 t c. T-H system. Jones and Pullman cars. Phœnix engines. Pres. R. B. Harrison. Sec. L. Wallace, Jr., Gen. Man. & Supt. A. A. Boyd. Capital, $180,000. Office cor. 13th st. & Buffalo ave. Eastern office 1 Broadway, New York. 9 3

MARION, O.—Marion St. Ry. Co.

MARLBORO, MASS.—Marlboro St. R. R. Co. Elec. 3.322 m, 4-8 g, 38, 48 lb T and girder r, 9 m c Edison system. Ellis and Newburyport cars. Pres. E. R. Alley, V. Pres. S. H. Howe, Sec. F. L. Claflin, Treas. T. T. Robinson, Gen. Man. & Supt. H. E. Bradford. Capital $50,000. Bonds $50,000. Office 88 Maple st. 1 4

MARQUETTE, MICH.—Marquette City & Presque Isle Ry. Co. Elec. 5 m, 4-8½ g, 50 lb Johnson girder r, 5 c, of which 3 are m c & 2 t c. T-H system. Laclede cars. Hamilton-Corliss engines. Pres F. O. Clark, Sec. M. E. Asire, Treas. J. Connolly, Supt. C. Retallic. Capital, $200,000. 9 3

MARSHALLTOWN, IA.—Marshalltown Light Pow. & Ry. Co. 3¼ m, 3½ m s, 4-8½ g, 40 lb T r, 5 c, of which 4 are m c and 1 t c. T-H system. Brill and Pullman cars. Ide and St. Louis engines. Pres. C. D. Jones. Sec. S. B. Hovey, Treas. M. W. Hovey, Supt. J. J. Roe, Pur. Agts. Jones & Hovey, Elecn. W. G. Bowe. Capital $250,000. Bonds $125,000. 4 4

MARTINSBURG, W. VA.—Martinsburg St. Ry. Co. 3½ m, 40 lb T r, 6 c of which 3 are m c and 3 t c. Edison system. Brill cars. McIntosh & Seymour engines. Pres. & Treas. J. B. Wilson. Sec. J. W. Walker. Capital, $50,000; authorized $100.000. 9 3

MARYSVILLE, CAL.—M'ville & Yuba City St R. R. Co. 4 m, 3-6 g, 16 lb T r, 5 c, 4 h, 14 mu. Pres. D E. Knight, V. Pres. S. H. Bradley, Sec. W. T. Ellis, Jr Supt. L. Graves. Capital $40,000. Office, cor. D & 1st sts. 4 4

MAYSVILLE, KY.—Maysville St. R.R. & Transfer Co. Elec. 4 m, 4-8½ g, 40 lb T r, 12 c, of which 5 are m c and 7 t c. Pres. A. M. J. Cochran, Sec Treas. & Gen, Man. R. A. Cochran, Jr., Supt. of lines cars, &c., J. Limbrick. Capital $30,900; authorized $100,000. Bonds $65,000. Office, Court st. 4 4

MECHANICSBURG, ILL. — Mechanicsburg & Buffalo Ry. Co. 7¼ m, 3-10 g, 16 & 20 lb T r, 3 4-wheel open c, 4 mu. Pres. J. B. Hunter, V. Pres. H. Thompson, Sec. J. T. Fullenwider. Treas. A. T. Thompson Capital, $12,000. b 7 1

MEMPHIS, TENN.– Citizens' St. R R. Co. (Owns City & Suburban Ry.) 50 m, 4-8½ g, 60, 76 lb T & girder r, 125 c, of which 65 are m c and 60 t c. Edison system.. Lamokin cars. Ide engines. Pres. C. H. Ruddock, Sec. & Treas. L. R. Godwin, Gen. Man. & Pur. Agent, G. F. Jones. Office, 29 Hernando st. 4 4

City & Suburban Ry. Co. Owned by Citizens' St. R. R. Co.) Elec. m. 4-8½ g, 45 & 52 lb T and tram r, 10 c, of which 5 are m c and 5 t c. T-H system. St. Louis cars. Pres. F. G. Jones, Sec. L. R. Goodwin, Treas. R. L. Benson. Capital stock, $150,000; auhorized, $165,000. Office, 56 E Court st. 10 2

East End Ry. Co. 5½ m steam, 4-8½ g, 35-50 lb steel T r, 8 c, 4 steam dummies. Ohio Falls cars. Baldwin engines. Pres. J. Overton, Jr, V. Pres. B. M. Stratton, Sec J. E. Wade, Treas. W, D. Bethell, Gen. Man. J. C. Sneed. Capital $150,000. Bonds $150,000. Office, 310 2nd st. 9 3

Raleigh Springs Ry. Co. 11 m, 4-8½ g, 60 lb girder & T r, 15 c, of which 9 are m c and 6 t c. T-H system. Brill cars. Allis and Hampson engines. Pres. B. L. Duke. V. Pres. & Gen Man. W. R. Hall, Sec. S. L. Finley, Treas. C. B. Buchanan. Capital $264,100; authorized $265,000. Office, 10 W. Court st. 10 3

MENOMINEE, MICH.—Menominee Elec. Ry. & Pow. Co. 6.9 m, 4-8½ g, 40 lb T r, 12 c, of which 8 are m c & 4 t c. Edison system. Pres. A. Spies, V Pres. P. A. Van Bergen, Sec., Treas. & Gen. Man E. Daniell. Capital $110,000. Bonds $54,000. 4 4

MERIDEN, CONN.—Meriden Horse R. R. Co 7 m, 4-8½ g, 35 & 40 lb T r, 21 c, 90 h. Pres. Geo. R Curtis, Sec. & Treas. Chas. L. Rockwell, Capital, $80,000. Bonds, $70,000. 5 2

MERIDIAN, MISS.—Meridian St. Ry. Co. 6 m of which 1½ are steam and 4½ horse, 4-8½ g, 25 & 36 lb T & flat r, 10 c, 50 mu. Pres. Geo. S. Covert, Sec J. M. Kelley, Supt. & Gen. Man. J. L. Handley. Capital, $30,000. 3 1

Meridian Dummy Line Ry. Co. 2 m, 4-8½ g, 40 lb T r. 6 c. Pres. J. H. Wright, V. Pres. C. C. Coffee, Sec. & Treas. G. Q. Hall, Engr. N. M. Brandon. Capital $20,000. 5 3

MERRILL, WIS.—Merrill Ry. & Lighting Co Elec. 1½ m, 4-8½ g, 38 lb Johnson girder r, 3 m c. Pres. F. P. Hixon, V. Pres. R. Werdner, Sec., Treas. & Gen. Man. E. S. King, Capital, $20,000. Bonds, $40,000. Office, 990 Main St. 5 3

MICHIGAN CITY, IND.—Lake Cities Electric Ry. Co. 4 m, 4-8½ g, 22 lb flat & T r, 5 c, 15 h. Laclede cars. Pres. R. B. Harrison, Sec. L Wallace, Jr., Man. F. H. Root. Capital, $200,000. Eastern office, 1 Broadway, New York. 1 4

MIDDLETOWN, CONN.—Middletown Horse R. R. Co. 3½ m, 4-8½ g, 36 & 38 lb Johnson & T r, 7 c, 40 h. Pres. John M. Douglas, V. Pres. A. C. Allison, Sec. & Treas. J. K. Guy, Gen. Man. & Supt. W. A. Larrabee. Capital, $23,000; authorized, $50,000. Office, 265 Main st. 9 3

MIDDLETOWN, N. Y.—Middletown-Goshen Traction Co. 3¾m, 4-8½ g, 60, 70 lb T and girder r, 6 m c. Gen. Elec. system. Jewett and St. Louis cars. Payne engines. Pres. J. C. Hinchliffe, V. Pres. & Elecn. M. J. Wightman, Sec. E. G. Wightman, Treas. & Gen. Man. W. B. Rockwell, Supt. F. D. La Bar, Ch. Engr. of Power Station G. Hess. Capital, $200,000. P. O. Box 401. 5 4

MIDDLETOWN, O.—Middletown & Madison St. R.R. Co. 2 m, 4-8½ g, 45 lb girder r, 6 c, 6 h. Receiver D. B. Bnndy. Capital $50,000. Bonds $20,000. 4 4

MILFORD, MASS.—Milford & Hopedale St. Ry. Co. Elec. 6 m, 4-8½ g, 30 & 60 lb tram r, 6 4-wheel box c. Hopedale storage battery system. Pres. & Gen. Man. E. P. Usher, Treas. A. G. Morse. Capital $60,000. Bonds, $60,000. Office, 23 Court st, room 618 Boston. 9 2

MILLERSVILLE, PA.—Lancaster & Millersville St. R.R. Co. (See Lancaster, Pa.)

MILWAUKEE, WIS.—Milwaukee St. Ry. Co. 138 m, 4-8½ g, 45, 70 lb girder r, 273 c, of which 263 are m c and 10 t c, 100 h. T-H and Edison systems. Brill, Brownell, Jones and St. Charles cars. Allis engines. Pres. W. N. Cromwell, V. Pres. H. C. Payne, Sec. & Treas. C. A. Spofford, Asst. Sec. & Treas. G. O. Wheatcroft, Gen. Man. C. D. Wyman, Gen. Supt. G. W. Hommell, Asst. Supt. G. M. Kimmerlein, Pur. Agt C. L. Jones, Supt. of repairs, A. W. Lynn, Auditor, W. L. Mason, Elecn, O. M. Rau, Ch. of Construction of Power Station R. S. Stikeman. Office 209-11 W. Water St. 1 4

Milwaukee & Wauwatosa Electric Co. 12 m, 4-8½ g, 65 lb girder r, 4 m c. Edison system. Allis engines. Pres. C. Stickney, Sec. & Treas. G. Pabst, Gen. Man. E. D. Hoyt, Supt. & Elecn. T. F. Grover. Capital $75,000. Office 917 Chestnut st. 1 4

Milwaukee & Wauwatosa Motor Ry. Co. Steam. 12 m, 4-8½ g, 56 lb girder r, 9 c, of which 3 are steam and 6 t c. Pres. J. Petley, V. Pres. J. W. Bingham, Sec. & Treas. A. B. Meyers, Supt. H. Mortimer. Capital, $300,000. Office, 371 Broadway. 9 3

MINNEAPOLIS, MINN.—Twin City Rapid Transit Co. Elec. (Includes Minneapolis St. Ry. and St. Paul City Ry.) Minneapolis Division. 127 m, 4-8½ g, 47, 60, 78 lb T & girder r, 500 c, of which 300 are m c, and 200 t. c. Edison and T-H systems. Pres. Thos. Lowry, V. Pres. C. G. Goodrich, Treas. M. B. Koon, Gen. Man. W. J. Hield, Supt. B. W. Martindale, Mast. Mech. W. Cooper, Audr. J. F. Calderwood. Capital $5,000,000. Office, 200 3d ave. N. 5 3

St. Paul Division 120 m, of which 5 are cable and 115 elec, 4-8½ g, 40-76 lb Johnson girder & T r, 265 c, of which 25 are g c, 110 m. c and 117 t c. Edison and T-H systems. Allis engines. Pres. Thos. Lowry, V. Pres. C. G. Goodrich, Sec. J. F. Calderwood, Treas. W. R. Merriam, Gen. Man. W. J. Hield, Supt. F. S. Hoskins. Capital $5,000,000. Office Globe Bldg. 4th st. 2 4

MOBILE, ALA.—Mobile St. Ry. Co. 20½ m, 16 m s, 45-70 lb T & girder r, 40 c, of which 20 are m c and 20 t c. Gen. Elec. system. Stephenson cars. McIntosh & Seymour engines. Pres. J. C. Morris, V. Pres. F. J. Gasquet, Sec. R. B. Owen, Treas. & Gen. Man. R. Semmes, Elecn. & Ch. Engr. of Power Station J. F. McAviney. Capital, $500,000. Office, Anthony and Royal Sts. 1 4

Mobile & Spring Hill Ry. Co. Steam and Elec. on same track. 7 m, 7 m s, 4-8½ g, 35 lb T r, 10 c of which 5 are m c and 5 t c, 2 dummies. Winkler system. St. Louis cars. Rent power. Pres. W. Goodwin, V. Pres. F. Swift, Gen. Man. J. H. Bleoo. 3 4

Mobile Light & Ry. Co. 7½ m, 4-8½ g, 45 lb T r, 20 c, of which 9 are m c and 11 t c. T-H and Westinghouse systems. Brill and Stephenson cars. Pres. J. Wilson, V. Pres. & Gen. Man. J. H. Wilson, Sec. A. J. Peaper. Capital, $500,000. 9 3

MOHAWK, N. Y.—Mohawk & Ilion Horse R.R. Co. 1¾ m, 4-8½g, 30 lb flat & T r, 5 c, (Cars towed by contract.) no h. Pres. J. B. Rafter, V. Pres. C.W. Carpenter, Sec. H. D. Alexander, Treas., Supt. & Pur. Agt. R. M. Devendorf. Capital, $15,000. No bonds. 1 4

Herkimer & Mohawk St. Ry. Co. 1½ m, 4-8½ g, 30-40 lb T r, 4 c, of which 3 are 4-wheel box and 1 is 4-wheel open, 8 h. Pres., Treas. & Man. H. D. Alexander, V. Pres. H. Delmel, Sec. E. L. Prince. Capital $17,000; authorized $20,000 Office Mohawk, N. Y. 1 4

MOLINE, ILL.—Moline Central St. Ry. Co. Elec. 4 m, 4-8½ g, 35, 50 & 57 lb T & Wharton girder r, 8 c, of which 4 are m. c. and 4 t. c. Edison and Westinghouse systems. Pres. S. H. Velie, V. Pres. L. S. McCabe, Sec. & Gen. Man. E. H. Guyer, Treas. C. F. Hemenway, Supt. G. H. Moon. Capital $33,000; authorized $100,000. Bonds $17,500; authorized $48,000. Secretary's office, Rock Island, Ill. 1 4

MONTEREY, CAL.—Monterey & Pacific Grove St. Ry. & Elec. Pow. Co. 5 m. 3-6 g, 20 lb T r, 8 c, 45 h. Fitzgerald cars. Pres. O. S. Trimmer, V. Pres. H. A. Greene, Sec. & Gen. Man. J. Malarin, Treas. J. S. Metteer, Supt. A. J. Haynes. 4 4

MONTGOMERY, ALA.—Montgomery St Ry. Co 9 m, of which 2 are horse and 7 elec., 4-8½ g, 45-51 T and girder r, 9 c, of which 2 are h c and 7 m c. T-H system. New Castle cars. Armington & Sims, Atlas and Corliss engines. Pres. J. W. Dimmick, V. Pres. John D. Roquemore, Sec. J. C. Virden, Treas. G. W. Craik, Gen. Man. E. L. Coolahan, Elecn. R. F. Scott, Ch. Eng. of Power Station J. W. Lutz. Capital $350,000. Bonds $240,000. Office, 5½ Dexter Ave. 2 4

West End & Riverside Park Electric St. Ry. Co. 4 m, 4-8½ g, 56 lb girder & T r, 5 m c. Westinghouse system. Brill cars. Westinghouse engine. Pres. S. D. Seelye, Sec. J. N. Browder. Office 14 Dexter Ave. 2 4

MONTREAL, CAN.—Montreal St. Ry. Co. Elec 59.35 m, of which 47.35 are horse & 12 elec. 4-8½ g, 44 lb r, 200 c, 100 sleighs, 75 'buses, 1200 h. Royal, Edison and Westinghouse systems. Pres. L. J. Forget, Sec. & Treas. E. Lusher, Supt. J. J. Franklin, Engr. & Acting Man., G. C. Cunningham. Capital authorized $2,000,000. Bonds, $300,000; authorized, $1,000,000. 11 2

Montreal Park & Island Ry. Co. 8 m, 2 m s, 4-8½ g, 56 lb T r, 2 m c. Royal and Westinghouse systems. Brill cars. Pres. L. Beaubien, V. Pres. J. R. Thibaudeau, Asst. Sec. A. Cinq-Mars, Treas. R. L. Gault, Gen. Man. W. S. Williams, Ch. Engr. J. R. Roy, Elecn. L. E. Marple, Ch. Engr. of Power Station L. Gouilland. Capital authorized. $500,000. Bonds $43,000. Office, 17 Place d' Armes Hill. 1 4

MT. CLEMENS, MICH.—Mt. Clemens St. Ry Co., Ltd. 3¼ m, 4-8½ g, 35 lb tram r, 5 c, 12 h. Jones and Stephenson cars. Pres. M. L. Williams, Sec. G. A. Skinner, Treas. & Gen. Man. M. Slush. Capital, $25,000. General office, Berea, O. 9 3

MT. VERNON, N. Y.—Mount Vernon & East Chester Ry. Co. 4 m, 4-8½ g, 48 lb c. b. r, 14 c, 33 h Pres. C. Strauss, Sec. W. H. Martens Treas. D. O'Brien, Supt. J. H. Small. Capital, $60,000. Bonds $75,000 1 3

MUNCIE, IND.—Muncie St. Ry. Co. (Owned by Citizens' St. Ry. Co.) 8 m steam 4-8½ g, 35 lb T r, 14 c, 4 steam motors. Baldwin and Porter motors. 5 3

Citizens' St. Ry. Co. Elec. 6 m, 4-8½ g, 48-60 lb T r, 16 c, of which 12 are m. c. and 4 t. c. Gen. Elec. system. St. Louis cars. Ide engines. Pres. J. S. Talley, V. Pres. C. W. Talley, Sec. G. F. McCulloch, Treas. C. F. Miller, Gen. Man. J. W. Hilligoss, Supt. W. C. Gotshall. Capital, $250,000. 6 3

MUSCATINE, IA.—Muscatine Electric Ry. Co. 7¼ m, 4-8½ g, 48 lb T r, 7 c of which 5 are m c and 2 t c. Gen. Elec. system. American Car Co. Ideal engines. Pres. G. W. Seevers, Sec. & Treas. H. W. Seevers, Gen. Man. T. S. Seevers. Capital, $300,000. 9 3

MUSKEGON, MICH.—Muskegon Ry. Co. Elec 15 m, 4-8½ g, 30, 38 lb T & girder r, 33 c. of which 18 are m c and 15 t. c. Short system. Pres. F. A. Nims, V. Pres. J. W. Moon, Sec. D. P. Erwin, Treas. Wm. B. McLaughlin, Supt. F. W. Thompson. Capital $100,000. Office, Michigan and Franklin Sts. 2 3

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NASHUA, N. H.—Nashua St. Ry. Co. 10 m, 3 g, 35, 38 lb T, tram & girder r, 27 c, 100 h. Pres. G. H, Knowles, V. Pres. J. A. Fisher, Sec. & Treas. J. D. Chandler, Supt. H. F. Webster. Office 85 Kinsley st. 5 3

NASHVILLE, TENN.—Nashville St. Ry. Co 52 m, 5 g, 35, 45 lb T & girder r, 69 m c. Edison, T-H & Westinghouse systems. Pres. W. H. Jackson, V. Pres. T. M. Steger. Sec. & Treas. R. F. Jackson. Gen. Man. E. G. Connette. Capital, $1,000,000. 4 4

Citizens' Rapid Transit Co. Elec. 5 m, 4-11¾ g, 40, 45 lb T & girder r, 5 m c. Edison system. Stephenson cars. Pres. W. H. Mitchell, Sec., Treas. & Gen. Man. Wm. S. Jones. Capital stock $18,000. Bonds $75,000. 1 3

Nashville & West Nashville St. Ry. Co. Dummy Line, 7 m, 4-8½ g, 46 lb T & Johnson r, 8 c, 4 engines Pres. L. H. Davis, V. Pres. M. S. Cockrill, Sec. J Woods, Jr. Capital, $81,000. 11 2

Overland Ry. Co. 9¼ m of which 3 are steam and 6¼ elec. 4-11¾ g, 35-45 lb T & girder r, 12 c, of which 7 are m c and 5 t c 5 dummies. T-H system. St. Louis cars. Pres. & Gen. Man. F. W. Hunter, V. Pres J. Compton, Sec. & Treas. T. Taylor, Supt. J. K. Spicer. Capital, $125,000. Bonds, $210,000. 9 3

Richland Ry. Co. Steam. 8 m, 2.6 m s, 4-8½ g, 46 lb girder & T r, 8 c, 4 engines. Brill cars. Baldwin engines. Pres. L. H. Davis, V. Pres. J. C. Rodemer, Sec. Treas. Gen. Man. Supt. & Pur. Agt. J. Woods, Jr. Capital, $87,300; author-ized, $100,000. Office, 217 Union St. 4 4

NATCHEZ, MISS.—Natchez St. Ry. Co. 5 m 4-8½ g, 25–52 lb girder, flat & T r, 7 c, 20 mu. Pres & Supt. Maurice Moses, Sec. & Treas. A. Moses. Capital, $25,000; authorized, $100,000. Office Natchez Savings Bank. Main & Pearl sts. 4 4

Bluff City Ry. Co. 2 m, of which 800 ft. is double track incline plane, 6-2 g, incline 3-6 g remainder, 24 c, 1 h, 4 mu, 4 engines. Pres. S. E. Rumble, V. Pres. R. C. Learned, Sec. & Treas. T. V. Wensel, Gen. Man. & Supt. J. C. Monteith. Capital $100,000. Office, Main and Broadway. 1 4

NATICK, MASS.—Natick & Cochituate St. Ry. 6 m, 3 ms. 3 m, 4-8½ g, 35 lb T & flat r, 7 c, of which 5 are m c and 2 t c, 1 h. Westinghouse system. Pres. H. Harwood, Clerk F. H. Hayes, Treas. W. H. Bent, Supt. Geo. F. Keep. Capital, $31,500. 4 4

Natick Electric St. Ry. Co. 6 m, 4-8½ g, 45 lb T r 9 m c. T-H & Short systems. Pres. A. C. Pond, Sec. & Treas. T. T. Robinson, Supt. H. W. True Capital $60.000. 11 2

NEBRASKA CITY, NEB.—Nebraska City St Ry. Co. 7 m, 4-8½ g, 20, 40 & 45 lb T and girder r, 4 c, 2 h, 20 mu. Pres. & Gen. Man. H. H. Bartling, V. Pres. J. J. Teten, Sec. J. C. Watson, Treas. F. W. Rodenbrock. Capital, $17,500; authorized $50,000. 1 4

NEENAH, WIS.—Menasha & Neenah St. Ry. Co. 4 m, 4 8½ g, 35 lb tram r, 2 c, 10 h. Pres. & Treas. F. Schumacher, Sec. C. Griggs, Gen. Man. T. Schumacher. Capital, $125,000; authorized $300,000. Bonds, $25,000. 4 4

NEGAUNEE, MICH.—Negaunee & Ishpeming St. Ry. Co. 4 m. c. T-H system. 12 2

NEW ALBANY, IND.—New Albany Ry. Co. 7 m, 4-8½ g, 52 lb T r, 30 c, of which 17 are h c, 9 m c and 4 t c. Gen. Elec. system. St. Louis cars. Receiver J. MacLeod, Sec. & Treas. H. W. Heazlitt, Supt. G. MacLeod, Ch. Engr, R. H. Young, Elecn. B. Schlater. 4 4

Highland R R. Co. 2 m, 3 m c. Edison system. Pres. J. F. Gebhart, Sec. & Treas. W. W Tuley. 1 4

NEW BEDFORD, MASS.—Union St. Ry. Co Elec. 18 m, of which 13 are horse and 5 elec. 4-8½ g, 38-80 lb girder & T r, 84 c, of which 61 are h c, and 20 m c, 229 h. T-H system. Pres. & Gen. Man. A. P. Smith, V. Pres. J. Irvine, Sec. & Treas. G. R. Phillips. Capital $260.000. Bonds, $100,000. Office, Five Cent Savings Bank Bldg. Purchase St. 9 3

NEW BRITAIN, CONN.—Central Ry. & Electric Co. 12 m, 4-8½ g, 56 lb T r, 18 c, of which 16 are m c and 2 t c. Gen. Elec. system. Brill cars. Allis & Harrisburg engines. Pres. A. M. Young, Sec. C. S. Landers, Treas. F. G. Platt. Gen. Man. & Supt. E. S. Breed, Capital, $1,000,000. 4 4

NEW BRUNSWICK, N. J.—New Brunswick City Ry. Co. 4¼ m, 4-8½ g, 43 lb c. b. & girder r, 13 c, 45 h. Pres. H. Congar, V. Pres. A. Le Massena, Jr., Sec & Treas. W. B. Price, Supt. W. F. Price. Capital $100,000. Bonds, $25,000. Office, Sanford st. 6 3

NEW CASTLE, PA.—New Castle Electric St. Ry. Co. 2¾ m. 4-8½ g, 45½-66 lb girder r, 4 m c. T-H & Westinghouse systems. New Castle cars. Pres. T. W. Phillips, V. Pres. & Gen. Man. W. M. Brown, Sec & Treas. S. S. Hamilton, Supt. L. D. McClusky. Capital stock, $40,000. 9 3

NEW DECATUR, ALA.—Decatur St. Ry. Co. 3½ m, 3½ m s, 4-8½ g, 20 lb T r, 5 4-wheel box c, 31 mu. St. Louis cars. Pres. W. W. Hedges, V. Pres A. C. Hartshorne, Sec. Treas. & Gen. Man. W. A. Bibb. Capital, $100,000. 1 4

NEW HAVEN, CONN.—Fair Haven & Westville R. R. Co. 15 m, 8¼ m s, 4-8½ g, 50, 70 lb T r, 63 c Westinghouse system. Brill, Lewis & Fowler and Stephenson cars. Allis engines. Pres. & Pur. Agt. H. S. Parmelee, V. Pres. S. Hemingway, Sec. & Treas. L. Candee, Supt. Walter A. Graham. Capital, $400,000. Office 730 Chapel st. 4 4

New Haven & Centreville Horse R.R. Co. 2¾ m 4-8½ g, 46 lb c b r, 16 c, 62 h. Pres. & Gen. Man. C Pierpont, Supt. T. R. Hull. Capital $31,000; authorized $40,000. Office, 1 Broadway. 9 3

New Haven St. Ry. Co. (Includes New Haven & Morris Cove Ry., State Street Horse R. R. and Whitney Avenue Ry.) 9¼ m. 4-8½ g, 42, 50 lb. T and c b r, 24 m c, 86 h. Pres. D. Correy, V. Pres. C. A. Warren, Sec. & Treas. G. A. W. Dodge. Office, 16 Exchange Bldg. 2 4

State Street Horse R. R. Co. (Operated by New Haven St. R. R. Co.)

Winchester Ave. R. R. Co. (Owns and operates New Haven & West Haven R. R.) 16 m, 4-8½ g, 50, 56, 60 lb T r, 65 c, of which 49 are m c and 16 t c. Short & Westinghouse systems. Brill, Jones, Lewis & Fowler, Newburyport and Stephenson cars. Westinghouse engines. Pres. A. C. Pond, Sec. Treas. & Gen. Man. I. A. Kelsey, Supt. A. E. Pond. Capital, $40,000; authorized, $60,000. In addition to $100.000 of New Haven & West Haven road. Bonds, $500,000. 1 4

NEW LONDON, CONN.—New London St. Ry. Co. 8 m, 7 m s, 4-8½ g, 48 lb T r, 13 m c. Gen. Elec. system. Newburyport cars. McIntosh & Seymour engines. Pres. E. P. Shaw, Sec. W. Learned, Treas. W. A. Tucker, Gen. Man. & Pur. Agt. E. P. Shaw, Jr., Supt. L. Bentley, Elecn. E. A. Brown. Capital $150,000. Bonds $110,000. 4 4

NEW ORLEANS, LA.—Canal & Claiborne R. R. Co. 13½ m, 5-2½ g, 37 45 & 5) lb tram & girder r, 40 box c, 20 mu. Pres. E. J. Hart, Sec., Gen. Man. & Supt. Jos. H. DeGrange. Capital, $240,000. Bonds $150,000, Office 6 Camp st. 1 4

Algiers & Gretna Ry. Co. 3.75 m, 3 g, 30 lb T r, 4 c, 24 h. Stephenson cars, Pres., Gen. Man. & Supt. A. M. Halliday, Sec. & Treas. W. Royal. Capital $25,000. Bonds $25,000. Office Canal St. Ferry. 6 3

New Orleans & Carrollton R. R. Co. Elec. 19 m, 4-8½ g, 50, 60, 70 lb T & girder r, 70 m c. T-H system. St. Louis cars. Lane & Bodley Corliss engines. Pres. J. Lennes, Sec. & Treas. Walter V. Crouch, Gen. Man. & Supt. Chris. V. Halle. Capital $1,200,000. Bonds $600,000. Office Jeannette and Dublin Sts. 6 3

New Orleans Traction Co. (operates Crescent City and New Orleans City & Lake Rys.) Pres. J. H. Maury. Sec. & Treas. H. Seligman, Gen. Man. H. M. Littell. 3 3

Crescent City R. R. Co. (Operated by New Orleans Traction Co.) Elec. 26 m. 5-2½ g, 35-47 lb c. b. & T r, 25 c. Pres. H. M. Littell, Sec. & Treas. A. H. Ford, Supt. B. B. Gilman. Capital, $1,150,000; authorized, $2,000,000. Bonds, $140,000. 5 3

New Orleans City & Lake R.R. Co. 66 m, 5-2½ g, 42, 46 lb flat & T r, 218 c, of which 182 are h c and 36 steam coaches, 7 locomotives, 867 mu. Pres. H. M. Littell, Sec. & Treas. A. H. Ford, Supt. B. B. Gilman. Capital, $1,500,000. Office 102 Canal st. 5 3

Orleans R. R. Co. 9½ m, 5 g, 35-40 lb T r, 32 c, 135 h, 5 mu. Pres. Gen. Man. Supt. & Pur. Agt. A. Cassard. Sec. & Treas. P. Cougot. Capital $185,000. Authorized $500,000. Bonds $19,000. Office, cor. White & Laharpe sts. 1 4

St. Charles St. R. R. Co. Operates 3 lines. 11½ m, 11.4 m s, 5-2½ g, 40 lb s b r, 66 4-wheel box c, 65 h, 218 mu. Stephenson cars. Pres. & Supt. Alden McLellan, Sec. N. Riviere. Capital, $594,350; authorized $1,000,000. Bonds $120,000. Office, cor. Carondelet & 8th sts. 1 4

NEW ROCHELLE, N. Y.—New Rochelle Ry & Transit Co. 8 m, 4-8½ g, 38 lb Johnson r, 14 c, of which 10 are 4-wheel box & 4 4-wheel open, 40 h Pres. Thos. E. Crimmins, Sec. & Treas. C. Strauss Supt. Frank Ryan. 3 2

NEW WESTMINSTER, B. C.—New Westminster & Vancouver Tramway Co. 16½ m, 5 m s, 4-8½ g, 40 lb T r, 13 c of which 11 are m c and 2 t c. Edison system. Brill cars. Ball and Ide engines. Pres. D. Oppenheimer, V. Pres. B. Douglas, Sec. & Treas. L. N. Smith, Traffic Man. G. F. Gibson, Supt. G. Lubke, Ch. Engr. of Power Station J. Robertson. Capital, $1,000,000. Office, Columbia st. 4 4

NEW WHATCOM, WASH.—Bellingham Bay Electric Ry. Co. 4 m, 4-8½ g, 40 lb T r, 6 c, of which 4 are m. c. and 2 t. c. T-H system. Pres. H. Eldridge, 1st V. Pres. P. B. Cornwell, 2nd V. Pres. C. L. Roth, Sec. E. B. Leaming, Treas. V. A. Roeder, Gen. Man. & Supt. E. Cosgrove, Capital, $200,000. 1 4

NEW YORK, N.Y.—Central Crosstown R. R. Co. (Includes Christopher & Tenth St.) 11.7 m, 4-8½ g, 52 lb r, 94 box c, 608 h Pres. Geo. S. Hart, V. Pres. A. Cammack, Sec. Milton I. Masson. Treas. E. Burton Hart. Office, 170 Christopher st. Capital, $600,000. Bonds, $250,000. 1 4

Christopher & Tenth St. R. R. Co. (Leased to and operated by Central Crosstown R. R. Co.) Pres. A. Wagstaff, V. Pres. I. Hendrix, Sec. & Treas. Geo. W. Linch. 1 4

Dry Dock, East Broadway & Battery R.R. Co. 18½ m, 4-8½ g, 181 c, 60, 90 lb c b & girder r. Pres. R. Kelly, Sec. E. T. Landon, Treas. J. Byrns, Supt. Fred F. White. Capital, $1,200,000. Bonds, $840,000. Office, 605 Grand st. 1 4

Eighth Ave. R.R. Co. 20 m, 4-8½ g, 60 lb r, 165 c of which 125 are box and 40 open, 1155 h. Pres. Geo. Law, V. Pres. Jacob Hays, Sec. & Treas. James G Affleck, Supt. E. R. Sherman. Capital $1,000,000. Bonds $1,000,000. Office, Eighth Ave. & 50th st. 1 4

Forty-second St., Manhattanville & St. Nicholas Avenue Ry. Co. 24.20 m, 4-8½ g, 47-60 lb r, 119 c, 1,023 h. Pres. John S. Foster, Sec. C. F. Naething, Treas. Jacob Fleischhauer, Supt. S. M. Sisson. Capital $2,500,000. Bonds, $2,700,000. Office, 118 E. 42 st. 1 4

Manhattan (Elevated) R. R. Co. 100 m, 36 m s, 4-8½ g, 50-90 lb T r. 1076 c, 334 locomotives. Pres. G. J. Gould, Sec. & Treas. D. W. McWilliams, Gen. Man. & 2nd V. Pres. F. K. Hain, Auditor E. F. J. Gaynor, Ticket Agt. C. P. McFaddin, Ch. Engr. J. Waterhouse, Asst. Engr. L. Moss, Master Mechanic T. W. Peeples. Capital $29,902,980; authorized $30.000,000. Bonds $19,675,000. Office 71 Broadway. 1 4

Metropolitan St. Ry. Co. (Includes Chambers St. & Grand St. Ferry R. R. Co., Houston St., West St., and Pavonia Ferry R. R., Broadway R. R. Co., and South Ferry R. R. Co., also operates Broadway & Seventh Ave., Sixth Ave. Ninth Ave. and 23d St. Rys.) 13 m, owned, 23 m. leased, 4 8½ g, 60 lb c b r, 45 box c, 370 h. Pres. & Gen. Man. H. H. Vreeland, First V. Pres. D. B. Hasbrouck, 2d V. Pres., H. A. Robinson, Sec. C. E. Warren, Treas. H. S. Beattie, Pur. Agt. A. C. Tully. Capital, $8,200,000. Bonds, $500,000. Office, 621 Broadway. 4 4

Broadway & Seventh Ave. R.R. Co. (Leased to Metropolitan St. Ry. Co.) 23 m, of which 10 are cable and 13 h. 4-8½ g, 47-60 lb r, 225 c, of which 160 are g c and 65 h c. Laclede and Stephenson cars. Penna. Iron Works engines. Pres. E. A. Wickes, V. Pres. J. P. O'Brien, Sec. & Treas. J. W. Ritchie, Supt. Henry A. Newell, Pur. Agt. A. C. Tully, Ch. Engr. F. S. Pearson Capital, $2,100,000. Bonds, $12,500,000, first consolidated mortgage. Office, 621 Broadway. 4 4

Ninth Ave. R. R. Co. (Leased to Metropolitan St. Ry. Co.,) 16 m, 4-8½ g, 45 & 60 lb T r, 60 c, of which 40 are 4-wheel box and 20 4-wheel open, 542 h. Pres. Geo. Law, V. Pres. Jacob Hays, Sec. & Treas. J. G. Affleck. Capital $800,000. No bonds. Offices 814 Ninth Ave. 4 4

Sixth Ave. R.R. Co. (Leased to Metropolitan St. Ry. Co.) 9¾ m, 4-8½ g, 60 lb r, 122 c, of which 102 are box and 20 open, 925 h. Pres. Frank Curtiss. Sec. & Treas. E. H. Garrison. Capital $1,500,000. Bonds, $500,000. Office 758 6th ave. 7 3

Twenty-third St. Ry. Co. (Leased to Metropolitan St. Ry. Co.) 14¾ m, 4-8½ g, 50 lb c b & tram r, 101 c, 946 h. Brill, Jones, Lewis & Fowler, Pullman and Stephenson cars. Pres. H. H. Vreeland, V. Pres. D. B. Hasbrouck, Sec. C. E. Warren, Treas. H. S. Beattie. Capital, $600.000. Bonds, 400,000; Broadway Surface Bonds, $375,000. Office, 621 Broadway. 4 4

Metropolitan Crosstown Ry. Co. (Operates 42d St. & Grand St. Ferry R.R. and Central Park, North & East River R.R.) 4-8½ g. 60 lb girder r, 30 c. Pres. H. H. Vreeland, V. Pres. D. B. Hasbrouck, Sec. C. E. Warren, Treas. H. S. Beattie. Pur. Agt. A. C. Tully. Capital, $300,000. Bonds, 1st. mtg., $600,000; 2d mtg., $300,000. Office, 621 Broadway. 1 4

Central Park North & East River R.R. Co. (Leased to Metropolitan Crosstown Ry. Co.). 26 m, 4-8½ g. 60 lb r, 196 c, of which 136 are box and 60 open, 1,157 h. Pres. H. H. Vreeland. V. Pres. D. B Hasbrouck, Sec. C. E. Warren, Treas. H. S. Beattie, Supt. J. Sittler. Office, 621 Broadway. Capital, $1,800,000. Bonds, $1,200,000. 4 4

Forty-second Street & Grand Street Ferry R.R. Co. (Leased to Metropolitan Crosstown Ry. Co.) 10.25 m, 4-8½ g, 60 to 64 lb r, 72 c, of which 52 are box and 20 open, 480 h. Pres. H. H. Vreeland, V. Pres. D. B. Hasbrouck, Sec. C. E. Warren, Treas. H. S. Beattie. Pur. Agt. A. C. Tully. Capital, $748,000; authorized, $750,000. Bonds, $236,000. Office, 621 Broadway. 4 4

Metropolitan Traction Co. (Controls Metropolitan St. Ry., Broadway & Seventh Avenue, Ninth Avenue, Sixth Avenue, and 23d Street railways, which, are operated by the Metropolitan St. Ry. Co. Also controls Metropolitan, Crosstown, Central Park, North & East River, and 42d Street & Grand Street Ferry Rys., which are operated by Metropolitan Crosstown R. R. Co.) Pres. C. R. Henderson, V. Pres. P. A. B. Widener, Sec. & Treas. C. E. Warren, Ch. Engr. F. S. Pearson. Capital, $30,000,000. Office, 621 Broadway. President's office Mutual Life Bldg,, 32 Liberty st. 4 4

New York & Harlem R.R. Co. 17¾ m, 8 7-12 m s, 4-8½ g, 47-64, lb r, 187 box c, 1,646 h. Pres. C. Vanderbilt. V. Pres. C. C. Clarke. Sec. & Treas. Ed. V. W. Rossiter, Supt. Alfred Skitt, Pur. Agt. A. Bourn. Capital, $10,000,'00. Bonds, $12,000,000. Office, Grand Central Depot 4 4

North & East River R. R. Co. 3 m, 1½ m s, 4-8½ g. 45 lb, s-b r, 12 c, 54 h. Pres. E. T. McLaughlin, V. Pres. Gen. Robert Avery, Sec. F. C. Gaffney, Treas. T. F. Carney, Supt. W. Farrell. Capital, $300,000. Bonds, $125,000. Office, 232-4 Front St. 1 4

Second Ave. R.R. Co. 28 m. 4-8½ g, 60 lb r, 352 c, of which 169 are box and 168 open h c, and 15 are Waddell-Entz storage cars, 1938 h. Pres. G. S. Hart, V. Pres. C. F. Cox, Sec. J. B. Underhill, Treas. H. E. Doremus. Capital $1,860,000, authorized $2,500,000. Bonds $1,750,000. Office, Second ave. cor. 96th st. 1 4

Third Ave. R. R. Co., 28¾ m cable, 14 m s, 4-8½ g, 80 lb r 568 c, of which 256 are h c & 60 t c, 252 g c; 1600 h. Pres. A. J. Elias, V. Pres. Henry Hart, Sec. Alfred Lazarus, Treas. J. Beaver, Supt. John H. Robertson, Ch. Eng R. P. Tomassek, Ch. Eng. of Power Station C. G. Bliss. Capital, $7,000,000. Bonds $5,000,000. Office, 65th St. & Third ave. 1 4

Twenty-eighth & Twenty-ninth sts. R. R. Co. 9.13 m, 4-8½ g, 60 lb. steel grooved r, 40 c. Pres. J. H Crane, V. Pres. D. D. Conover,, Sec. D. J. Apgar Treas. J. H. Davis. Capital $500,000. Bonds, $500,000. Office, 45 William st. 4 4

Union Ry. Co. of New York City. Elec. 24 m, 4-8½ g, 72½, 90 lb girder r, 110 m c. T-H and Westinghouse systems. Gilbert and St. Louis cars. Cooper engines. Pres. Gen. Man. & Pur. Agt. E, A. Maher, V. Pres. C. A, Stadler, Sec. & Treas. T. W. Olcott, Supt. J. Carrigan, Elecn. F. A. Wardlaw, Ch. Engr. of Power Station E. W. Van Brunt. Capital, $2,000,000. Bonds, $2,000,000. Office, 2389 3d ave. 4 4

NEWARK, N. J.—Newark Passenger Ry. Co. (Includes Rapid Transit Ry. and controlled by Consolidated Traction Co. of New Jersey), 75 m, of which 45 are horse and 30 elec, 5-2½ g, 50, 57 & 60 lb tram & girder r, 277 c, of which 200 are h. c. and 77 m. c, 300 h, T-H and Edison systems. Office, Prudential Building. 9 2

Consolidated Traction Co. of New Jersey. (Controls Newark Passenger and Jersey City & Bergen railroads) Pres. E. F. C. Young, J. O'Rourke, Sec. T. J. George, Treas. R. F. Bower, Gen. Man. D. Young, Audr. W. J. Ramsey, Pur. Agt. C. H. Thorne, Supts. (Newark) D. W. Sharpe, (Jersey City), T. Sayre, Roadmasters (Newark), A. W. Pratt, Jersey City), J. W. Leahy. 6 3

Newark & S. Orange, St. Ry. Co. Elec. 13 m, 5-2½ g, 90 lb girder r, 30 m. c. Westinghouse system Pres. E. S. Ward, V. Pres. G. Kreuger, Sec. & Treas W. Scheerer, Gen. Man. & Supt. A. Radel. Capital $1,500,000. Bonds, $1,500,000. Office S. Orange Ave and S. 19th st. 1 3

NEWARK, O.—Newark & Granville Elec. St. Ry. Co. (Includes Newark City Ry.) 13 m, 4-8⅛ g, 30-51½ lb T & girder r, 22c, of which 10 are m c & 12 t c. T-H and Edison systems. Gilbert & Lamokin Cars. Hamilton and Russell & Taylor engines. Pres. R. Scheidler, V. Pres. J. A. Flory, Sec. & Gen. Man. W. C. Christian, Treas. F. A. Crane, Supt. H. R. Scheidler, Pass. Agt. W. C. Wells. Capital, $73,000. Authorized $100,000. Bonds $120,000. 9 3

NEWBURGH, N.Y.—Newburgh St. Ry. Co. 5 m 4-8½ g, 40 lb T r, 13 c, of which 11 are box and 2 open 72 h. Pres. M. H. Hirschberg, V Pres. J. C. Adams Sec. & Treas. Wm. Moores, Gen. Man. & Supt. W P. Rayland. Office, 246 Broadway. 1 4

NEWBURYPORT, MASS.—Newburyport & Amesbury St. R. R. Co. 19.729 m, 18.046 m s, 4-8½ g, 35, 40 lb T and flat r, 41 c of which 24 are m c and 17 t c, 6 h. T-H system. Ellis and West End cars. McIntosh & Seymour engines. Pres. & Treas. Chas. Odell, Sec R. G. Calef, Supt. & Pur. Agt. C. F. Dennis, Ch. Engr. A. G. Dickerman, Ch. Engr. of Power Station O. W. Morrison. Capital, $90,000. Bonds, $350,000. Office, 32 Market sq. 4 4

NEWPORT, KY.—Cincinnati, Newport & Covington Ry. Co., Newport Division. (See Covington, Ky.)

NEWPORT, R. I.—Newport St. Ry. Co. Elec 4.17 m, 4-8½ g, 45 lb T r, 15 c, of which 9 are m c and 6 t c, T-H system. Ellis and Newburyport cars. Pres. & Gen. Man. A. C. Titus, Sec. & Treas. Francis Burdick, Asst. Man. R. G. Lee, Elecn. G. E. Levan. Capital $101,000; authorized, $110,000. Bonds, $50,000. Office, 227 Spring st. 4 4

NEWTON, MASS.—Newton St. Ry. Co. Elec. 8.280 m. Capital $23,725. c r 1 4

NEWTONVILLE, MASS.—Newton & Boston St Ry. Co. 5.11 m, 5.11 m s, 4-8½ g, 56 lb T r, 16 m. c. Gen. Elec. system. Hollingsworth and Trimble cars. Westinghouse engines. Pres. Gen. Man. & Pur. Agt. H. B. Parker, V. Pres. A. R. Mitchell, Sec. R. A. Sears, Treas. J. L Richards, Supt. F. G. L. Henderson, Ch. Engr. & Ch. Engr. of Power Station G. H. Leonard, Elecn. L. H. McLain. Capital, $100,000; authorized, $250,000. Bonds, $80,000. 4 4

Newtonville & Watertown St. Ry. Co., Elec. 2.142 m. Capital $50,000. c r 1 4

NIAGARA FALLS, N. Y.—Niagara Falls & Suspension Bridge Ry. Co. Elec. 13 m, 4-8½ g, 60 lb girder r, 23 c, of which 15 are m c and 8 t c. T-H system. Pres. C. B. Gaskill, V. Pres. H. L. Taylor, Sec. & Treas, Chas. B. Hill, Supt. J. C. Brewster. Capital, $400,000; Bonds, $400,000. 4 4

NIAGARA FALLS, ONT.—Niagara Falls, Wesley l'ark & Clifton Tramway Co. 4 m, 4-8½ g, 30 & 45 lb T r, 10 c, of which 8 are 4-wheel box & 2 4-wheel open, 25 h. Pres. J. N. Mooney, Treas. John N. Hayward, Supt. C. Black. Capital $50,000. 6 3

Niagara Falls, Park & River Ry. Co. Elec. 14 m, 4-8½ g, 56 lb. T r, 40 c, of which 24 are m. c. and 16 t. c. T-H system. Pres. E. B. Osler, V. Pres. W. Hendrie, Sec. & Treas. R. A. Smith. Gen. Man. R. Mackenzie. 4 4

NILES, O.—Mineral Ridge & Niles Electric Ry. Co. 3½ m, 3½ m s 4-8½ g, 45 lb T & girder r, 4 m. c. Edison system. American cars. Allis-Corliss engines. Receiver E. J. Ohl, Elecn. E. H. Bowan, Ch. Engr. of Power Station, H. Williams. Capital, $50,000. Bonds, $40,000. 4 4

NORFOLK, NEB.—Norfolk St. Ry. Co. 4½ m 4-6 g, 16 lb T r, 5 c., of which 4 are h c and 1 m c, 10 h, 4 mu. Edison system. Pres. R. A. Stewart, V. Pres. Dr. A. Bear, Sec. N. A. Rainbolt, Treas. C. B. Burrows. Capital, $51,000. Office, 400 Main st. 9 2

NORFOLK, VA.—Norfolk City R.R. Co. 5½ m 5-2 g, 45, 50, 65 lb tram, girder & s b r, 32 c, 125 h. Pres. W. H. Taylor, Sec. & Treas. H. C. Whitehead Supt. Jas. J. Ferris. Capital, $100,000; Bonds, $125-000. Office, 125 Main st. 9 3

The Suburban & City Ry. & Improv't Co. 3½ m, 3 ½ m s, 5-2 g, 80 lb girder r, 15 c, of which 9 are 4-wheel box and 6 4-wheel open, 56 h. Pres. Jas. W. McCarrick, Sec. & Treas. H. C. Whitehead, Supt. E. W. Savage, Elecn. J. F. Macartney. Capital $50,000. Bonds $75,000. Office, 125 Main st. 4 4

NORRISTOWN, PA.—Citizens' Pass. Ry. Co. 6m, 6 m s, 5-2½ g, 60 lb girder r, 8 m c. Curtis system Lewis & Fowler cars. Pres. John Slingluff, V. Pres. J. W. Shepp, Sec. Geo. R. Kite, Treas. G. Shannon, Supt. I. D. B. Spatz. Capital $80,000. 4 4

Norristown, Bridgeport & Conshohocken Traction Co. (Leases Norristown Pass. Ry. and Montgomery County Pass. Ry.) 5⅛ m, 5-2¼ g, 47, 66 lb girder r, 11 c, of which 6 are closed and 5 open. Westinghouse system. Buckeye engine. Pres. C. Gallager, V. Pres. M. Wills, Sec. & Treas. E. S. Perot. Gen. Supt. I. H. Passmore. Capital $125,000. Office Trust Bldg. 4 4

Norristown Pass. Ry. Co. (Operated by Norristown, Bridgeport & Conshohocken Traction Co.) 4 m, 5-2¾ g, 45 & 50 lb tram & girder r, 9 c, of which 8 are 4-wheel box and 1 4-wheel open, 28 h, 6 mu. V. Pres. C. Gallagher, Sec. & Treas. H. Freedley, Supt. Louis Heck. Capital, $45,000. 4 4

NORTH ABINGTON, MASS.—Rockland & Abington St. Ry. Co. 11 m, 11 m s, 4-8½ g, 45, 56, 60 lb T & girder r, 14 m c. Gen. Elec. system. Jones cars. Pres. E. P. Reed, V. Pres. M. N. Arnold, Sec. G. W. Kelley. Treas. C. N. Cobb, Gen. Man. Supt. Pur. Agt. & Elecn. A. H. Walcott, Ch. Engr. C. W. Howland, Ch. Engr. of Power Station L. McCarty. Capital $120,000. 4 4

NORTH ADAMS, MASS.—Hoosac Valley St. Ry Co. Elec. 6 m, 4-8½ g, 40 lb. T & flat r 13 c, of which 7 are m c and 6 t c T-H system. Brill and Newburyport cars. Fitchburg engines. Pres. & Treas. C. Q. Richmond, Gen. Man. H. A Fitzsimons. Capital $50,000. 4 4

NORTH TONAWANDA, N. Y.—Tonawanda Electric R. R. Co. of Tonawanda, Erie Co. 6 m, 4-8½ g, 45 lb T & girder r, 8 c, of which 3 are m. c. and 5 t c. T-H system. Brill cars. Noye engines. Pres. E. H. Butler, V. Pres. M. Nellany, Sec & Treas. C. M. Howard, Gen Man. G. P. Smith, Supt. H. R. Wellman. Capital, $125,000; authorized $250,000. 4 4

Tonawanda St. R. R. Co. Elec. 3½ m, 4-8½ g, 56, 62 lb T & girder r, 5 m c. T-H system. Pres. & Gen. Man. G. P. Smith, Sec. A. J. Hathaway, Treas G. C. Herschell, Supt. H. R. Wellman. Capital $250,000. Bonds $40,000. Office, Main st. 1 4

NORTH WOBURN, MASS —North Woburn St. Ry. Co. 7.5 m, 35, 48 lb tram & T r, 12 c, 53 h. Pres. A. F. Breed, Lynn, Mass., Sec. & Treas. D. H. Sweetser, Supt. W. L. Brockway. Capital $100,000; authorized $200,000. 4 4

NORTHAMPTON, MASS.— Northampton St Ry. Co. 4¾ m, 4 8½ g, 40, 58 lb T r, 19 c of which 12 are m c and 7 t c, 2 h. T-H system. Jones cars. Hamilton-Corliss engines. Pres. J. Olmstead, Treas. D. N. Winter, Supt. E. C. Clark, Jr., Ch. Engr. of Power Station T. J. Murray. Capital $150,000. Bonds $25,-000. 1 4

NORWALK, CONN.—Norwalk Horse R. R. Co 3½ m, 4-10 g, 56 lb T r, 8 c, 43 h. Pres. E. I. Hill, Sec. W. F. Acton, Supt. Edwin G. Hoyt. Capital $50,000 1 4

Norwalk Tramway Co. Elec. 3½ m, 4-8½ g, 50 lb T r, 4 m c. Pres. G. N. McKibbin, Sec. G. W. Mansfield, Supt. G. M. Pierce. Capital $70,000. Office South Norwalk. 4 4

NORWICH, CONN.—Norwich St. Ry. Co. 14½ m, 13 m s, 4-8½ g, 45, 50 lb T r, 46 c, of which 26 are m c and 20 t c, 5 h. Gen. Electric system. Newburyport cars. Pres. C. P. Cogswell, Sec., Gen. Man. & Pur. Agt. E. P. Shaw, Jr., Treas. W. A. Tucker, Electrician W. L. Adams, Ch. Eng. Power Station Geo. Bennett. Capital $250,000; authorized $600,000. Bonds, $265,000. 1 4

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OAKLAND, CAL.—Consolidated Piedmont Cable Co. Elec. 24 m, of which 6 are horse, 13 cable and 5 elec. 3-6 & 5 g, 25 & 40 lb girder r, 52 c, of which 17 are h c, 25 g. c, 5 m c and 5 t c, 120 h. Pres. E. A. Heron, V. Pres. J. L. Bradbury, Gen. Man. & Supt. H. P. Garthwaite. Capital, $1,500,000; authorized, $2,000,-000. Bonds, $600,000. 6 3

Central Avenue Ry. Co. Elec. 5¼ m, 2½ m s, 3-8 g, 40 lb compound r. 6 m c. T-H system. Ingler & Atkinson cars. S. F. Tool Co. engines. Pres. W. F. Beck, V. Pres. A. H. Clough, Sec. Treas. & Gen. Man, W. F. Rudolph, Supt. & Ch. Engr. S. B. Lennegan, Elecn. P. J. Brandt. Capital, $19.000, authorized, $1,0.0,000. Office 12th and Kirkman sts. 1 4

East Oakland St. Ry. Co. Elec. 6 m, 4-8½ g, 45 lb combination r, 11 m. c. T-H system. Pres. C. E. Wilson, V. Pres. & Gen. Man. E. P. Vandercook, Supt. A. G. Briggs. Capital $250,000. Office. 458 9th St. 4 4

Highland Park & Fruit Vale R. R. 10½ m, 6 m s, 4-8½ g. 40-50 lb girder & T r, 8 double deck m c. T-H system. Pullman cars. Pres. E. C. Sessions, Sec. & Treas. F. J. Woodward, Gen. Man. Pur. Agt. & Supt. J. E. Morris, Elecn. H. E. Richards. Capital, $500,000. Bonds, $150,000. Office 118 Broadway. 1 4

Oakland Consolidated St. Ry. Co. Elec. 36 m, 16 m s, 3-6 g, 35, 40 lb girder r, 28 m. c. T-H system. Pres. F. M, Smith, V. Pres. J. W. Coleman, Sec. & Supt. A. K. Grimm, Treas. 1st Nat. Bank, Elecn. J. Sparks, Ch. Engr. of Power Station J. A. Munroe. Capital, $1,000,-000. Bonds, 500,000. Office 47th st & Grove. P. O. Box 126. 1 4

Oakland R. R. Co. (Owned by Southern Pacific Ry. Co. of San Francisco) Elec. 16.2 m, of which 5.2 are cable and 11 elec. 3 g, 40, 72 lb girder r, 32 c of which 12 are cable and 20 m c. T-H system. Supt. Geo. Y. Loring. Office, San Pablo and 20th sts. 6 3

Oakland, San Leandro & Haywards Ry, Co. 25 m, of which 2 are horse and 23 elec. 19 m s, 3-6 g, 35, 40 lb T and girder r, 33 c, of which 2 are h c and 31 m c. T-H system. Carter cars. Ball and McIntosh & Seymour engines. Pres. H. W. Meek, V. Pres. W. J. Landers, Sec. A. L. Stone, Treas, C. E. Palmer, Supt. F. M. Leland, Ch. Engr. E. DeGroat. Capital, $500,000. Bonds, $250,000. Office, 908 Broadway. 1 4

OGDEN, UTAH.—Ogden City St. Ry. Co. Elec. 10 m, 4-8½ g, 30 lb T r, 20 c, of which 12 are m c and 8 t. c. Pres. W. H. Rowe, V. Pres. H. M. Jarvis, Sec. & Supt. R. M. Spivey, Treas. S. L. Conklin. Capital, $350,000. Office Power House, 1920 Washington Ave. 4 4

OGDENSBURG, N. Y.—Ogdensburg St. Ry. Co. 5 m, 4-8½ g, 25 lb T r, 7 c, 19 h. Pres. W. H. Daniels, V. Pres. & Gen. Man. H. B. Howard, Sec. E. A. Newell, Treas. A. E. Smith. Capital, $30,000. 4 4

OIL CITY, PA.—Oil City St. Ry. Co., 2½ m, 2 m s, 4-8½ g, 56 lb. girder r, 6 m c. Curtis system, New Castle cars. Pres. & Gen. Man. J. B. Smithman, Sec. G. S. Bredin, Treas. G. W. Parker. Capital $52,000; authorized $90,000. 12 3

OLEAN, N. Y.—Olean St. Ry. Co. 2.45 m, 3-6 & 4-8½ g, 25-50 lb T r, 4 box c, 14 h. Pres. & Supt. John Fobes, V. Pres. C. S. Carey, Sec. & Treas. G. H. Strong. Capital, $16,000. Office, 264 Union st. 11 2

OLYMPIA, WASH.—Olympia Light & Power Co. Elec. 4 m, 4-8½ g, 40 lb T r, 5 m c. T-H system. Brill and Pullman cars. Water power. Pres. G. D. Shannon, V. Pres. R. Frost, Sec. & Gen. Man. A. H. Chambers, Supt. C. McClelland, Pur. Agt. T. B. Faulkner, Elecn. H. C. Ranft, Ch. Engr. of Power Station. F. M. Cooper. Capital, $250,000. Bonds $150,000. Office 5th & Chestnut Sts. 4 4

OMAHA, NEB.—Omaha St. Ry. Co. Elec. 89½ m, of which 18 are horse 6½ cable and 65 elec., 4-8½ g, 45, 58½ lb T & girder r, 270 c of which 42 are h c, 22 g c, 96 m c and 110 t c, 75 h. T-H, Edison and Westinghouse systems. American, Laclede, Pullman and Stephenson cars. Allis, Wright and Westinghouse engines. Pres. Frank Murphy, V Pres. Guy C. Barton, Sec. D. H. Goodrich, Treas. W. W. Marsh, Gen. Man. W. A. Smith, Supt. F. A. Tucker. Capital, $5,000,000. Bonds, $2,250,000. 4 4

Dundee Place Car Line. 1½ m, 4-8½ g, 35 lb T r 2 m c. Detroit system. Pres. R. W. Patrick, Man. W. A. Smith. 9 3

East Omaha St. Ry. Co., 4.2 m, 4-8½ g, 40, 45 lb. T and girder r, 14 c, of which 7 are m c and 7 t c. Westinghouse system. Pres. A. S. Potter, V. Pres. D. Smith, Sec. & Gen. Man., A. B. De Long, Treas. H. W. Yates, Office 16th and Furman Sts. 3 4

ONEIDA, N. Y.—Oneida Ry. Co. 1½ m, 1 m s, 4-8½ g, 47 lb c b r, 3 box c, 10 h. Stephenson cars. Pres. W. E. Northrup, Sec., Treas. & Gen. Man. H. C. Stone, Supt. G. Leggett. Capital, $13,500; authorized $15,000. 1 4

ONEONTA, N. Y.—Oneonta St. R. R. Co, 2¾ m 4-8½ g, 35 & 38 lb T & flat r, 4 c of which 3 are 4-wheel box and 1, 4-wheel open, 12 h. Pres. & Supt. Geo. I. Wilber, V. Pres. D. F. Wilber, Sec. & Treas. T. D Tallmadge, jr. Capital $20,000. 4 4

ONTARIO, CAL.—Ontario & San Antonio Heights Ry. Co. 8½ m, 4-8½ g, 30 lb T r, 2 4-wheel open c. 4 h. Pres. C. E. Harwood, V. Pres. & Gen. Man C. Frankish, Sec. W. E. Collins. Capital $150,000. 9 3

ORANGE, N. J.—Orange Crosstown and Bloomfield St. Ry. Co. 7 m, 5-2 g, 38 lb Johnson girder rail, 13 box c, 86 h. Pres. & Gen. Man. Francis M Eppley, Sec. Thos. Marsh, Treas. Edw. A. Pearson Supt. J. Waller. Capital stock, $60,000; bonds, $60,000 4 4

Suburban Traction Co., 7 m, of which 3½ are horse and 3½ elec., 7 m. s, 5-2½ g, 80 lb. girder r, 21 c of which 13 are h. c. and 8 m. c., 50 h. Brill & Stephenson cars. Pres. & Pur. Agt., F. W. Child, V. Pres. J. L. Seward, Sec. A. W. Kissam, Treas. A. P. Foster, Supt. W. Henkerson, Jr., Elecn, H. F. Tidman, Capital, $1,500,000. Bonds, $400,000. 4 4

Orange Mountain Cable Co. 8000 ft, 8 g, 56 lb. m. p. r, 2 c. Roebling engines. Pres. A. Z. Mason, V. Pres. & Gen. Man. F. W. Child, Sec. Treas. & Pur. Agt. W. Kissam, Supt. W. Condon. Capital, $350.000. Bonds, $350,000. Office Orange Nat. Bank Bldg. 1 4

ORANGEBURG, S. C.—Orangeburg City St. Ry. Co. 2½ m, 4-8½ g, 40 lb. T r, 6 c, 2 h, 4 mu. Pres. & Gen. Man. J. W. H. Dukes, V Pres. N. H. Bull, Sec. & Treas. B. H. Moss. Capital, $11,000. 1

ORLANDO, FLA.—Orlando St. Ry. 3 m, 4-9 g, 30, 40 lb T r, 7 c, 5 mu. Pres. & Gen. Man. H. W. Moultob, Sec. J. M, Cheney, Treas. M. D. Brooks. Capital $10,000; authorized $50,000. 3 4

OSHKOSH, WIS.—Oshkosh St. R. R. Co. 8⅛ m, 4-8½ g, 30 lb, tram r, 13 c, of which 10 are 4-wheel box & 3 4-wheel open, 57 h. Pres. Chas. Barber, V. Pres. J. H. Porter, Sec. & Treas J. H. Jenkins, Gen. Man. & Supt. C. E. Montgomery. Office, 222 Main st. 4 4

OSKALOOSA, IA.—Oskaloosa St. Ry. & Land Co 5 m. 4 g, 16, 40, 50 lb tram, T & girder r, 4 c, 14 h. Minneapolis and St. Louis cars. Pres. W. M. Peatman, Sec. C. Winter, Treas. W. G. Clark, Supt. J. M. Powell. Capital $30,000. Office, 100 High Ave., West. 9 3

OSWEGO, N. Y.—Oswego St. Ry. Co. 7½ m, 4 m s, 4-8½g, 51-72 lb T & girder r, 12 c, of which 7 are m c and 5 t c. T-H system. Brill cars. Power is rented. Pres. & Pur. Agt. M. E. Graves, V. Pres. L. Clancy, Sec. W. A. Fineran, Treas. & Man. M. McGowan, Supt. & Ch. Eng. F. E. Prichard. Capital, $125,000. Office, East First & Bridge sts. 1 4

OTTAWA, ILL.—Ottawa Electric St. Ry. 8 m 4-8½ g, 56 lb girder r, 8 motor and 4 trail c, T-H system. Pres. T. J. Evans, Sec. & Treas. T. P. Bailey Gen. Man. H. A. Kin. Capital, $100,000. 6 2

OTTAWA, ONT.—Ottawa Electric Ry. Co. 20 m 10 m s, 4-8½ g, 52, 56, 60 lb girder & T r, 48 m c, Westinghouse system. Ottawa cars. Water power. Pres. J. W. McRae, V. Pres. G. P. Brophy, Sec. & Treas. J. D. Fraser, Gen. Man. T. Ahearn, Supt. J. E. Hutcheson. Capital, $500,000. Office, 337 Albert St. 1 4

OTTUMWA, IA.—Ottumwa Electric Ry. Co. 7.25 m, 7 m s, 4-8½ g, 38 & 40 lb girder & T r, 12 c, of which 11 are m c and 1 t c. Gen. Elec. and Westinghouse systems. Pullman and St. Louis cars. Allis and Ball engines. Pres. & Gen. Man. W. R. Daum, V. Pres. J. B. Sax, Sec. T. H. Eaton, Treas. C. F. Blake, Supt. of Car Service, E. M. Campbell, Ch. Engr. & Ch. Engr. Power Station W. M. Evans, Elecn. W. J. Jones. Capital, $300,000; authorized, $500,000. Bonds $200,000. Office, 102 S. Market st. 6 3

OWENSBORO, KY.—Owensboro City R. R. Co Elec. 10 m, 4-8½ g, 40 lb T r, 25 c, of which 12 are m c and 13 t c. T-H system. Stephenson cars. Harrisburg engines. Pres. W. E. Whitely, Sec. R. A. Miller. Treas. J. H. Parish, Gen. Man. J. N. Alsop, Supt. R. H. Neely. Capital $50,000. Bonds, $25,000. 9 3

P

PADUCAH, KY.—Paducah St. Ry. Co. Elec. 8½ m, 4-8½ g, 35, 54 lb T r, 22 c, of which 14 are m c and 8 t c Edison system. Pres. Geo. C. Thompson, V. Pres C. Dallam, Sec. & Treas. T. J. Flournoy, Gen. Supt. A. S. Thompson, Elec'n & Supt. Mo. Pow. D. B. Simon. Capital, $115,000; authorized, $200,000. Bonds, $112,000. Office, 1342 Broadway. 4 4

PAINESVILLE, O.—Painesville, Fairport & Richmond St. Ry. Co. 6¼ m, 4-8½ g, 52, 60 lb girder r, 7 c, of which 5 are m c and 2 t c. Gen. Elec. system. Ball engines. Pres. & Gen. Man. I. K. Pierson, V. Pres. F. C. Moodey, Sec. & Treas. E. W. Rudder. Capital $50,000; authorized $150,000. Bonds $150,000. 4 4

PALATKA, FLA.—Palatka & Heights St. Ry Co. 2 m, 3 g, 30 lb centre bearing r, 2 c, 3 mu. Pres Wm. P. Craig, Sec. Marcus Loab, Treas. E. S. Crill, Gen. Man. W. C. Snow. Capital, $10,000. 4 4

PARIS TEX.—Paris Elec. Lt. & Ry. Co. 5 m, 4-8½ g, 22 & 36 lb T & flat r, 10 c, of which 8 are 4-wheel box & 2 4-wheel open, 45 mu. Pres. J. J. Walsh, V. Pres. S. J. Wright, Sec. & Treas. B. J. Baldwin, Jr., Supt. R. F. Grimes. Capital, $200,000; authorized, $300,000; Bonds, $150,000. Office over Farmers' & Merchants' Bank. 2 3

PARKERSBURG, W. VA.—Park City St. R. R Co. 5 m, 4 8½ g, 40 lb flat & T r, 7 c, 14 h, 14 mu Pres. D. Gould, V. Pres., & Sec. R. Covert, Treas W. H. Wolfe, Gen. Man. & Supt. W. A. McCosh. Capital, $40,000; authorized $75,000. Office 332 Juliana st. 1 4

PASADENA, CAL.—City Ry. Co. (Controlled by Los Angeles Consolidated Electric Ry. Co.) 5¼ m, 3-6 and 4-8½ g, 16, 20, 30 lb T & flat r, 5 c, of which 2 are 4-wheel box & 3 4-wheel open; 10 h, 4 mu. Baker cars. V. Pres. C. W. Buchanan, Sec. Treas. & Gen. Man. M. D. Painter. Capital, $20,300; authorized, $50,000. 1 4

Alhambra & Pasadena St. Ry. Co. (See Alhambra, Cal.)

Colorado St. Ry Co. 5½ m, 3-6 g, 16 lb. T r, 5 c, 9 h. V. Pres. T. P. Lukens, Sec. E. E. Jones. Capital, $50,000. Office, 50 South Los Robles Ave. 1 4

Pasadena & Mt. Wilson Ry. Co. 8½ m, of which 3 are elec. and ½ cable 2 c. Edison system. Pelton water wheels. Pres. T. S. C. Lowe, V. Pres. P. M. Green, Sec. A. P. West, Treas. T. W. Brotherton. 6 3

Pasadena St. Ry. Co. (Controlled by Los Angeles Consolidated Electric Ry. Co.) 3½ m, 3-6 g, 16 lb T r, 5 box c, 8 h. Baker cars. Pres. & Gen. Man. W. Thomson, V. Pres. G. R. Thomas, Sec. P. G. Wooster, Treas. P. M. Green. Capital, $20,300; authorized, $50,000. Office, Wooster Block. 10 3

PATERSON, N. J.—Paterson Ry. Co. Elec. 36 m, 4-8½ g, 58½ lb c b & T r, 75 c, of which 60 are m c and 15 t c. T-H., Westinghouse and Edison systems. Gilbert and Stephenson cars. Ball engines. Pres. Garret A. Hobart, V-Pres. H. Romaine, Sec. A. A Wilcox, Treas. E. T. Bell, Gen. Man. M. R. McAdoo, Supt. M. Pettigrew. Capital $1,250,000. Bonds $1,250,000 1 4

Jersey City, Hoboken & Rutherford. 15 m, 11 m s, 4-8½ g, 90 lb girder r, 20 c, of which 15 are m c and 5 t c. Westinghouse system. St. Louis cars, Pres. C. A. Johnson, V. Pres. J. A. Morrisse, Sec. J. T. Maginnis, Treas. L. Fitzgerald, Gen. Man. & Ch. Engr. T. McCann, Supt. R. DeBevoise. Capital $300,000. 4 4

Paterson Central Electric R. R. Co. 4 m, 4-8½ g, 45, 58½ lb T & girder r, 18 c. Westinghouse system. Gilbert cars. Pres. T. H. Bakewell, V. Pres. F. C. Vandike, Sec. J. J. Scanlon, Treas. J. A. Morrisse, Gen. Man. & Supt. W. Ring. 6 3

Paterson, Passaic & Rutherford Electric Ry. Co. (Includes Paterson & Little Falls, Grand St. Elec. Ry., People's Park Elec. Ry. Paterson & Passaic Elec Ry. and Passaic, Rutherford & Carlstadt Ry. Cos.) 20 m, 13 m s, 4-8½ g, 70, 90 lb T and girder r, 24 c. of which 15 are m c and 9 t c. Westinghouse system. Brill, Laconia and St. Louis cars. Rent power. Pres. C. A. Johnson, 1st V. Pres. & Asst, Treas. J. A. Morrisse, 2d V. Pres. F. C. Van Dyk. Sec. J. J. Scanlan, Supt. W. Ring. Capital $800,000. Office Cor. Main and Ward sts. 4 4

PAWTUCKET, R. I.—Pawtucket St. Ry Co. Elec 15 m. of which 6.5 are horse and 8.5 elec; 4 g, 54-60 lb Prov. girder & T r, 50 c, of which 35 are m c and 15 m c, 142 h. T-H system. Pres. N. W. Aldrich, V. Pres. L. B. Goff, Sec. & Gen. Man. C. F. Luther, Treas. E. N. Littlefield. Capital $200,000. Office, 54 Broad st. 9 3

Interstate St. Ry. Co. Elec. 24 m, 4-8½ g, 50 lb T r, 40 c, of which 23 are m c and 17 t c. T-H system. Briggs and Newburyport cars. Pres. & Gen. Man. H. M. Daggett, Jr., Sec G. E. Webster, Treas. W. N. Otis, Pur. Agt. E. Holmes, Elecn. J. Tregoning. Capital, $362,500; authorized, $500,000. 4 4

PEORIA, ILL.—Central Ry. Co. 24 m, 12 m s 4-8½ g, 48, 80 lb girder r, 89 c, of which 47 are m c and 42 t c. T-H system. American, Laclede and St. Louis cars. Corliss engines. Pres. W. Barker, V. Pres. S. Clark, Sec. J. N. Ward, Treas. E. Callender, Gen. Man. & Pur. Agt. J. Finley, Supt. P. Brady, Ch. Engr. A. L. Kellogg, Elecn. D. E. Flynn. Capital, $600,000. Bonds $200,000. Office, 622 S. Adams st. 4 4

Fort Clark St. Ry. Co. Elec. 14 m, 4-8½ g, 38, 50, 75 lb girder & T r, 34 c, of which 14 are m c and 20 t c. T-H system. St. Louis cars. Ball and Ide engines. Pres. F. W. Horne, Sec. & Treas. J. A. Trawick, Supt. W. D. Allison. Capital, $250,000; authorized, $500,000. Bonds, $250,000. Office, Abington & Monroe Sts. 4 4

PETERSBURG, VA.—Petersburg St. Ry. Elec. 3¼ m, 3¼ m s, 4-8½ g, 45 & 47 lb c b r, 12 c, of which 2 are h c and 10 are m c. T-H system. Jones cars. Receiver R. Gilham, Supt. G. Beadle. Capital, $100,000. Bonds, $100,000. 4 4

Petersburg & Asylum Ry. Co. Dummy. 3½ m, 4-8½ g, 50 lb T r, 1 Baldwin engine, 4 c. Receiver R. Gilham, Supt. G. Beadle. Capital $20,000. Bonds $30,000. 4 4

PHILADELPHIA, PA.—Citizens' Pass. Ry. Co. (Leased by Electric Traction Co.)

Electric Traction Co., includes Lombard & South Sts. Pass. Ry., Lehigh Ave. Ry., Frankford & Southwark City Pass. Ry., Citizens' Pass. Ry., and Second & Third Sts. Pass. Ry.) 129 m, 5-2 g, 45, 47, 50, 78, 93 lb. girder & Tram r, 253 c, 1,705 h, 10 steam dummies. Gen. Elec. and Curtis systems. McIntosh & Seymour and Porter-Allen engines. Pres. J. J. Sullivan, V. Pres. G. S. Gandy, Sec. F. Weckerley, Treas. R. C. Brewster, Supt. W. H. Janney, Ch. Engr. E. B. Ives. Capital $1,875,000. Office, 2501 Kensington ave. Engr's office, 11th & Colona sts. 12 3

Frankford & Southwark City Pass. Ry. Co. (Leased to Electric Traction Co.)

Lehigh Ave. Ry. Co. (Owned by Frankford & Southwark Phila. Pass. R. R. Co.)

Lombard & South Sts. Pass. Ry. Co. (Owned by Frankford & Southwark Ry.)

Second & Third Sts. Pass. Ry. Co. (Owned by Frankford & Southwark Phila. City Pass. R. R. Co.

Hestonville, Mantua & Fairmount Pass. R.R. Co. 17.78 m, 10 m s, 5-2½ g, 47 lb r, 82 c, 537 h. Pres. J. Hopkins, V. Pres. I. Blum, Sec., Treas. & Pur. Agt. W. R. Benson, Ch. Engr. A. L. Johnston. Capital, $39,322; authorized, $41,000. Bonds. $499,500 Office, 4300 Lancaster ave. 4 4

People's Pass. Ry. Co. (Lessee of Germantown Pass. and Green & Coates Rys. and is controlled by People's Traction Co.) 49 m, 49 m s, 5-2 g, 49 m s, 93 lb girder r, 173 c, 1475 h. Gen. Elec. system. Allis engines. Own cars. Pres. H. C. Moore, Sec. & Treas. David C. Golden, Gen. Supt. J. C. Lugar, Ch. Engr. L. H. McIntyre. Capital, $2,250,000. Bonds $750,000. Office, 8th & Dauphin sts. 4 4

People's Traction Co. (controls People's Pass. Ry. Co.) Lamokin and St. Louis cars. Pres. J. Lowber Welch, Sec. & Treas. C. Kruger, Ch. Engr. & Gen. Man. L. H. McIntire. 4 4

Germantown Pass. Ry. Co. (Leased to People's Pass. Ry. Co.)

Green & Coates R. R. Co. (Leased to People's Pass. Ry. Co.)

Philadelphia City Pass. Ry. Co. 12.417 m, 5-2½ g, girder r. Pres. Wm. W. Colket, Sec. & Treas. T. W. Pennypacker. Capital, $1,000,000. Office, 202 Walnut place. Leased to W. Phila. Pass. Ry. Co. 4 4

Philadelphia & Darby Ry. Co. (Leased to Phila City Pass. Ry. Co.)

Philadelphia Traction Co. (Lessee of Empire Pass. Phila. & Gray's Ferry, Ridge Ave, 17th & 19th Sts. 13th & 15th Sts., 12th and 16th Sts., Phila. City Pass. Schuylkill River Pass., the Continental Pass., Catherine & Bainbridge Pass., Phila. & Darby, 22d St. & Allegheny Ave., Union Pass. and West Phila. Rys.,) 250 m, of which 126 are horse, 90 elec. and 34 cable, 5-2½ g, 47, 78, 90 lb r, 1116 c, of which 406 are h. c. 575 m. c. and 135 g c, 3622 h. Brill and Laclede cars. Westinghouse and Wetherill engines. Pres. P. A. B. Widener, 1st V. Pres. W. L. Elkins, 2d V. Pres. G. D. Widener, Sec. & Treas. D. W. Dickson, Gen. Man. J. T. Gorman. Capital, $6,000,000. Office, n w cor. 41st and Haverford sts. V. Pres., office 423 Walnut st. 4 4

Empire Pass. Ry. Co. 8½ m, 5-2 g, 45 lb r. Pres James McManes, Sec. and Treas. D. W. Dickson Capital, $600,000. Office, N. E. cor. 41st & Haverford sts. Leased to Phila. Traction Co. 1 4

Philadelphia & Gray's Ferry Pass. R. R Co. (Leased to Phila. Traction Co.)

Ridge Ave. Pass. Ry. Co. (Leased to Phila. Traction Co.)

Seventeenth & Nineteenth Sts. Pass. Ry. Co. (Leased to Phila. Traction Co.)

Thirteenth & Fifteenth Sts. Pass. Ry. Co. (Leased to Phila. Traction Co.)

Union Pass. Ry. Co. (Leased to Phila. Traction Co.)

West Philadelphia Pass. Ry. Co. (Leased to Phila. Traction Co.)

Schuylkill River Pass. Ry. Co. Leased to Phila delphia & Gray's Ferry. Pass R. R. Co. 12 3

PHŒNIX, ARIZ. T.—Phœnix City Ry. Co. 10 m. of which 5 are horse and 5 elec. 3-6 and 4-8½ g, 20, 30, 35 lb T r. Pres. M. H. Sherman, Sec. & Man. B. N. Pratt. 6 3

PIERRE, S. DAK.—Pierre City Ry. Co. 4.1 m 4-8½ g, 27-35 lb r, 5 open c, 7 h, 16 mu. Pres. W. G Warden, V. Pres. Randal Morgan, Sec., Supt. & Gen. Man. S. B. Wallace. Capital $75,000. 6 3

PINE BLUFF, ARK.—The Citizens' St. Ry. Co 12½ m, 4 & 4-8½ g, 20, 35, 45 lb T r, 28 m. c. 4 h, 140 mu. Pres. T. S. James, Sec. A. Murray, Treas. & Gen. Man. & Supt. W. Jones, Capital $200,000. Bonds $90,000. Office, 207½ Main St. 11 2

PIQUA, O.—Miami Valley Ry. Co. 14 m, 4-8½ g, 35,48 lb T r, 12 c, of which 8 are m c and 4 t c. Edison and T-H systems. Pres. W. P. Orr, V. Pres. & Man. A. M. Orr, Sec. & Treas. L. M. Flesh, Gen Supt. F. C. Davies. Capital $300,000. Bonds $200,000. 3 4

PITTSBURGH, PA.—Birmingham, Knoxville & Allentown Traction Co. 1.4 m. horse and 1,600 ft. cable, 5 g, 45 lb steel & T r, 9 c, 24 h. Pres. H. S. A. Stewart, Sec. Danl. Beech Treas. T. H. Given, Supt. M. S. Holden. Capital, $100,000. 11 1

Central Traction Co. 8½ m, of which 5 are cable & 3½ elec. 5-2½ g, 65 lb girder r, 26 c, of which 18 are g c and 8 m c. Westinghouse system. Brill and Pullman cars. Wetherill and Westinghouse engines. Pres. Geo. I. Whitney, V. Pres. T. A. Gillespie, Sec. J. F. Miller, Treas. G. F. Wright, Supt. W. C. Smith. Capital, $1,500,000; bonds $375,000. Office 33d st. & Herron Avenue, 4 4

Citizens' Traction Co. 30 m of which 6 are horse, 12 cable and 12 elec. 5-2½ g, 54 & 65 lb girder & tram r-90 c, of which 4 are h c, 66 g c and 20 m c, 28 h. Westinghouse system. Gilbert, Pullman and Stephenson cars. Buckeye and Wetherill engines. Pres. Jno. G. Holmes, V. Pres. H. S. A. Stewart, Sec. J. G. Bright, Treas. N. Holmes, Jr., Gen. Man. J. E. Rugg. Capital $3,000,000. Bonds $1,250,000. General office 537 Penn Ave., business office 3404 Penn Ave. 4 4

Duquesne Inclined Plane Co. 1,586 ft., 5 g, 60 lb T r 2 c. Pres. S. Severance, V. Pres. F. B. Nimick, Sec. K. Q. Brigham, Treas. S. Severance, Jr., Supt. Geo. L. Holliday. Capital, $50,000. 9 2

Duquesne Traction Co. Elec. 28 m, 5-2½ g, 48 lb girder r, 60 m c, T-H. system. Pres. C. L. Magee, V. Pres.————, Sec. Jas. L. McDevitt, Treas. Jno F. Steel. Capital, $3,000,000. Bonds, $1,500,000 Leased to Pittsburgh Traction Co, 9 2

Federal St. & Pleasant Valley Ry. Co. Elec. 28 m, 4-8½ g, 50, 52, 66 lb girder and tram r, 75 m c, 13 h. Edison and Westinghouse systems. Brill and Pullman cars. Buckeye and Westinghouse engines. Pres. D. F. Henry, V. Pres. R. H. King, Sec. Wm. H. Graham, Treas. R. F. Ramsey, Gen. Man. & Elecn. W. M. Ramsey, Supt. W. H. Foster, Ch. Engr. of Power Station J. Johnston. Capital $1,400,000. Bonds $1,250,000. Office 42 6th. Ave. 2 4

Fort Pitt Inclined Plane Ry. Co. 350 ft., 10 g, 2 c Pres. Wm. Flinn, Sec. & Supt. S. H. French, Treas. F. L. Stephenson. Capital, $60,000. Office 125 Fourth Ave. 3 2

Knoxville Inclined Plane Co. 2,640 ft. 9 g, 60 lb. T r, 2 c. Capital $150,000. Office 96 Diamond st.

WHEN IN PHILADELPHIA, Stop at the New "HOTEL HANOVER," ARCH AND TWELFTH STREETS.
BEST EQUIPPED $2.50 AMERICAN PLAN HOUSE IN THE WORLD.

Monongahela Inclined Plane Ry. Co. 2 planes, 640 ft, 5 & 12 g, 45 & 80 lb T r, 2 pass. 2 freight c. Pres. Jas. M. Bailey, Sec. Treas. & Supt. John L. Awl Capital, $300,000 3 2

Penn. Inclined Plane Ry. 840 ft, 10 g, 60 lb T r Pres. Joshua Rhodes, 1st ave.

Pittsburgh & Manchester Traction Co. Elec. 18 m, of which 1¼ are horse and 16⅞ elec. 52½ g, 63 lb girder r, 72 c of which 1 is h c, 61 are m c, and 10 t c. T-H system. Pres. J. H. Dalzell, V. Pres. Joshua Rhodes, Sec. A. M. Neeper, Treas. W. Montgomery Gen. Man. G. F. Greenwood. Capital, $3,000,000. Bonds, $1,500,000. Office, S. Market & Liberty sts. and Beaver st & Island ave, Allegheny. 1 4

Pittsburgh & Birmingham Traction Co. Elec. 13 m 5-2½ g, 63½ lb girder r, 42 m c. Westinghouse system. Gilbert cars. Hamilton-Corliss engines. Pres. H. S. McKee, Sec. F. J. Tener, Treas. Daniel Beach, Gen. Supt. Miller Elliott. Capital $3,000,000. Bonds $1,500,000. Office, 30th & Carson sts. 4 4

Pittsburgh & Castle Shannon R. R. Cable. (Includes 2 inclines). 6½ m, 3-4 g, 60 lb T r, 4 c. Incline No. 1, 1,375 ft. 10 g, 60 lb T r, 2 c. Incline No. 2, 2,112 ft. 10 g, 60 lb T r, 2 c. Jackson & Sharp cars. Pittsburgh Loco. Works engines. Pres. Walter Chess, V. Pres. J. M. Bailey, Sec. & Treas. E. J. Reamer, Supt. & Pur. Agt. O. A. Rogers. Capital, $481,000. Bonds, $200,000. 1 4

Pittsburgh & West End Pass. Ry. Co. 16 m, 8 m s 6-2½ g, 78 lb tram r, 44 c of which 18 are h c and 26 m c 6 h. Westinghouse system. Laclede and Stephenson cars. Russell engines. Pres. John C. Reilly, V. Pres. Thomas S. Bigelow, Sec. W. V. Callery, Treas. & Gen. Man. William J. Burns, Ch. Engr. & Elecn. M. Murphy. Capital, $1,500,000. Bonds $500,000. Office, Carson st. and Point Bridge. 4 4

Pittsburgh Traction Co. 12 m, of which 10 are cable and 2 elec, 7 m s, 5-2 g, 65 lb. girder r, 74 c, of which 72 are g c and 2 m. c. Atwood system. Brill and Philadelphia Traction Cars. Wetherill engines. Pres. Geo. W. Elkins, V. Pres. C. L. Magee, Sec. and Treas. J. G. Traggardh, Gen. Man. & Pur. Agt. W. L. Elkins, Ch. Eng'r J. M. Gorman. Capital $1,900,000; authorized $2,500,000. Bonds $750,000. Office, 6006 Penn ave. 1 4

St. Clair Incline Plane Ry. Co. .40 m, 5 g, 56 lb T r, 2 box c. Pres. & Supt. W. S. Hughes, Sec. W. S. Jones, Treas. R. B. Mellon. Capital, $150,000. Bonds $75,000. Office, 514 Smithfield St. 9 3

Schenley Park & Highlands Ry. Co. Elec. 3¼ m. 5-2½ g, 40, 45, 60 lb T & girder r, 5 m c. Daft system Gilbert cars. Pres R. G. Wood, V. Pres. & Gen. Man S. J. MacFarren, Sec. J. H. Adams, Treas. T. A. Noble Capital $100,000. Bonds $50,000. Office 415 Lewis Block. 2 4

Second Avenue Pass. Ry. Co. Elec. 10¼ m, 5-2½ g 54 lb Johnson & T r. T-H & Westinghouse systems Pres. Jas. D. Callery, Sec. C. G. Milnor, Treas. John W. Taylor, Gen. Man. W. J. Burns, Supt. John Murphy. Capital, $300,000. Bonds $150,000. Office Glenwood, 23d Ward. 9 2

Suburban Rapid Transit St. Ry. Co. 7 m, 4 m s, 5-2½ g, 52 lb girder r, 16 m, c. Sperry, Westinghouse and United Columbian systems. Laclede and Lewis & Fowler cars. Fisher and Green engines. Pres. H. Miller, Sec., Treas. & Gen. Man. Thos. A. Noble, Supt. & Elecn. J. F. Saitz, Ch. Engr. of Power Station M. McLachen. Capital $100,000; authorized, $120,000. Bonds $100,000. 1 4

PITTSFIELD, MASS.—Pittsfield Electric St. Ry Co. 3½ m, 4-8½ g, 56 lb flat r, 10 c of which 5 are m. c. and 5 t. c., 3 h. Westinghouse system. Pres. Jos. Tucker. Sec. J. M. Stevenson, Treas. & Gen. Man. P. C. Dolan. Capital $40,000. Office Seymour & Wahconah Sts. 12 3

PLAINFIELD, N. J.—Plainfield St. Ry. Co. 3½ m, 3½ m s, 5-2½ g, 72 lb tram r, 5 m c. T-H. system. Brill cars. Westinghouse engines. Pres. T. N. Nevins, V. Pres. T. J. Fritts, Sec. & Treas. C. W. Riker, Gen. Man., Supt., Pur. Agt. & Elecn. J. H. Adelman. Ch. Engr. & Ch. Engr. of Power Station, M. McClurg. Capital, $100,000. Office West 14th St. 4 4

PLYMOUTH, MASS.—Plymouth & Kingston Ry. Co. 9 m, 9 m s, 4-8½ g, 35, 42 lb T r, 12 c, of which 11 are m c and 1 t c. 1 h. T-H system. Briggs and Newburyport cars. Pres. J. H. Cunningham, Sec. T. Loring, Treas. J. D. Thurber, Gen. Man. Supt. Pur. Agt. & Ch. Engr. C. E. Barnes. Capital $70,000; authorized, $100,000. Bonds $35,000. 1 4

POMONA, CAL.—Orange Grove St. R. R. Co. 4 m 3-6 g, 16 lb T r, 3 c. 8 mu. Pres. & Treas. B. B. Nesbit, Sec. C. E. Rice Gen. Man. & Supt. P. C. Towner. Capital $25,000. 11 2

PORT ARTHUR, ONT.—Port Arthur Electric St. Ry. 8 m, 8 m s, 4-8½ g, 40 lb T r, 3 m c. Edison system. Patterson & Corbin cars. Goldie & McCulloch engines. Capital $115,000. J. M. Neelin, Chairman of the Elec. Ry. Committee, Treas. J. McTague, Supt. & Elecn, G. Lowe. Bonds $115,000. 4 4

PORT HURON, MICH.—City Electric Ry. Co. 9 m, 4-8½ g, 45 lb T r, 23 c, of which 18 are m c and 5 t c, T-H system. Ellis and St. Louis cars. Rent power. Pres. W. Canham, Sec. & Treas. F. J. Dixon, Gen. Man. A. Dixon, Supt. H. A. Dickson, Elecn. H. Ludwig. Capital $100,000. Bonds $50,000. Office 316 Huron ave. 1 4

PORT NORFOLK, VA.—Port Norfolk Electric Ry. Co. 3½ m, 3½ m s, 4-8½ g, 40 lb T r, 6 c, of which 5 are h c and 1 t c, 1 steam motor. Pres. W. H. Stewart, V. Pres. Treas & Gen Man. M. W. Mason. Sec. E. T. Powell. Capital $50,000; authorized $500,000. Bonds 60,000. Office Mt. Vernon Ave. 1 4

PORT RICHMOND, S. I., N. Y.—Port Richmond & Prohibition Park R. R. Co. Elec. 2 m, 4-8½ g, 56 lb girder r, 10 c, of which 5 are m c and 5 t c. Edison system. Stephenson cars. Ball engines. Pres. C. A. Starbuck, V. Pres. J. C. Thompson, Sec. & Treas. R. C. Vilas, Gen. Man. & Supt. H. C. Vilas. Capital $100,000. Bonds $75,000. 1 4

PORT TOWNSEND, WASH.—Port Townsend St. Ry., Light & Power Co. 4¼ m, 4-8½ g, 38 & 40 lb T & girder r. Not in operation. 3 4

Port Townsend Belt Ry. Co. 4 m, 2 m c. Edison system. 12 2

PORTLAND, CONN.—Portland R. R. Co.

PORTLAND, ME.—Ocean St. R.R. Co Operated by Portland R. R. Co.

Portland R. R. Co. 20.14 m, of which 11.42 are horse and 8.72 elec. 16.53 m s, 4-8½ g, 35, 48, 58, 72 lb, T tram and girder r, 68 c, of which 42 are h c, 18 m c, and 8 t c, 240 h. T-H system. Ball and McIntosh & Seymour engines. Pres. W. R. Wood, Sec., Treas., Gen. Man., Pur. Agt. & Supt., E. A. Newman, Elecn. J. A. Hutt, Ch. Engr. of Power Station, C. M. Thompson. Capital $300,000; authorized $500,000. Bonds $180,000. Office 471 Congress st. 4 4

PORTLAND, ORE.—Barnes Heights & Cornell Mt. Ry. Co. 3½ m, 3 m c. T-H system. 12 2

Portland Cable Co. 7½ m, 3¼ m s, 3-6 g, 22, 38 comb. r, 24 g c. Stockton cars. Hamilton-Corliss engines. Receiver & Gen. Man. F. I. Fuller. Bonds $400,000. Office Mill & Chapman Sts. 1 4

City & Suburban Ry. Co. Elec. 46 m, of which 35 are elec. and 11 steam, 3-6 g, 30, 40 lb T & girder r, 56 c, of which 52 are m c and 4 t c, 7 steam motors, 13 coaches. T-H system. Pullman cars. Baldwin engines. Pres. H. Failing, V. Pres. T Woodward, Sec. & Treas. C. F. Swigert, Gen. Man. H. C. Campbell. Capital, $1,000,000. 9 3

City & West Portland Park Motor Co. 7 m, of which 6 are steam and 1 elec. 4-8½ g, 45, 50 T r, 17 c, 2 steam motors. Edison system. Pres. E. T. Johnson, V. Pres., Treas. & Gen. Man. T. A. Wood, Sec. W. H. Wood. Capital $100,000. Bonds $100,000. Office Room 1, I. O. O. F. Temple. 9 3

East Side Ry. Co. (Includes Mt. Tabor R. R.) Elec. 22 m of which 4½ are steam and 17½ elec., 4-8½ g, 30, 40 lb T r, 19 c of which 15 are m c and 4 t c, 3 steam motors. Edison and T-H systems. Baldwin engines. Pres. & Gen. Man. G. A. Steel, V. Pres. & Treas. J. Steel, Sec. J. B. Cleland. Capital $195,300; authorized $250,000. Bonds $153,000. Office 212 Madison St. 4 4

Portland Consolidated St. Ry. Co. 32 m, 13½ m s 3-6, 4-8½ g, 35, 40 lb T r, 79 c. of which 74 are m c. and 5 t c. Gen. Elec. and Westinghouse systems. Brill, Hand and Stephenson cars. Ball and Beck engines. Pres. G. B. Markle, V. Pres. J. Steel, Sec D. F. Sherman, Treas. J. L. Hartman, Supt. & Pur Agt. J. E. Thielsen, Elecn. H. Rustin. Capital, $525,000; authorized $1,000,000. Bonds $660,000. Office 100 Front st. 4 4

Portland St. Ry. Co. 2 m, 4-8½ g, 30 lb tram r, 4 c, 30 h. Pres. J. Holladay, V. Pres. G. W. Weidler, Sec. T. Gray. 4 4

PORTSMOUTH, O.—Portsmouth St. R. R. & Lt. Co. 5 m, 5 m s, 4-8½ g, 45 lb T & girder r, 6 c, of which 4 are m c and 2 t c. Westinghouse and Curtis systems. St. Louis cars. Ball & Wood engines. Pres. L. D. York, V. Pres. H. S. Grimes, Sec. Treas & Pur. Agt. S. B. Timmonds, Gen. Man. Floyd L. Smith. Supt. & Elecn. S. P. Baird, Ch. Engr. W. Williamson, Ch. Engr. of Power Station C. Hood. Capital $125,000. Bonds $83,000. 1 4

PORTSMOUTH, VA.—Portsmouth St. Ry. Co, 4.7 m, 4.7 m s, 4-8½ g, 30 lb s b r, 8 c, 10 h, 15 mu. Pres. L. R. Watts, V. Pres. H. L. Page, Sec. J. L. Watson, Treas. J. L. Billsley, Supt. L. C. W. Page. Capital $50,000. Bonds, $50,000. n 4 4

POTTSTOWN, PA.—Pottstown Passenger Ry. Co. 6 m, 3 m s, 4-8½ g, 48, 63 lb T & girder r, 14 c, of which 10 are m c and 4 t c. Westinghouse system. Brill and Jackson & Sharp cars. Ball engines. Pres. G. Maltzberger, Sec. & Treas. C. Fegely, Gen. Man. & Supt. L. P. Muthart, Elecn. D. Lafferty. 1 4

POTTSVILLE, PA.—People's Ry. Co. 4½ m, of which 3½ are steam and 1 elec., 4-8½ g, 52 lb girder and 60 lb T r, 8 c. Short system. Pres. T. A. Reilly Sec. & Supt. Wm. D. Pollard. Office, 221 S. Centre st. 1 4

Schuylkill Electric Railway Co. 8¼ m, 4-8½ g, 48½ lb T & girder r, 15 c, of which 14 are m c and 1 t c. Short system. Brill and Lamokin cars. Ball engines. Pres. J. K. Sigfriied, V. Pres. F. G. Yuengling, Sec. J. Newlin, Treas. J. F. Zerby, Supt. W. Conrod, Elecn. C. Swan. Capital, $150,000. Bonds, $95,000. 4 4

POUGHKEEPSIE, N. Y.—City R. R. Co. 4½ m 4-8½ g. 42 lb s b & c b r, 10 c, 49 h. Pres. J. W. Hinckley, Sec. I. DeGroff, Treas. J. Doheny, Supt. C. M. Davis. Capital $80,000. Office, 491 Main st. 1 4

PROVIDENCE, R. I.—Union R. R. Co. 87 m 4-8½ g, 54, 70, 90 lb girder r, 303 m c. T-H system. Jones and Newburyport cars. Providence engines. Pres. N. W. Aldrich, V. Pres. C. W. Perkins, Sec. Henry V. A. Joslin, Treas. C. A. Babcock, Gen. Man. & Pur. Agt. A. T. Potter, Ch. Engr. G. C. Tingley, Elecn. W. D. Wright, Ch. Engr. of Power Station M. H. Bronsdon. Capital, $2,000,000; authorized, $3,000,000. Office, 32 Westminster St. 4 4

Providence Cable Tramway Co. Cable. 3.2 m, 3.2 m s, 4-8½ g, 38 & 50 lb girder r, 58 c of which 14 are g c and 44 t c, 168 h. Own and Stephenson cars. Harris-Corliss engines. Pres. N. W. Aldrich, Sec. H. V. A. Joslin, Treas. C. A. Babcock, Gen. Man. & Pur. Agt. A. T. Potter, Supt. M H. Bronsdon. Capital, $300,000; authorized, $400,000. (Stock held by Union R. R Co.) Office, 32 Westminster St. 1 4

PUEBLO, COLO.—Pueblo City Ry. Co. Elec. 25 m, 4 g, 35 & 40 lb T r. 40 c, of which 24 are m c and 16 t c. T-H system. Woeber cars. Allis engines. Pres. J. E. Downey, V. Pres. F. J. Chamberlain, Sec. Supt. & Elecn. W. A. Martin, Treas. G. H. Hard, Receiver & Pur. Agt. H. E. Chubbuck. Capital, $500,000. 4 4

PUNXSUTAWNEY, PA.—Punxsutawney St. Pass. Ry. Co. Elec. 2 m, 4-8½ g, 51½ lb girder r, 3 m c. Westinghouse system. Newcastle cars. Greene engines. Pres. S. E. Wilson, V. Pres. J. K. North, Sec. A. J. Truit, Treas., Gen. Man. & Supt. L. C. Myers. Capital, $18,000. Bonds, $14,000. 8 3

PUT-IN-BAY, O.—Put-In-Bay Water Works, Light & Ry. Co. 2 m, 4-8½ g, 75 lb T r, 8 c, of which 4 are m c, and 4 t. c. Westinghouse system. St. Louis cars. Pres. G. H. Ketcham, V. Pres, and Gen. Man. J. K. Tillotson, Sec. and Treas. F. M. Ohl. 3 4

Q

QUEBEC, CAN.—Quebec St. Ry. Co. 3 m, 4-8¼ g, 45 lb Phila. r, 12 c, 8 busses, 11 sleighs, 62 h. Pres Chas. St. Michel, V. Pres. W. Hossack, Sec., Treas Supt. & Man., F. T. Boomer. Capital $50,000. Authorized $100,000. Box 74, Crown St. 6 3

St. John St. Ry. Co. Lim. 1½ m, 4-8½ g, 35 lb s.b. r, 4 4-wheel box c, 24 h. Run a 'bus service out 4 m. from city limits, connecting with car service Pres. A. Robertson, V. Pres. W. DeQuincy Sewell, Sec. & Man. W. W. Martin. Capital, $30,000. Office, 564-6 St. John St. 6 3

QUINCY, ILL.—Quincy Horse Ry. & Carrying Co., 11¾ m, 5 g, 38, 45, 52 lb T & girder r, 27 c, of which 20 m c & 7 t c, 4 mu, T-H. system. St. Louis cars. Hamilton-Corliss engines. Pres. W. S. Warfield, V. Pres. E. J. Parker, Sec. Supt. & Pur. Agt. E. K. Stone, Jr., Treas. F. W. Meyer, Elecn. J. L. Miswander, Ch. Engr. of Power Station I. L. Fawcett. Capital $160.000. 4 4

QUINCY, MASS.—Quincy St. R. R. Leased to Quincy & Boston St. Ry. Co.

Quincy & Boston St. Ry. Co. Elec. 14 m, 4-8 g, 35, 58 lb T & flat r, 20 m c. T-H system. Pres. J. R. Graham, Sec. & Treas. F. H. Smith, Supt. B. J. Weeks. Capital, $50,000. 9 3

R

RACINE, WIS.—Belle City St. Ry. Co. Elec. 15 m, 4 g, 45, 52 lb T & girder r, 26 c, of which 20 are m c and 6 t c. Detroit system. American, Lamokin and St. Louis cars. Bullock-Corliss, McIntosh & Seymour and Westinghouse engines. Pres. & Treas. C. H. Holmes, V. Pres. Sec. & Gen. Man. A. Shewmon. Capital $100,000; authorized $200,000. Bonds $300,000. Office, 233 Main St. 1 4

RALEIGH, N. C.—Raleigh St. Ry. Co. Elec 11 m, 3 m s (in city) 4-8½ g, 30 lb T and girder r, 21 c, of which 9 are m c and 12 t c. Edison system. Brill cars. Allis & Hampson engines. Receivers Grosvenor & Tate, Act. Sec. H. S. Trezevant, Supt. & Elecn, J. Erickson, Pur. Agt. S. Tate, Ch. Engr. of Power Station W. J. Whitfield. Capital stock, $25,000. Bonds $125,000. 4 4

RAPID CITY, S. DAK.—Rapid City St. Ry. Co 4 m, 2 m s, 4 g, 25 lb r, 2c, 4 h. Pres. E. B. Chapman, V. Pres. James Halley, Sec. Treas. & Supt. J. W. Leedy. Capital $100,000. 1 4

READING, PA.—Reading City Pass. Ry. Co. (Operated by Reading Traction Co.)

East Reading Electric Ry. Co. (Operated by Reading Traction Co.)

Neversink Mountain R. R. Elec. 12 m, 2 m s, 4-8½ g, 56 lb T r, 13 c, of which 7 are m c and 6 t c. Edison system. Brill and Pullman cars. Water power. Pres. H. T. Kendall, V. Pres. G. Brooke, Sec. M. C. McIlrain, Treas. D. W. Stehman, Gen. Man., Pur. Agt. & Elecin., Paul D. Milholland. Ch. Engr. & Ch. Engr. of Power Station, B. F. Kraft, Capital $150,000. Office, 536 Pine St. 4 4

Reading & South Western St. Ry. Co. Elec. 5½ m 1½ m s, 4-8½ g, 40-56 lb T and girder r, 14 c, of which 8 are m c and 6 t c. Curtis and Gen. Elec. systems. Brill, Lewis & Fowler and Stephenson cars. Ball engines. Pres. J. W. Shepp, V. Pres. J. B. Sterley, Sec. & Treas. V. S. Seltzer, Gen. Man. Supt. & Pur. Agt., G. W. Keim, Electn. W. T. Kautner. Capital, $130,000. Office, Water st., below Chestnut. 4 4

Reading Traction Co. (Operates Reading City Pass. Ry. and East Reading Electric Ry.) 28 m, of which 5 are horse and 23 elec. 26 m s, 5-2½ g, 60, 90, 93 lb girder r, 124 c, of which 34 are h c, 54 m c and 36 t c, 141 h. Brill and St. Louis cars. Green and Lake Erie engines. Pres. Gen. Man. & Pur Agt. J. A. Rigg, Sec. & Treas. M. C. Aulenbach, Supt. S. E. Rigg Ch. Engr. of Power Station J. L. Boyer. Capital $1,000,000. Bonds $100,000. 3 4

RED CLOUD, NEB.—Red Cloud Street Ry. 1 m, 3 c, 6 mu. Proprietor, L. Crabill. 2 3

REDLANDS, CAL.—Redlands St. Ry. Co. 2½ m, 2½ m s, 4-2½ g 20 lb T r, 1 open c, 7 mu. Baker Iron Works cars. Pres. A. E. Sterling V. Pres. S. J. Hayes. Treas. First National Bank, Gen. Man. Supt. & Pur. Agt. A. E. Stuting. Capital, $50,000. 1 4

RED OAK, IA.—Red Oak St. R.R. Co. 1½m, 4-2½ g. 20 lb flat r, 1 c, 2 mu. Pres. Gen. Man. & Supt. M. Bonham, V. Pres. J. Hayes, Sec. F. M. Byriket. Capital $75,000. 3 4

RICHMOND, IND.—Richmond City Elec. St. Ry Co. 11 m, 4-8½ g, 40, 60 lb T r, 24 c. of which 14 are m c and 10 t. c. T-H system. Pres. J. F. Miller, Sec. R. B Harrison, Treas. D. G. Reid, Receiver & Gen. Man. A. D. Titsworth, Elec. Supt. E. Kessler. Capital $200,000. 3 4

RICHMOND, VA.—Richmond Ry. & Electric Co. 50 m, 4-8½ g, 45-55 lb flat and c b r, 112 c. Edison and Westinghouse systems. Pres. J.P. Munn, Treas. & Gen. Man. G. E. Fisher; Supt. City Division C. Selden; Supt. Union Division, J. W. Wilbur; Supt. Manchester Division, B. R. Selden. Capital, $1,250,000; authorized, $2,000,000. Office, 909 Bank st. New York office, 261 Broadway. 3 3

RIVERSIDE, CAL.—Riverside & Arlington St. Ry. 12½ m, 4-6 g, 22-34 lb T r, 6 c, of which 3 are 4-wheel box & 3 4-wheel open, 20 mu. St. Louis cars Pres. S. C. Evans, V. Pres. O. Backus, Sec. F. A. Miller, Treas. Riverside Banking Co., Gen. Man. G. O. Newman, Supt. J. C. Little. Capital $40,000; authorized $200,000. 6 3

ROANOKE, VA.—Roanoke St. Ry. Co. 23m, 21½ m s, 4-8½ g, 50 lb T r, 14 c, of which 9 are m c, and 5 t c, 2 h. Westinghouse and Edison systems. Brill and Gilbert cars. Armington & Sims engines. Pres. S. W. Jamison, V. Pres. & Treas. J. T. Engleby, Sec. G. C. McCahan, Gen. Man. Supt. & Elecn. W. F. Carr, Ch. Engr. of Power Station W. J. Updyke. Capital, $300,000; authorized, $500,000. Bonds, $200,000. Office, 301 Terry Bldg. 4 4

ROCHESTER, PA.—People's Electric St. Ry. Co. 3.7 m, 1½ m s., 4 m, 5-2½ g, 45 lb T & girder r, 4 m c. T-H system. Laclede cars. Phœnix engines. Pres. H. P. Brown, Sec. J. P. Stone, Treas. C. H. Bentel, Gen. Man. & Pur. Agt., P. Bentel. Ch. Engr & Elecn. A. L. Fickel. Capital, $150,000. Bonds $50,000. 4 4

ROCHESTER, N. Y.—Rochester Ry. Co. (Controls Rochester & Irondequoit R. R. Co., and Rochester Electric Ry. Co.) 77.45 m, 4-8½ g. 40, 78 lb girder & T r, 207 c, of which 151 are m c and 56 t c, 80 h. Short and Westinghouse systems. Pres. John N. Beckley, V. Pres. W. C. Barry, Sec. W. D. Ellwanger, Treas. F. Cook, Supt. W. Rosborough. Capital, $5,000,000. Bonds $3,275,000. Office, 267 State st. 11 2

Rochester & Irondequoit R. R. Co. (Controlled by Rochester Ry. Co.) 10 m, 4-8½ g, 56 lb T r, 10 m c. Gen. Elec. system. Stephenson cars Pres. J. N. Beckley, V Pres. W. C. Barry, Sec. W. D. Ellwanger, Treas F. Cook. 4 4

Rochester Electric Ry. Co. (Controlled by Rochester Ry. Co.) 8.88 m, 4-8½ g, 40 lb T r, 23 c, of which 12 are m c. and 11 t.c. T-H. system. Gilbert and Stephenson cars. Armington & Sims and Woodbury engines. Pres. A. Luetchford, V. Pres. J. N. Beckley, Sec. & Treas. M. H. Briggs, Gen. Man. & Pur. Agt. C. A. Derr, Elecn. G. Meginan, Ch. Engr. of Power Station J. Farnan. Capital, $200,000. Office Charlotte. 1 4

Grand View Beach Railway Co. Elec. 9½ m, 4-8½ g, 40 lb T r, 7 c, of which 5 are m c and 2 t c. Gen. Elec. system. Newburyport cars. McIntosh & Seymour engines. Pres. H. H. Craig, V. Pres. Sec. Treas. & Gen. Man. M. Doyle, Supt. W. H. Gillette. Capital, $100,000. Bonds, $200,000. 9 3

ROCK ISLAND, ILL.—Rock Island & Milan St Ry. Co. 6½ m, 4-8½ g, 20, 30 & 40 lb r, 8 pass c, 8 ft c 7 h, 2 motors, Pres. H.C. Connelly, Sec. J. M. Buford Treas. P. Fries, Supt. J. Huntoon. p 1 3

ROCKAWAY, N. Y.—The Rockaway Village Ry. Co. 1 m, 4-8½ g, 47 lb c. b. r, 3 c, of which 2 are box and 1 open, 10 h. Pres. C. A. Cheever, V Pres. J. D. Cheever, Sec. J. S. Auerbach, Treas. D. L. Haight. Capital $25,000. Bonds $25,000. Office. 13 Park Row, New York. 9 3

ROCKFORD, ILL.—Rockford City Ry. Co. Elec 15 m, 4-8½ g, 40–45 lb tram & T r; 20 c, of which 18 are m. c, and 2 t c, 4 h. T-H system. Laclede and St. Louis cars, Ball and Ide engines. Pres. R. N. Baylis, Sec. F. W. McAssey, Treas. W. H. McCutchen, Gen. Man. Supt. & Pur. Agt. T. M. Ellis, Elecn. H. J. Termolhen. Capital $150,000. Bonds $120,000. 1 4

West End St. Ry. Co. 10.20 m, 10.20 m s, 4-8½ g, 40,45 lb T & girder r, 17c, of which 13 are m. c. and 4 t c, Short system. Northern and Stephenson cars. Ide engines. Pres. Treas. Gen. Man. & Pur. Agt. J. S. Ticknor, V. Pres. H. B. Andrews, Sec. Treas. & Supt. F. A. Ticknor, Elecn. F. L. Colby, Ch. Engr. of Power Station —— Kipp. Capital, $57,000; authorized, $75,000. Bonds, $100,000. Office, 205 S. Main st. 1 4

ROCKLAND, MASS.—Rockland & Abington St. Ry. Co. (See North Abington, Mass.)

ROCKLAND, ME.—Rockland, Thomaston & Camden St. Ry. Co. Elec. 14½ m, 4-8½ g, 50 lb T r, 23 c. Edison system. Briggs cars. Hamilton-Corliss engines. Pres. & Gen. Man. G. E. Macomber, V. Pres. H. L. Shepherd, Sec. H. M. Heath, Treas. A. D. Bird, Supt. H. C. Weston. Capital, $300,000. 9 3

ROCKPORT, TEX.—Aransas Pass St. Ry. Co 4 m, 4 g, 20 lb T r, 2 c, 4 mu. Pres. H. W. Davis V. Pres. W. P. Poland, Sec. & Treas. C. W. Booth Capital, $25,000. Address Box 129, P. O. 1 4

ROME, GA.—Rome St. R. R. Co. (Operates North & South St. Ry.) 5 m, 5 m s, 4-8½ g, 40, 45 lb T r, 10 c, of which 4 are m c and 6 t c. Edison system. Brill and Lamokin cars. Ball engines. Pres. & Gen. Man. John S. Laurence, Sec. L. A. Dean, Treas. & Pur. Agt. J. King, Supt. C, M. Fouche, Ch. Engr. of Power Station J. R. Watts. Capital, $100,000. Bonds, $100,000. Office, East First St. 2 4

ROME, N. Y.—Rome City St. Ry. Co. Elec. 6¾ m 4-8½ g, 38½ lb girder r, 14 c, 15 h. Stephenson cars. Pres. J. S. Wardwell, V. Pres. A. C. Kessinger, Sec. & Treas. W. P. Rayland. Capital, $50,000. Bonds, $125,000. Offices, 115 John st. 9 3

RONDOUT, N. Y.—Kingston City R. R. Co. Elec 2.77 m, 4-8½ g, 72 lb girder r, 6 m c. Gen. Elec. system. Pullman cars. Payne engines. Pres. S. D. Coykendall, Sec. & Treas. Peter E. Schoonmaker, Auditor Oscar L. Eastman, Gen. Man. & Pur. Agt. Geo. Coykendall. 4 4

ROXBOROUGH, PA. — Manayunk & Roxborough Incline Plane & Ry. Co. 7½ m, 5-2½ g, 48 lb r, 5 c, 36 h. Pres. G. M. Brill, Sec. F. Pearson, Treas. C. J. McGlinchy, Supt. J. Bramble. Capital, $58,475. Office, Roxborough. 9 3

RUTLAND, VT.—Rutland St. Ry. Co. 8 m, 4-8½ g, 20 lb Tr 10 c, of which 8 are 4-wheel box & 2 4-wheel open. 30 h. Brill and Stephenson cars. Pres. J. W. Cramton, Sec. S. M. Willson, Treas. N. K. Chaffee. Supt. M. McKeough. Capital $50,000. Bonds $28,000. Office 60 State St. 4 4

S

SACRAMENTO, CAL.—Central St. Ry. Co. Elec. (Includes Sacramento City and Highland Park. Controlled by Sacramento Elec. Lt. & Power Co.). 19½ m, 4-8½ g, 30 to 65 lb girder & T r, 27 c, of which 24 are m c and 3 t c. T-H and Edison systems. Pres. A. Gallatin, Sec. J. Baker, Treas. National Bank (D. O. Mills & Co.). Gen. Man. J. B. Edson, Supt. G. P. Kingsbury. Capital $500,000. Bonds $265,000. Office 28 and N sts. 1 4

SAGINAW, MICH.—City of Saginaw St. R. R. Co. 3¾ m, 4-8½ g, 42 lb c. b. r, 16 c, of which 9 are 4-wheel box & 7 4-wheel open, 50 h. Pres. David H Jerome Sec. & Treas. Geo. L. Burrows. Supt. Fred G. Benjamin. Capital $30,000. Office, 426 N. Hamilton st. 1 4

Saginaw Union St. Ry. 30 m, 25 m s, 4-8½ g, 35, 60 lb T and tram r, 45 c, of which 1 is h c, 27 m c and 17 t c, 12 h. Detroit system. Brill, Gilbert, Jones and Pullman cars. Bartlett-Corliss engines. Pres. F. E. Snow, V. Pres. W. A. Jackson, Sec. L. T. Durany, Treas. J. M. Nichol, Gen. Man. Pur. Agt. & Ch. Engr. W. J. Hart. Capital, $300,000. Bonds, $325,000. 4 4

ST. CATHARINE'S, ONT.—St. Catharine's, Merritton & Thorold St. Ry. Co. Elec. 8½ m, 4-8½ g, 30 lb T & flat r. 10 c, of which 8 are m. c. and 2 t. c. Van Depoele system. Pres. W. B. Gilleland, V. Pres. & Gen. Man. T. Nihan, Sec. & Treas. T. E. Nihan, Jr. Capital, $80,000. Office, St. Paul st. 3 2

ST. CLOUD, MINN.—St. Cloud City St. Car Co. Elec. 10 m, 4-8½ g, 40 lb T r, 8 m c. T-H system. St. Louis cars. Pres. H. M. Byllesly, V. Pres. C. K. Stearns, Sec. W. P. Johnson, Treas. G. C. Duffie, Supt. C. S. Benson. Capital $100,000. Bonds, $125,000. 9 3

St. Cloud & Sauk Rapids Ry. Co. 3 m, 2 m c. T-H system. 9 3

ST. JOHN, N. B.—The Consolidated Electric Co., Ltd., 5 m, 4-8½ g, 45-60 lb r, 5 m c. Edison system. Pres. John F. Zebley, Sec. H. B. Zebley, Gen. Man. C. D. Jones, Supts. A. R. Bliss, J. R. Purdy. 4 3

ST. JOSEPH, MICH.—St. Joseph & Benton Harbor Electric Ry. & Light Co. 5½ m, 4-8½ g, 45 & 52 lb T & and girder r, 12 c, of which 6 are m c and 6 t c. T-H system. Brill cars. Williams engines. Pres. Gen. Man. & Pur. Agt. W. W. Bean, Sec. W. H. Hull Treas. W. G. Keith, Supt. H. C. Mason. Capital, $100,000. Bonds $200,000. 1 4

ST. JOSEPH, MO.—St. Joseph Traction & Lighting Co. 33 m, 4 8½ g, 30, 35, 38, 40, 47, 52 lb T and girder r, 61 c, of which 49 are m c and 12 t c, 8 h, 2 mu. Edison, T-H, Westinghouse and Wightman systems. Brill, Brownell, Gilbert, Lewis & Fowler, St Louis and Stephenson cars. Armington & Sims engines. Pres. J. T. Gardiner, V. Pres. J. R. Owens, Sec. S. S. Terry, Treas. N. Fish. Asst. Treas. G. L. Rollins, Gen. Supt. W. T. Van Brunt. 3 4

ST. LOUIS, MO.—Baden & St. Louis R. R. 3 m, 4-10 g, 24,28,42½ lb T & tram r, 10 c, 27 h. Pres. & Gen. Man. Geo. S. Case, V. Pres. F. J. McMaster Supt. H. Nelson. Capital, $50,000. Office, Broadway near Baden ave. 1 4

Cass Avenue & Fair Grounds Ry. Co. (Includes Northern Central and Union Rys.) 35 m, 4-10 g, 85 lb girder r, 210 c, of which 70 are m c. and 140 t c. T-H system. Pres. D. G. Hamilton (Chicago), V. Pres. & Gen. Man. Robt. McCulloch, Sec. & Treas. C. N. Duffy, Capital $2,500,000. Bonds, $2,000,000. Office 3,820 Easton Ave. 1 4

Citizens' Ry. Co. 16 m, 10 of which are cable, 3 elec. and 3 horse, 4-10 g, 63 lb girder r, 246 c, of which 55 are g c, 54 m c and 137 t c, 67 h & mu. Pres. D. G. Hamilton (Chicago), V. Pres. & Gen. Man. Robt. McCulloch, Sec. & Treas. C. N. Duffy. Capital $1,500,000. Office, 3,820 Easton Ave. 1 4

Fourth St. & Arsenal Ry. Co. 5 m, 4-10 g, 78 lb girder r, 15 c. Pres. Chas. Green. V. Pres. & Gen. Man. J. Mahoney, Acting Sec. D. J. Mahoney. Capital $150,000. Office 1,801 Park ave. 12 3

Jefferson Ave. Ry. Co. 5.7 m, 4-10 g, 56 lb tram r 40 c, of which 20 are box & 20 open, 190 mu. Pres P C. Maffit, Sec. W. D. Henry, Supt. T. W. Murphy Gen, Man. J. Scullin. Capital $112,000. Office, Jefferson ave. & Gravois road. 1 4

Lindell Ry. Co. Elec. 50 m, 4-10 g, 78, 81 lb girder r, 245 m c and t c. Edison, Short and Westinghouse systems. Brill and St. Louis cars. Porter-Allen engines. Pres. E. Whitaker. V. Pres. C. D. McLure, Sec. & Treas. Jas. Adkins, Gen. Man. Geo. W. Baumhoff. Capital, $2,500,000. Bonds $1,500.000. Office, 2330 Chouteau Ave. 1 4

Compton Heights, Union Depot & Merchants' Terminal Ry. Co. (Operated by Lindell Ry. Co.) Capital $1,000,000. Bonds, $500.000. 1 4

Taylor Avenue St. Ry. Co. (Operated by Lindell Ry. Co.) Capital $500,000. 1 4

Missouri R.R. Co. Elec. 27.52 m, 9.06 of which are cable and 18.46 elec. 4-10 g, 63 lb girder r, 290 c, of which 40 are g. c. 44 m. c. and 206 t. c. T-H. system. American, Brill and Brownell cars. Harris & Hamilton engines. Pres. & Gen. Man. P. C. Moffit, V. Pres. J R. Lionberger, Sec. & Treas. F. R. Henry, Supt. James F. Davidson. Capital $2,300,000; authorized $2,400,000. Office, 10 S. Compton Ave. 1 4

Forest Park & Laclede Ave. & Fourth St. Ry. Co Elec. Operated by Missouri R. R. Co.

People's R. R. Co. Cable. 9½ m, 4-10 g, 78 lb girder r 120 c, of which 40 are g c and 80 t c, 12 h. Brownell and Stephenson cars. Hooven, Owens & Rentschler engines. Pres. Chas. Green, V. Pres. & Gen. Man. J. Mahoney. Asst. Sec. & Treas. D. J. Mahoney. Capital, $300,000; authorized, $1,000,000. Office, 1,801 Park ave. 1 4

St. Louis County Ry. Co. Pres. J. B. Greensfelder Central P. O.

St. Louis R. R. Co. Cable. 14⅔ m, 4-10 g, 78 lb girder r, 240 c, of which 80 are g. c. 80 box & 80 open c, Pres. D. G. Hamilton (Chicago), V. Pres. C. Pepper Sec. & Treas. R. B. Jennings, Gen. Man. Robt. McCulloch. Capital, $2,000,000. 1 4

St. Louis & East St. Louis Electric Ry. Co. 2 m, 1 m s, 4.10 g, 48-56 lb girder r, 8 m. c. T-H system. Brownell and St. Louis cars. Pres. D. R. Powell, V. Pres. C. C. Carroll, Sec. D. T. Breck, Asst. Supt. W. H. Williams. Capital $250,000. Bonds $75,000. Office, 115 N. 3d st. 4 4

St. Louis & Suburban Ry. Co. (Operates Midland St. Ry.) 28 m, 4-10 & 3 g, 35,40,69 lb T & girder r, 120 c, of which 60 are m c and 60 t c. T-H system. Pres. C. H. Turner, V. Pres. S. MKennard, Sec. & Treas. S. D. Barlow, Jr., Gen. Supt. T. F. Sneed. Capital, $2,500,000. Office, DeHodiamont. 1 4

Midland St. Ry. Co. (Operated by St. Louis & Suburban Ry. Co.) 3 m, 4-10 g, 35 lb T r, c, of which 1 is m c and 2 t c. T-H system. Pres F. Kuhn, V. Pres. E. C. Robbins, Sec. & Treas. G. Kingsland, Gen. Man. E. H. Benoist. Capital $20,000. Office, 823 N. 2d St. 1 4

Southern Electric Ry. Co. Elec. 16 m, 4-10 g, 78 lb girder r, 120 c, of which 40 are m c and 80 t c. T-H system. Allis and Ball engines. Pres. Tom L. Johnson, Sec. Treas. & Gen. Man. Jos. S. Minary, Supt. J. C. Allen. Office, 4,041 So. Broadway. 1 4

Union Depot R. R. Co. (Controls Benton, Bellefontaine and Mound City Rys.) 67 m, 4-8½ g, 78 lb girder r; 381 c, of which 215 are m c and 166 t c. Gen. Elec. system. Pres. J. Scullin, V. Pres. & Gen. Man. H. Scullin, Sec. Jas. H. Roach, Supt. T. W. Murphy. Capital $1,000,000. Bonds $3,500,000. Office Geyer & Missouri aves. 1 4

ST. PAUL, MINN.—Twin City Rapid Transit Co (see Minneapolis, Minn).

St. Paul & White Bear Ry. Co. 11½ m, 4-8½ g, 50 lb T r, 13 c, of which 9 are m c and 4 t c. T-H system. Laclede and Pullman cars. Baldwin engines. Pres. & Gen. Man. H. M. Byllesby; V. Pres. H. C. Lewis, Sec. & Treas. W. Ruan, Supt. S. B. Livermore. Capital, $200,000. Bonds, $200,000. 9 3

ST. THOMAS, CAN.—St. Thomas St. R. R. Co. 2 m, 3-6 g, 30 lb tram r, 4 c, 8 h. Pres. Cameron Currie, V. Pres. J. Winter, Sec. C. W. Smith, Treas S. Hendrie, Supt. S. Chambers. Office, St. Thomas Ont. 2 4

SALEM, MASS.—(See Lynn).

SALEM, N. C.—Winston-Salem Ry. & Elec. Co (See Winston, N. C.)

SALEM, O.—Salem Electric Ry. Co. 3½ m, 4-8½ g 45 lb Johnson girder r, 6 c, of which 4 are m. c. and 2 t. c. T-H system. Buckeye engines. Pres. & Treas. M. Davis, V. Pres. J. M. Evans, Sec. D. L. Davis, Supt. & Pur. Agt. L. Davis, Elecn. W. Shaffer, Ch. Engr. of Power Station J. Wolf. Capital, $100,000. Bonds, $50,000. Office, 210 E. Main st. 4 4

SALEM, ORE.—Salem Consolidated St. Ry. Co. 8 m, 8 m s. 4-8½ g, 40 lb. T r, 9 m c. Edison system. Brill, Pullman and Stockton cars. Beck, Sioux City and Westinghouse engines. Pres. C. B. Markle, V. Pres. E. P. McCornack, Sec. F. H. Page, Treas. A. P. Fuller, Gen. Man. Pur Agt. & Ch. Engr. F. R. Anson, Supt. & Elecn, L. McGrew, Ch. Engr. of Power Station L. Kibele. Capital, $289,900; authorized, $500,000. Bonds, $250,00. Office, 179 Commercial St. 2 4

SALT LAKE CITY, UTAH.—Salt Lake City R. R. Co. Elec. 42 m, 4-8½ g, 30, 35, 40, 72, lb. T r, 63c, of which 57 are m c and 6 t c. Westinghouse, T-H & Edison systems. Stephenson cars. Fraser & Chalmers engines. Pres. A. W. McCune, V. Pres. R. C. Chambers, Sec, & Treas. Joseph S. Wells, Supt Walter P. Read. Capital, $650,000; authorized $1,000,000. Bonds $650,000. Office Hooper building. 4 4

Salt Lake Rapid Transit Co., Elec. 32 m, 26 m s 4-8½ g, 35, 40, 79 lb T & girder r, 41 c, of which 30 are m c and 11 t c. 3 h. T-H Edison and Westinghouse systems. Stephenson and Woeber cars. Ide engines. Pres. & Gen. Man. J. S. Cameron, V. Pres. J. M. Donnellan, Sec. C. B. Jock, Treas. G. S. Gannett, Supt. & Pur. Agt. A. M. Hinckley, Ch. Engr. of Power Station C. M. Dunlap. Capital, $500,000. Office, 176 State st., Rooms 14, 15, 16. 4 4

West Side Rapid Transit Co. Elec. & Steam. 8 m, of which 6 are steam and 2 elec, 4-8½ g, 30 lb T r, 4 c. T-H system. Pres. & Gen. Man. J. G. Jacobs Treas. E. W. Wilson. Capital $300,000. Bonds, $400,000. Office Eagle Block. 1 4

SAN ANTONIO, TEX.—San Antonio St. Ry. Co. Elec. 43 m, 40, 45, 56 lb T r, 45 c, of which 39 are m c and 6 t c. T-H system. St. Louis cars. Armington & Sims engines. Pres. & Treas. W. H. Weiss, V. Pres. C. H. Weiss, Sec. C. A. Buford, Supt. J. W. Greer, Ch. Engr. & Ch. Engr. of Power Station, W. H. Rowley. Capital, $200,000; authorized, $1,000,000. Bonds, $200,000. Office 311½ W. Houston St. 1 4

Citizens' Electric Power & St. Ry. Co. 13 m, 4-8½ g, 40, 48 lb T r, 20 c, of which 10 are m c and 10 t c. T-H system. Lewis & Fowler cars. Pres. W. J. Clark, V. Pres. H. E. Barnard, Sec. & Treas. A. H. Dollard, Gen. Man. C. E. Harris, Supt. S. F. Walker. Capital, $300,000; authorized $600,000. Bonds $300,000. Office, 415 Navarro St. 9 3

San Antonio Rapid Transit St. Ry. Co. 5 m, 4½ m s, 4-8½ g, 40 lb T r, 5 c of which 3 are m c and 2 t c. T-H system. Brill cars. Bullock engines. Pres. J. W. B. Patterson, V. Pres. R. H. Russell, Sec. & Gen. Man. G. S. Limons, Treas. C. W. Ogden, Supt. Pur. Agt. & Ch. Engr. B. W. Randall, Elecn. B. Parker. Capital, $100,000; authorized $200,000. Bonds, $100,000. Office 525 E. Houston St. 1 4

West End St. Car Co. Elec. 5½ m, 4-0 g, 30 lb T r, 6 c, of which 3 are m c and 3 t c. T-H system. Pres. & Gen. Man. G. W. Russ, V. Pres. F. H. Baldwin, Sec. J. N. Groesbeck, Treas. Thad. W. Smith, Gen. Man. G. W. Russ, Supt. F. M. Dowden. Office, 285 Commerce St. 11 2

SAN BERNARDINO, CAL.—Southern California Motor Road Co. 12 m, 4-8½ g, 40 lb T r, 6 c, 3 Baldwin motors. Receiver J. A. Muir, Sec. & Treas. W. S. Hooper, Supt. H. C. Guiteau. Capital, $1,000,000. Office, 3rd & E Sts. 4 4

San Bernardino St. Ry. Co. 1½ m, 3 ft. g, 20 lb T r, 2 c, 2 h. Pres. I. R. Brunn, Sec. & Treas, W. S Hooper. Capital $50,000. 6 3

SAN DIEGO, CAL.—San Diego Cable Ry. Co. 10¼ m, 3-6 g, 20-30 Z & T r, 14 c of which 10 are comb'n & 4 open. Receiver, G. H. Hensley. 11 2

San Diego Electric Ry. Co. 20 m, of which 5 are horse and 15 elec, 4-8½ g, 38, 40, 52½ lb T & girder r, 40 c, of which 30 are h c and 10 m c. T-H system Pres. A. B. Spreckels, V. Pres. E. S. Babcock, Sec., Treas. & Gen. Man. J. A. Flint. Capital $500,000 authorized $350,000. Office E and Arctic sts. 9 3

San Diego, Old Town & Pacific Beach R. R. Co. Dummy. 11½ m, 4-8½ g, 35, 40 lb T r, 11 passenger c, and 3 motors. Pres. & Gen. Man. H. Dabury, Sec R. P. Dabury. Capital, $250,000. 11 2

SAN FRANCISCO, CAL.—California Street Cable R.R. Co. 11 m, 5½ m s. 3-6 g, 38 lb s-b r, 60 c. Pres. J. B. Stetson, V. Pres. Antoine Borel, Sec. Albert Stetson Treas, A. Borel & Co., Gen. Man. Supt. & Pur. Agt. J. W. Harris, Ch. Eng. of Power Station A. D. McLean. Office, Cor. California & Hyde sts. 1 4

Geary St., Park & Ocean R.R. Co. 9 m, of which 8 are cable and 1 steam, 4½ m s, 4-8½, 5 g. 40,72 girder and T r, 85 c, of which 31 are g c, 10 comb'n c, 37 t c and 7 motors and coaches. Union Iron Works engines. Pres. C. F. Crocker, V. Pres. A. Grant, Sec. & Gen. Man. J. L. Willcutt, Treas. N. T. Smith, Supt. A. W. Barron, Man. of Purchases and Supplies, R. P. Schwerin. Capital. $1,000,000. Bonds, $671,000. Office, 4th & Townsend Sts. 2 4

Market St. Ry. Co. (Controls Central, City, Ferries & Cliff House, North Beach & Mission, Omnibus and Potrero & Bay View Railroads) 158½ m, of which 56 are horse, 68.5 cable, 18.3 steam, elec. (op. by horses) 15.7, 89.1 m s, 3, 3-6, 4-8½ and 5 g, 37-72 lb c b, 3 b, girder and T r, 729 c, of which 264 are h c, 408 comb'n c, 57 motors and coaches. Union Iron Works engines. Pres. C. F. Crocker, V. Pres H. E. Huntington, Sec. & Controller J. L. Willcutt, Treas. N. T. Smith, Act. Man. (Transp'n. Dept.) M. D. Stein, Div. Supts. A. W. Barron, J. C. Skinner, J. F. Clark, H. O. Rogers. Man. of Purchases and Supplies, R. P. Schwerin, Engr. G. H. Fairchild. Capital, $17,892,000; authorized, $18,750,000. Bonds, $7,035,000, Office, 4th & Townsend sts. 2 4

Metropolitan St. Ry. Co. 11 m, 5½ m s, 5 g, 40 lb girder r, 22 m c. T-H system. Risdon Iron Works engines. Pres. W. Easton, V. Pres. P. Lilienthal, Sec. C. G. Miniffe, Treas. Anglo-Californian Bank, Supt. H. A. Iddings, Elecn. F. Vanatta, Ch. Engr. of Power Station, T. Mirk. Office 317 Carl St. 1 4

Presidio & Ferries R. R. Co. 11½ m of which 7½ are cable, 2 horse & 2 steam, 5 g, 40 & 42 lb c b r, 30 c of which 5 are h c and 25 g c, 30 h. Pres. G. A. Newhall, V. Pres. H. M. A. Miller, Sec. John B. Leighton, Treas. J. C. Johnson, Supt. I. F. Kydd. Capital $10,000. Bonds $250,000. Office, 1,111 Union St. 6 3

San Francisco & San Mateo Ry. Co. 24 m, 17 m s 4-8½ g, 50 lb T & comb'n r, 33 c, of which 30 are m c and 3 t c. T-H system. O'Brien caas. Risdon I. W engines. Receiver, S. Bennett, Pres. & Gen. Man. B. Joost, V Pres. C. C. Butler, Sec: G. T. Smith, Treas. Nevada Bank of San Francisco, Supt. Ch. Engr. Elecn. & Ch. Engr. of Power Station F. Hoffmeister, Pur. Agt. W. A. Andrews. Capital $2,000,000 Bonds $1,100,000. Office 30th St. & San Jose Ave. 4 4

Sutter St. Ry. Co. 13 m, of which 1 is horse & 12 cable, 5½ m s, 5 g, 42 lb girder r, 50 c, of which 2 are h c and 48 g c, 90 h. Own cars. Union Iron Works engines. Pres. R. F. Morrow, V. Pres. J. L. Schmitt Sec. A. K. Stevens, Treas. M. Schmitt, Supt. & Pur. Agt. J. Reynolds, Ch. Engr. F. E. Mason. Capital $2,000,000. Bonds $900,000. Office, corner Sutter & Polk sts. 1 4

SAN JOSE, CAL.—San Jose & Santa Clara R.R. Co Elec. 12 m, of which 1 is horse & 11 elec. 3 g, 20 & 35 lb T r, 29 c, of which 4 are h c, 17 m c and 9 t c. T-H & Edison systems. Pres. J. H. Henry, V. Pres. & Gen Man. J. P. Burke, Sec. J. T. McGeoghegan, Supt. W W. Skinner. Capital $500,000. Bonds $200,000. Office The Alameda. 1 4

First St. R. R. Elec. 10 m, 3 g, 30 lb steel T r, 12 c of which 7 are m. c. and 5 t. c. T-H system. Jacob Rich, Sole Owner; Sec. E. M. Rosenthal. 3 4

Willow Glen R.R. 2½ m, 3 g, 20 lb steel T r, 3 c, 20 h Sole owner Jacob Rich, Sec. E. M. Rosenthal. 3 4

SAN LUIS OBISPO, CAL.—San Luis St. Ry Co. (Owned by West Coast Land Co.) 2½ m, 3 g, 16 lb T r, 5 c, of which 2 are 4-wheel box & 3 4-wheel open, 10h. Pres. J. L. Howard, Man. C. O. Johnson Office, Higura St. 4 4

SANDUSKY., O.—Sandusky St. Ry. Co. Elec. 11¼ m, 4-8½ g, 45 lb T and girder r, 14 c, of which 12 are m c and 2 t c. Westinghouse system. Brownell and Gilbert cars. Pres. A. J. Stoll, V. Pres. C. Moss, Sec. & Treas. G. F. Anderson, Supt. E. G. Schmidt. Capital $119,000; authorized $150,000. Bonds $40,000. 4 4

People's Electric Railway Co. 6¼ m, 4-8½ g, 40-45 lb T & girder r, 8 m c. Westinghouse system. Pres. H. C. Post, V. Pres. G. Barney, Sec. & Treas. A. W. Prout, Gen. Man. T. Wood, Supt. E. L. Crawford Capital $80,000; authorized $100,000. Bonds $31,500 Office 122 Lawrence st. 2 3

Sandusky, Milan & Norwalk Electric Ry. Co. Receiver, J. C. Gilchrist, Jr. Capital, $80,000; authorized $100,000. Office, 122 Laurence St. n 1 4

SANFORD, ME.—Mousam River R. R. Co. Elec 2½ m, 2½ m s, 4-8½ g, 60 lb T r, 4 c, of which 2 are m c and 2 t c, 1 elec. frt. loco. Westinghouse system. Amesbury and Briggs cars. Swampscott-Corliss engines. Humphrey water wheel. Pres. E. M. Goodall, V. Pres. & Treas. L. B. Goodall, Sec. G. B. Goodall, Gen. Man. Supt. Pur. Agt. & Elecn. E. K. Day, Ch. Engr. of Power Station S. Spinney. Capital, $75,000. 4 4

SANTA ANA, CAL.—Santa Ana, Orange & Tustin St. Ry. Co. 10 m, 3-6 g, 16 & 25 lb steel T r, 6 c, 10 h, 6 mu. Pres., Supt. & Gen. Man. M. J. Bundy, V Pres. Noah Palmer, Treas. Commercial Bank, Sec Miss. M. A. Ross-Lewin. Office, 419 North Main St Capital $35,660; authorized $50,000. 4 4

SANTA BARBARA, CAL.—Santa Barbara St. R.R. Co. and Citizens' St. R. R. Co. of Santa Barbara. 7 m, 3-6 g, 20 lbs T r, 7 c, 36 mu. Pres. Warren Gillilen, Sec. & Supt. C. R. Diver, Treas. G. H. Bonebrake. Capital $50,000; bonds $50,000. Office, State st. 6 3

SANTA CRUZ, CAL.—Santa Cruz Electric Ry. Co. (Operates Pacific Ave. R. R.) 7 m, 3-2 g, 35, 40 lb girder & T r, 8 m c. T-H system. Pres. J. H. Logan, V. Pres. E. G. Green, Sec. W. T. Jeter, Treas. Bank of Santa Cruz County, Gen. Man. F. W. Ely. Capital $500,000. 4 4

SANTA ROSA, CAL.—Santa Rosa, St. R. R. Co. 1½ m, 3-6 g, 12 lb T r, 5 c, 4 h, 3 mu. Pres. M. L. McDonald, Sec. & Treas. M. L. McDonald, Jr. Capital, $25,000. 4 4

Central St. Ry. Co. 3 m, 3-6 g, 24, 35 lb flat r, 4 c. Pres. J. D. Barnett, V. Pres. W. D. Reynolds, Sec. J. W. Warboys, Treas. W. Prindle, Supt. W. H. Lee. Capital, $25,000. 1 4

Union St. Ry. Co. 4 m, 3-6 g, 35 lb flat r, 8 c. Pres. B. M. Spencer, Sec. J. M. Farnham, Treas. J. H. Bush. Capital, $50,000. 1 4

SARATOGA, N. Y.—Union Electric Ry. of Saratoga. 10 m, 4-8½ g, 50 lb T r, 20 c, of which 8 are m c and 12 t c. T-H system. Pres. C. E. Arnold Sec. M. Nussbaum, Treas, E. J. Slattery. Capital $300.000. Bonds, $100,000. 9 2

SARNIA, ONT.—Sarnia St. Ry. Co. 4 m, 4-8½ g, 40 lb Tr, 9 c, 2 lh. Patterson & Corbin cars. Pres. & Treas. Jas. S. Symington, V. Pres James Smith, Sec. & Gen. Man. H. W. Mills. Capital, $50,000. Office, Front St., 4 4

SAUGATUCK, CONN.—Westport & Saugatuck Horse R. R. Co. (See Westport, Conn.

SAULT STE. MARIE, MICH.—Sault Ste. Marie St. Ry. Co. Elec. 4.25 m, 4-8½ g, 20 lb T r, 5 m. c. Detroit system. Pres. Thos. Ryan, V. Pres. B. F. McEvoy, Sec. & Treas. James R. Ryan, Gen. Man. Lorenzo G. Cody, Supt. G. A. Cody. Capital, $25,300. Cash paid in to equip, $60,000. 2 3

SAVANNAH, GA.—City & Suburban R. R. Co. Elec. 14 m, of which 5 are steam and 9 elec., 5 g, 35-52 lb c b & T r, 24 c, of which 6 are steam c, 12 m c and 6 t c. T-H system. Brill and St. Louis cars. Cooper-Corliss engines. Pres. J. H. Johnston, V. Pres. H. Parsons, Sec. E. J. Thomas, Treas. E. Schmitt, Asst. Supt. J. E. Lewis, Ch. Engr. of Power Station ——— McIntire. Capital, $50,000. Office 2d Ave. & Whitaker St. 1 4

The Electric Ry. Co. 25 m, 4-8½ g, 50 lb T and girder r 52 c of which 40 are m c and 12 t c. T-H, Edison and Westinghouse systems. Brill cars. Armington & Sims engines. Pres. J. S. Collins, Sec. & Treas. T. G. Read, Supt. J. W. McFarland. 1 4

Savannah, Thunderbolt & Isle of Hope Ry. Co. 8 m, 5 g, 45, 50 lb T r, 11 m c. T-H system. Brill and St. Louis cars. Cooper engines. Pres. & Treas. J. H. Johnston, V. Pres. H. Parsons, Sec. E. J. Thomas. Office Bolton st. 2 4

SCHENECTADY, N.Y.—Schenectady St. Ry. Co 4¾ m, 4½ m s, 4-8½ g, 45 lb Lewis & Fowler and Johnson girder r, 15 c, of which 12 are m c and 3 t c Edison system. Gilbert and Jones cars. Westinghouse and Armington & Sims engines. Pres. John Kreusi, Sec. A. MacAndrew, Treas. W. E. Gilmore, Gen. Man. & Pur. Agt. H. S. Cooper Capital authorized and issued $300,000. Bonds $300,000. Office. 224 State st. 1 4

SCRANTON, PA.—People's St. Ry. Co. Elec (Operates Nayaug, Crosstown, Scranton & Suburban and Scranton Passenger). 30 m, 4-8½ g, 40 & 52 lb girder & T r, 88 m c. Westinghouse system. Dickson-Corliss engines. Pres. P. S. Page, V. Pres. & Gen. Man. H. H. Archer, Sec. & Treas. Horace E. Hand, Supt. C. H. Smith. Capital, $600,000. 9 3

Scranton Passenger Ry. Co. Westinghouse system. Capital, $50,000. Bonds, $100,000. Owned and operated by People's St. Ry. Co. 9 3

Scranton & Suburban Ry. Co. (Merged with Nayaug and Crosstown Ry.) Westinghouse system. Capital, $100,000. Bonds $200,000. Leased to and operated by People's St. Ry. Co. 9 3

Scranton Traction Co. (Operates People's, Nayaug, Crosstown, Scranton & Suburban and Scranton Pass. Rys.) Pres.———————V. Pres. J. P. Ilsley, Sec. & Treas. C. F. Stevens, Gen. Man. H. H. Archer. Gen. Supt. C. H. Smith, Audr. J. H. Gormley. Capital $2,000,000. Bonds $1,000,000. 9 3

SEARCY, ARK.—Searcy & West Point R.R. Co 8½ m, of which 3½ are horse & 5 steam, 4-8½ g, 35 lb T r, 4 c, 1 mu. St. Louis cars. Porter engines. Pres. W. H. Lightle, Sec. W. S. Lay, Treas., Gen. Man. & Pur. Agt., J. Hicks, Ch. Engr., J. M. Finley, Capital $75,000. 4 4

SEATTLE, WASH.—Grant Street Electric Ry. Co. 7 m, 3-6 g, 56 lb girder & T r, 12 m c. Sander cars. Westinghouse engines. Pres. & Gen. Man. F E. Sander, V. Pres. N. B. Sander, Sec. & Treas. L. D. Bruns, Supt. R. E. Sander. Capital, $200,000. Bonds, $125,000. 9 3

Madison St. Cable Ry. Co. (Controls South Seattle Cable Ry.) 7¼ m, 3-6 and 4-8½ g, 38 lb girder r, 19 c of which 16 are g c and 3 frt. t c. S. C. H. & A. Works cars. Hoovens, Owen & Rentschler engines. Pres. H. G. Struve, V. Pres. R. H. Denny Sec. M. McMicken, Treas. J. Furth, Asst. Sec. W. B. Goodrich, Supt. S. Gibson. Capital $750,000. Office Madison St. Power House. 1 4

Rainier Avenue Electric Ry. Co. 8 m, 1 m s, 4-8½ g, 30-45 lb T & girder r, 20 c, of which 4 are m c and 16 t c, T-H system. Northern cars. Corliss type engine. Pres. J. K. Edmiston, Sec. & Treas. A. C. Marconnier, Supt. Pur. Agt. & Ch. Engr. W. M. Camp, Elecn. J. D. Chase, Ch. Engr. of Power Station J. O. Fisher. Capital, $250,000. Office at Columbia City, Wash. 1 4

Seattle City Ry. Co. Cable. 5 m, 5 m s, 3 g, 16 lb T r, 27 c, of which 12 are g c and 15 t c. Receiver W. A. Underwood, 40 Wall st., New York, Gen. Man. Supt. & Pur. Agt. A. F. Haas, Ch. Engr. of Power Station C. A. Johnston. Capital $600,000. Bonds $1,000,000. Office Power House, Yessler Ave. 1 4

Seattle Consolidated St. Ry. Co. (Controls Front St. Cable, Green Lake Electric, North Seattle Cable and Rainier Ry. & Power Co.) Elec. 13.7 m, 4-8½ g, 30, 40, 44, 46 lb T & girder r, 27 c, of which 23 are m c and 4 t c. Gen. Elec and Westinghouse systems. Jones, Pullman and own cars. Reynolds-Corliss engines. Pres. D. T. Denny, V. Pres. J. B. Denny, Sec. V. H. Smith, Treas. R. R. Spencer, Gen. Man. & Pur. Agt. C. S. Clark, Audr. A. Dunn. Ch. Engr. of Power Station W. D. Gordon. Capital, $1,200,000; authorized $1,500,000. Bonds $861,000. Office, 200 Pike st. 3 4

Green Lake Electric Ry. Co. (Leased to Seattle Consolidated St. Ry. Co.) 4½ m elec. 4-8½ g, 40 lb T r, 4 c, of which 2 are m c and 2 t c. T-H system. Pullman cars. Pres. W. D. Wood, V. Pres. J. Ledoy, Sec. & Treas. C. A. Kilbourne, Gen. Man. E. C. Kilbourne. Capital, $60,000; authorized, $70,000. Bonds, $50,000. Office, 815 Second St. 1 4

Union Trunk Line. 15 m, of which 13.64 are elec and 1.36 cable; 3-6 g, 56 lb T and girder r, 24 c, of which 16 are m c and 8 g c. Gen. Elec. system. Lane & Bodley engines. Pres. E. F. Wittler, V. Pres. F. E. Sander, Sec. J. D. Lowman, Treas. R. R. Spencer, Elec. D. Bunce, Ch. Engr. of Power Station J. C. Biegert, Gen. Supt. E. B. Hussey. Capital, $1,000,000. Office James St. Power station. 4 4

West Seattle Cable Ry. Co. 2 m, 3-6 g, 4 c. Wheelock engines. Pres. T. Ewing, Man. J. H. Watson. Capital $150,000. 12 1

West St. & North End Electric Ry. Co. 8 m, 4-8½ g, 35 & 45 lb T & girder r, 14 c, of which 13 are m c and 1 t c. T-H system. Northern Car Co. cars. Hamilton-Corliss engines. Pres. J. Leary, V. Pres. B. Pelly, Sec. E. C. Kellogg, Treas. W. R. Ballard, Gen. Man. & Supt. T. Imeson. Capital, $1,000,000. Office, cor. Alva & 3d ave. E. 4 4

Woodland Park Electric Ry. Co. 1½ m, 4-8½ g, 60 lb T r, 1 m c. T-H system. Brill cars. Pres. & Gen. Man. G. C. Finney, Sec. & Treas. C. J. Brenton. Office 110 Seneca St. 4 3

SEDALIA, MO.—The Electric Ry., Light & Power Co. of Sedalia. 12 m, 12 m s, 4-8½ g, 35 lb T r, 20 c, of which 10 are m c, and 10 t c. Edison system. Pres. W. E. Sterne, V. Pres. R. R. Moore, Sec. Treas. & Man. D. C. Metsker, Supt. Chas. Carroll. Office, 500 E. 9th St. 4 4

SELMA, ALA.—Selma St. & Suburban Ry. Co. Dummy. 8 m, of which 2½ are horse and 5½ steam 4-8½ g, 20 & 35 lb T r, 10 c, of which 6 are h c and 4 t c, 1 steam motor, 20 mn. Pres. S. H. March, Sec. Treas. & Gen. Man. R. H. McFaddin. Capital, $30,000. 11 2

SENECA FALLS, N. Y.—Seneca Electric Ry Co 3½ m, 4-8½ g, 40 lb T r, 6 c, of which 2 are m c, & 4 t c. T-H system. Brill cars. Pres. S. L. Phillips, V. Pres. & Treas. J. H. Gould, Sec. C. H. Williams, Supt. E. F. Slack. Capital, $50,000. 2 3

SHAMOKIN, PA.—Shamokin Electric St. Ry. Co 3 m, 5-2 g, 35, 48½ lb T and girder r, 6 c, of which 4 are m c and 2 t c. T-H. system. Brill cars. —— engines. Pres. R. S. Aucker, Sec. S. Heckert, Treas. M. Markle, Gen. Man. & Supt. G. Marshall. Capital $50,000; authorized, $80,000. Bonds, $22,500 6 3

Shamokin & Mt. Carmel Electric Ry. Co. 15 m, 4-8½ g, 50 lb. T r. 12 c, of which 6 are m c and 6 t c. Pres. E. C. Hamilton, Sec. D. J. Lewis, Treas. H. S. Robins. Office, 321 Independent St. 9 3

SHARON, PA.—Shenango Valley St. Ry Co. Elec 4½ m, 5-2½ g, 45 lb T & girder r, 4 m c. T-H system New Castle cars. Phœnix engines. Pres. J. C. Whitla, V. Pres. H. W. Reeves, Sec. & Gen. Man. M. L. Knight, Treas. F. G. Barker, Supt. J. O. Patterson. Capital, $150,000. 9 3

SHEBOYGAN, WIS.—Sheboygan City R. R. 8 m, 7 m s, 4-8 ½ g, 35-40 tram r, 11 c, 30 h, 30 mu. Laclede cars. Pres. J. M. Sæmann, Sec. & Treas. F. Sæmann, Supt. C. F. Bacon. Capital, $50,000. 4 4

SHEFFIELD, ALA.—Sheffield St. Ry. Co. 9 m, 4-8½ g, 35 lb steel r, 5 c, 2 steam motors. Pres. H. B. Tompkins, Supt. W. S. White, Asst. Supt. P. N. Totten, Sec. M. McTyer, Treas. C. D. Woodson. Capital $50,000. p 12 2

SHERMAN, TEX.—Sherman City R. R. Co. 4 m 4-8½ g, 20,35 lb T r, 9 c, 50 mu. Pres. Gen. Man & Owner C. W. Batsell, Sec. J. M. Batsell, Treas. C. W. Batsell Jr. Capital, $50,000. 8 3

College Park Rapid Transit Co. Elec. 4½ m, 4-8½ g 25 lb T r, 5 m. c. Edison system. Pres. J. M Cullers, V. Pres. J. R. Cole, Sec. C. W. Lewis, Treas J. P. Harrison, Supt. H. C. Morrow. Capital, $24,000 authorized, $100,000. 11 2

SHREVEPORT, LA.—Shreveport City R.R. Co. 1½ m, 4-4 g, 46 lb r, 6 c, 14 h. Pres. S. Levy, Jr., V. Pres. P. J. Trezovant, Sec. Jules Dreyfuss. 9

Shreveport Ry. & Land Improvement Co. Elec. 5¼ m, 4-8½ g, 40-45 T & Johnson girder r, 8 c, of which 4 are m. c. & 4 t. c. T-H system. Pres. S. B. McCutchen, Sec. W. B. Jacobs, Gen. Man. J. R. Jones, Supt. J. G. Keller. Capital, $32,000; authorized $100,000. Bonds $100,000. Office 525 Spring St. 9 2

SIASCONSET, MASS.—Siasconset St. Ry. Co. 2 m, 2 m s, 4-8½ g, 35 lb T r, 2 c, 16 h. Pres. H. H. Pratt, Treas. J. F. Timmins, Gen. Man. T. E. Macy. Capital $30,000; authorized $100,000. Bonds authorized $100,000. None issued. 1 4

SING SING, N. Y.—Ossining Electric Ry. Co. 3 m, 4-8½ g, 50 lb. T r. 10 m c. T-H system. Gilbert cars. Ball & Wood and McIntosh & Seymour engines. Pres. A. S. Underhill, V. Pres. J. V. Cockcroft, Sec. F. L. Young, Treas. S. E. Tompkins, Supt. & Elecn. F. A. Cole, Pur. Agt, J. Champlain, Ch. Engr of Power Station J. Kay. Capital, $100,000. Bonds $100,000. 4 4

SIOUX CITY, IA.—Sioux City St. Ry. Co. Elec 17 m, 4 g, 30, 40, 45 & 58½ lb. girder r, 50 c, of which 27 are m. c. and 23 t. c., T-H, Westinghouse & Edison systems. Pullman cars. Allis engines. Receiver, J. C. French, Cashier, F. L. Brown, Supt. I. B. Walker. Capital, $300,000; authorized $1,500,000. Office, 510 United Bank Bldg. 4 4

Riverside Park Ry. Co. 9 m elec., 4-8½ g, 40 lb steel T r, 20 c, of which 6 are m. c. 8 t. c, and 6 freight c Westinghouse system. Northern Car Co. cars. Westinghouse engines. Pres. A. M. Coffman, V. Pres. Jas E. Booge, Sec. & Treas. C. M. Swan. Supt. Pur. Agt. & Elecn. B. J. Jones, Ch. Engr. of Power Station E. Doolittle. Capital $250,000. Office, Masonic Bldg. 4 4

Sioux City & Morning Side Ry. Co. Dummy. 6 m, 4-8½ g, 50 lb T r, 6 c. Pres. J. N. Jackson, Sec. T. C. Prescot, Treas. D. L. Pratt. Capital $100,000. 6 3

Sioux City & Leeds Electric Ry. Co. 5.6 m, 4-8½ g 45 lb T r, 5 m c. Detroit system. Pres. A. M. Coffman V. Pres. C. C. Pierce, Sec. W. M. Stevens, Treas. E. W. Skerry, Supt. C. J. Lever. Capital, $200,000. 6 3

Sioux City Cable Ry. Co. 7 m, 4-8½ g, 45 lb Johnson girder r, 34 c, of which 14 are g c and 20 t c. Laclede and Trimble cars. Williams engines. Pres. J. Peirce, Sec. D. T. Hedges, Treas. W. V. Hedges, Gen. Man. & Supt. C. Moller. Capital, $250,000. 2 3

Sioux City Rapid Transit Co. Steam. 5½ m, of which 2 m are elevated track; 4-8½ g, 35 & 50 lb T r, 6 c, 2 engines. Northern cars. Porter engines. Pres. E. Haakinson, V. Pres. A. M. Jackson, Sec. A. V. Larimer, Treas. E. C. Peters, Gen. Man. C. E. Haakinson, Supt. T. L. Miller. Capital, $1,000,000. Office, Chamber of Commerce Bldg. 2 3

Washington Park & Spring Grove Ry. Co. 4½ m, 4-8½ g, 50 lb T r, 3 c. Porter Engines. Pres. E. Haakinson, V. Pres. D. T. Hedges, Sec. & Treas. C. E. Haakinson. Capital, $250,000. 8 3

SIOUX FALLS, S. DAK.—City St. Ry. Co. 9 m 4-g½ g, 30 lb. r, 6 c, 20 h 20 mu. Pres. R. F. Pettigrew, V. Pres. L. T. Dunning, Sec. & Treas. S. L. Tate, Supt. D. P. Beach. 11 2

S. Dakota Rapid Transit & Ry. Co. Elec. 7¾ m, 4-8½ g, 35, 45 lb T & tram. r, 5 c, of which 3 are m c and 2 t c. Edison system. Pullman cars. Armington & Sims engines. Pres. W. R. Kingsbury, V. Pres. C. W. Hubbard, Sec. J. H. Voorhees, Treas. & Gen. Man. F. H. Files, Supt. R. L. Wells. Capital, $100,000. Bonds, $75,000. 4 4

SOUTH BEND, IND.—South Bend & Mishawaka St. Ry. Co. Elec. 14 m, of which 9½ are horse and 4½ elec; 4-8½ g, 35, 65 lb T r, 22 c, of which 4 are h c, 10 m c and 8 t c, 10 h. T-H system. Stephenson cars. Allis engines. Pres. J. McM. Smith, V. Pres. O. H. Lawrence, Sec. & Treas. I. B. Newcombe. Capital, $200,000; authorized, $250,000. Bonds, $250,000. 6 3

SOUTH CHICAGO, ILL.—See Chicago.

SOUTHINGTON, CONN.—Southington & Plantsville Tramway Co. Elec. 2.8 m, 4-8½ g, 25 lb T r, 2 m. c. T-H. system. Stephenson cars. Russel engine. Pres. & Elecn. J. H. Osborne, V. Pres. R. W. Cowles, Sec. Gen. Man. & Pur. Agt., L. E. Southworth, Treas. S. Walkley, Supt., Ch. Eng. & Ch. Engr. of Power Station, T. L. Dawson. Capital, $20,000. Bonds, $16,000. Office, Centre st. 4 4

SPOKANE WASH.—Spokane & Montrose Motor R. R. Co. Elec. 3¼ m, 3-6 g, 30 & 35 lb T r, 4 m c T-H and Short systems. Pres. & Treas. Francis H. Cook, V. Pres. E. A. Routhe, Sec. L. C. Cook. Capital $50,000. Bonds $40,000. 3 2

Arlington Heights Motor Ry. Co. 2 m, 4-8½ g, 30 lb r, 1 m c. Edison system. Pres. W. Hughson. Capital, $50,000. 3 3

City Park Transit Co. Elec. 7 m, 4-8½ g, 35 lb. T r, 5 m. c. T-H system. Pres. D. Glass, Sec. & Treas. C. Glass, Supt. E. J. Comley. Capital $250,000. 3 3

Ross Park St. Ry. Co. Elec. 12m, 4-8½ g, 35 lb T r, 8 m c. T-H system. Pullman cars. Water power. Pres. H. N. Belt, Sec. & Gen. Man. W. S. Norman, Treas. J. D. Sherwood, Supt. E. E. Knowles, Auditor C. S. Smith. 4 4

Spokane St. Ry. Co. (Controlled by Washington Water Power Co. Includes Spokane Electric Ry. and Spokane Cable Ry.) 33 m, of which 1½ are cable and 31½ elec., 4-8½ g, 30, 35, & 40 lb T r, 20 c, of which 2 are g c, and 18 m c. T-H and Edison systems. Brill cars. Water power. Pres. H. Bolster, V. Pres. H. Brook, Sec. & Gen. Man. W. S. Norman, Treas. J. D. Sherwood, Supt. & Pur. Agt. E. E. Knowles, Ch. Engr., Elecn. & Ch. Engr. of Power Station J. B. Fisken. Capital, $500,000. Bonds $350,000. Office, Hazel Block. 2 4

SPRINGFIELD, ILL.—Springfield Consolidated Ry. Co. (Comprises Springfield City Ry. Co. and People's Elec. Ry. Co.) 22 m, 22 m s, 4-8½ g, 40, 60 lb T r, 51 c, of which 33 are m c and 18 t c. T-H and Detroit systems. Bates-Corliss engines. Pres. T. J. Minary, V. Pres. B. Wilson, Treas. & Gen. Man. C. K. Minary, Supt. F. P. McNeil. Capital, $750,000. Bonds, $650,000. 4 4

SPRINGFIELD, MASS.—Springfield St. Ry. Co. Elec. 33 m, 4-8½ g, 56 lb T r, 110 c, of which 100 are m c and 10 t c. T-H system. Pres. John Olmsted, Treas. & Man. A. E. Smith. Capital $1,000,000. Office cor. Main & Carew sts. 6 3

SPRINGFIELD, MO. — Metropolitan Electric Ry Co. 17 m, 4-8½ g, 45 lb Johnson girder r, 30c of which 16 are m. c. and 14 t. c.. Westinghouse system. Pres. B. F. Hobart, Sec. & Gen. Man. Frank B. Smith. Capital, $550,000; authorized, $600,000. Bonds, $550,000. 6 3

SPRINGFIELD, O.—Springfield Ry. Co. Elec. 25 m, 4 g, 45, 60 lb girder & T r, 25 m c. Westinghouse system. Brownell, Laclede and St. Louis cars. Russell & Co. engines. Pres. W. B. McKinley, V. Pres. R. S. Hunter, Sec. B. Hood, Treas. D. W. Slack, Gen. Man. S. L. Nelson, Supt. C. E. Miley. Capital, $1,000,000. Bonds, $500,000. 8 3

STAMFORD, CONN.—Stamford Street R. R. Co. 7 m, 4-8½ g, 25, 60 lb T r, 11 c, 48 h. Feigel, Jones and Stephenson cars. Pres. & Treas. R. A. Fosdick, V. Pres. Wm. W. Gillespie, Sec. L. J. Curtis, Supt. G. W. Pierce. Capital $92,500; authorized $100,000. Bonds $52,000. Office, Fessenden Block. 4 4

STATEN ISLAND, N. Y. — Staten Island Belt Line R. R. Co. 9 m, 4-8½ g, 25 lb T r, 10 c, 3 h. Receiver James D. Van Hoevenburg, 189 Broadway New York, Pres. M. E. Graves. Office, Tompkinsville 4 4

STAUNTON, VA.—City St. Car Co. 5½ m, 4-8½ g 25 & 42 lb. T & girder r, 13 4-wheel box c, 70 mu Pres. E. K. Sibley, New York; V. Pres. D. D. Parmley; Treas. Andrew Spotts, NewYork; Gen. Man. R. D Apperson, Staunton, Va. Capital $50,000. 1 3

STEUBENVILLE, O.—Steubenville St. Ry. Co. 2¾ m, 2¾ m s, 4-8½ g, 35 lb girder r, 6 m c. Edison system. Richmond L. & M. Works cars. Pres. D. B. Toucey, V. Pres. W. B. Donaldson, Sec. & Treas. T. N. Motley, Gen. Man., Supt., Pur. Agt., Ch. Engr., Elecn. & Ch. Engr. of Power Station J. F. Flood. Capital, $70,000. Office, 921 Sixth Ave.

STILLWATER, MINN.—Stillwater St. Ry. Co. Elec. 5 m, 4-8½ g, 30 lb. T & tram r, 8 m. c. Edison system. Receiver W. M. Hewitt. Office, Davenport, Ia. 4 4

STILLWATER, N. Y.—Stillwater & Mechanicville St. Ry. Co. 4½ m, 4-8½ g, 25-30 lb T & flat r, 6 c, 13 h. Jones cars. Pres. A. E. Powers, V. Pres. W L. Denison, Sec. Treas. & Supt. H. O. Bailey. Capital $11,775; authorized, $50,000. Bonds, $17,500. 4 4

STOCKTON, CAL.— Stockton Electric Ry. Co Elec. 12 m, 3-6 g, 45 lb. s. b & T r, 22 c. of which 11 are m. c. and 11 t. c. Westinghouse and T-H systems. Stockton cars. Pres. I. S. Bostwick, Sec. J. Fyfe, Treas. E. R. Hedges, Supt. G. E. Ladd. Capital $500,000. 8 3

STREATOR, ILL.—Streator Ry. Co. 5¾ m, 4-8½ g, 56 lb T & girder r, 8 m c. T-H system. Laclede cars. Armington & Sims engines. Pres. P. F. Barr, V. Pres. D. Heenan, Sec. W. Reeves, Treas. J. C. Barlow, Gen. Man. C. C. Barr, Supt. & Pur. Agt. C. D. Hagerty. Capital $250,000. 4 4

STROUDSBURG, PA.—Stroudsburg Passenger Ry. Co. 1¾ m, 4-8½ g, 28-30 lb T r, 3 box c, 9 h 3 mu. Pres. & Treas. J. Lantz, Sec. Jacob Houser Gen. Man. W. Kistler. Capital, $25,600. 3 1

SUNBURY, PA.—Sunbury & Northumberland St Ry. Co. Elec. 3½ m, 5-2 g, 56 lb girder r, 4 m. c. Westinghouse system. Stephenson cars. Harrisburg Fdry. & Mach. Co. engines. Pres. D. Coolidge, Sec. & Treas. S. P. Wolverton, Gen. Man. C. M. Clement Supt. M. Withington. Capital $125,000. 4 4

SYRACUSE, N. Y.—People's R. R. Co. 20 m, 4-8½ g, 47, 57, 66½ lb. r, 72 c, of which 31 are box and 41 open, 300 h. Pres. A. N. Palmer, Sec. H. H. Durr. Treas. F. W. Barker, Gen. Man. J. H. Moffitt. Capital, $1,000,000. 5 3

Syracuse, Eastwood Heights & De Witt R. R. Co. Elec. 10 m, 4-8½ g, 40 lb T r, 2 m c. Short system. Pres. N. S. Williams, Treas. G. B. Leonard, Supt. L. A. Williams. 6 3

Syracuse Consolidated St. Ry. Co. (includes Fifth Ward, Fourth Ward, Genessee & Water St., Seventh Ward, Syracuse & Geddes, Third Ward and Woodlawn & Butternut railways). Elec. 36 m, of which 16 are horse and 20 elec, 4-8 g, 35 to 66½ lb girder, s b & T r, 100 c, of which 52 are box, 17 open and 31 m c, 320 h. T-H system. Receiver P. J. Mack, Pres. W. W. Hazzard, V. Pres. P. T. Brady, Sec. W. P. Gannon, Treas. W. R. Kimball, Gen. Man. E. F. Rice. Supt. J. H. Moffett. Capital, $1,250,000. Office, 3 Syracuse Sav. Bank Bldg. 4 2

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TACOMA, WASH.—Tacoma Ry. & Motor Co. Elec. 48 m, of which 46 are elec. and 2 cable, 3-6 g, 40, 45, 60, 66 lb T & girder r, 31 c, of which 26 are m c and 5 g c. T-H and Edison systems, Pullman cars. Corliss, Frick and Stearns engines. Pres. Paul Schulze, V. Pres. S. Z. Mitchell. Sec. P. H. Kershaw, Treas. T. B. Wallace. Supt. J. H. Davis, Aud'r, G. W. Bird. Capital $750,000. Office, A & 13th sts. 4 4

Point Defiance, Tacoma & Edison Ry. Co. (Operates Tacoma & Puyallup Ry.) 13 m, 13 m s, 3-6 g, 40 lb T r, 14 c, of which 13 are m c and 1 t c. Gen. Elec. system. Brill and Pullman cars. Pres. A. C. Mason Treas. T. B. Wallace, Supt. N. Lawson, Audr. E. S. Shull, Jr. Capital $500,000. Office, 915 Railroad st. 4 4

Tacoma & Puyallup (Operated by Point Defiance Tacoma & Edison Ry. Co.) steam. 15 m, 3-6 g, 40 lb T r, 9 c. 3 Porter motors. 4 4

TAMPA, FLA.—Tampa St. Ry. & Power Co Elec. 5 m, 4-8½ g, 25, 30 lb T r, 10 m c. General Elec. system. Brill cars. Porter engines. Receiver T. C. Taliaferro Capital $500,000; authorized $600,000. Bonds $250,000. Office, Gulf Bank Bldg. 8 3

TAUNTON, MASS.—Taunton St. Ry. Co. Elec. 14 m, 4-8½ g, 40, 45, 60 lb T & girder r, 47 c, of which 23 are h c and 24 m c. Jones and Stephenson cars. McIntosh & Seymour engines. Pres. J. N. Beckley, Sec. O. A. Barker, Treas. S. M. Thomas, Supt. Geo. C. Morse. Capital, $100,000. 8 3

TERRE HAUTE, IND.—Terre Haute St. Ry. Co Elec. 16 m, 4-8½ g, 40, 45, 60 lb T & Johnson girder r, 37 c, of which 28 are m c and 9 t c. Westinghouse system. Centropolis and Pullman cars. Westinghouse engines. Pres. R. B. Harrison, V. Pres. W. Kidder, Treas. L. D. Thomas, Asst. Sec. & Treas. P. P. Thomas, Supt. M. F. Burke. Capital, $200,000. Office 100 N. Ninth st. 1 4

TEXARKANA, ARK.—Texarkana St. Ry. Co Elec. 5 m, 4-g, 30 lb T r, 8 c, of which 6 are 4-wheel box & 2 4-wheel open, 38 mu. Pres. J. Deutschman V. Pres. B, Collins, Sec. F. W. Offenhauser, Treas G.W. Fouke, Supt. B. M. Foreman. Capital $40,000 1 4

TIFFIN, O.—Tiffin & Interurban Consolidated Electric Ry. Co. 24 m, of which 6 are horse and 18 elec, 4-8½ g, 67-83 lb T and girder r, 24 c, of 18 are h c and 6 m c, 50 h. Westinghouse system. Laclede cars. Pres. & Gen. Man. R. M. Brown, V. Pres. A. Betts, Sec. N. W. Miller, Treas. T. T. Rosendale, Supt. J. Murphy. 5 4

TOLEDO, OHIO.—Toledo Consolidated St. Ry Co. Elec. 65 m, 4-8½ g, 48½, 56, 70, 75 lb girder r, 120 c, of which 109 are m c and 11 t c. Westinghouse system. Hooven, Owens & Rentschler engines. Pres. Norman B. Ream (Chicago), V. Pres. Albion E. Lang, Sec. Chas. L. Wight, Treas. W. E. Hale, Capital $1,500,000. Bonds $1,500,000. Office, 336 Summit st. 1 4

Toledo Electric St. Ry. Co. 27 m, 4-8½ g, 45, 52, 85 90 lb Johnson girder & T r, 80 m c, 9 h. T-H and Westinghouse systems. Brill cars. Cooper engines. Pres. D. Robison, Jr., V. Pres. L. S. Baumgardner, Sec. & Gen. Man. J. J. Robison, Treas. W. F. Robison, Div. Supts. C. L. Hulbut, E. F. Adler. Capital, $800,000. Bonds $800,000. Office, cor. Madison & Summit Sts. 1 4

TOPEKA, KAN.—Topeka Ry. Co. 35 m of which 1 is horse and 34 elec., 25 m s, 4 & 4-8½ g, 35, 52 lbs. T & girder r, 66 c, of which 36 are m c and 30 t c, T-H. system. Laclede, St. Louis and Stephenson cars. Allis engines. Pres. C. C. Baker, V. Pres. M. A. Low, Sec. & Treas. R. M. Gage, Gen. Man. & Elecn. J. M. Patten Capital $1,290,000. Office, 807 Kansas Ave. 2 4

Topeka Belt Ry. Co. Steam. 4 m, 4-8½ g, 45 lb T r, 11 c, 2 Baldwin motors. Pullman cars. Pres. Chas. S. Gleed, Sec. & Treas. J. Mackenzie. Supt. E. H. Littlefield. Capital, $1,000,000. Office, 110 W. 10th st. 6 3

West Side Circle Ry. Co. Steam. 6½ m, 4-8½ g, 40 lb T & girder r, 2 c, 3 Baldwin motors. Pres. C. S. Gleed, Sec. & Treas. G. H. Nolte, Asst. Sec. & Treas. F. H. Poole. Capital, $50,000; authorized, $100,000. Bonds, $50,000. Office, Knox Building. 4 4

TORONTO, ONT.—Toronto Ry. Co. 80 m, of which 20 are horse and 60 elec, 45 m s, 4-10¾ g, 70 lb girder r, 350 c, of which 80 are h c, 120 m c and 150 t c 200 h. Own cars. Armington & Sims engines. Pres W. McKenzie, V. Pres. H. A. Everett, Sec. & Treas J. C. Grace, Supt. James Gunn, Ch. Engr. & Elecn. W E. Davis, Ch. Engr. of Power Station D. C. McLean Capital, $6,000,000. Bonds, $1,700,000. Offices Canada Life Assurance Bldg., King st., west. 4 4

Metropolitan St. Ry. Co. 4½ m, 4½ m s, 4-10¾ g, 56 lb T r, 5 c. of which 3 are m c. and 2 t c. T-H system. Jones and St. James cars. Goldie & McCulloch engines. Pres. C. D. Warren, Sec & Treas. R. Jenkins, Gen. Man. J. W. Moyes. Capital, $130,000; authorized $250,000. Deer Park P. O. Ontario. 4 4

Toronto & Scarboro Electric Ry. Lt. & Pow. Co. 3 m, 4-8½ g, 56 lb T r 2 m c. T-H system. Patterson & Corbin cars. Pres. D. G. Stephenson, V. Pres. J. J. Foy, Sec. & Gen. Man. A. W. Dingman, Supt. C. A. Crawford. Capital, $50,000; authorized $400,000. Office, 38 King St. 8 3

TRENTON, N. J.—Trenton Pass. Ry. Co. Elec 37 m, of which 19 are horse and 18 elec.; 78-90 lb girder r, 85 c, of which 53 are h c and 32 m c, 175 h, 6 mu. Gen. Elec. and Short systems. St. Louis and Stephenson cars. Watts-Campbell engines. Pres. Gen. Man. & Pur. Agt. L Perrine, Jr., V. Pres. S. K. Wilson, Sec. J. H. Solomon, Treas. W. S. Cook, Supt. P. E. Hurley. Ch. Engr. & Ch. Engr. of Power Station J. Hyde, Jr., Elecn. D. S. Cook. Office cor. Greenwood and S. Clinton Aves. 1 4

TROY, N. Y.—Troy City Ry. Co. (Lessee of Troy & Lansingburgh and Waterford & Cohoes Rys.) 29¾ m, of which 4 are horse and 25¾ elec. 19½ m s, 4-8½ g 63½ lb girder & s. b. r, 150 c. of which 46 are h. c. and 98 m. c. Gen. Elec. system. Gilbert and Jones cars. Greene-Corliss engines. Pres. C. Cleminshaw, 1st V. Pres. A. N. Brady, 2d V. Pres. J. B. Carr, Sec. & Treas. J. J. Hagen, Supt. C. H. Smith. Capital, $2,000,000. Bonds $2,000,000. Office, 361 River St. 4 4

Troy & Lansingburgh R. R. Co. (Leased to Troy City Ry. Co.)

TUSCALOOSA, ALA.—Tuscaloosa St. Ry. Co (Owned by Tuscaloosa & Castle Hill Real Estate & Mfg. Co.) 4 m, 4-8½ g, 20, 25 lb T r, 9 box c, 8 mu. Stephenson cars. Pres. Jas. H. Fitts, Sec., Treas. & Gen. Man. S. F. Alston. Capital, $100,000. Office, Main st. 1 4

Tuscaloosa Belt Ry. Co. 4½ m, 4-8½ g, 35 lb. T r 1 c, 1 steam motor. Pres. W. C. Jemison, Sec. & Treas. J. L. Wallace, Supt. J. T. Cochrane. Capital $100,000. 1 4

TYLER, TEX.—Tyler St. Ry. Co. 3½ m, 3½ m s, 4-8½ g, 20, 40 lb T & flat r, 4 c, 9 mu. Pres. Sec. Treas. & Gen. Man. W. C. Scott, V. Pres. J. P. Douglas. Capital, $12,000. 1 4

U

UNION SPRINGS ALA.—Union Springs St. Car Co. 2 m, 5-1 g, 20 lb T r, 4 flat c for freight, 1 or 2 for pass., 4 mu. Pres. Wm. Stakley, Sec. & Treas. T. H. Mabson, Jr., Supt. A. D. Fielder. Capital, $10,000. p 12 2

UNIONTOWN, PA.—Uniontown St. Ry. Co. 3½ m, 5-2½ g, 68 lb girder & T r, 6 c, of which 5 are m c, and 1 t c. Edison system. Brill cars. Buckeye engines. Pres W. C. McCormick, Sec. & Treas. R. F. Hopwood, Gen. Man. & Pur. Agt. G. A. McCormick, Supt. & Ch. Eng. R. A. Smith. Capital, $50,000. 1 4

UTICA, N.Y.—Oneida St. R. R. Co. 1½ m, 4-8½ g 35 lb c b r, 3 c, of which 2 are box and 1 open, 8 h. Pres. & Gen. Man. Henry Ney. V. Pres. Dan'l L. Jones, Jr., Sec. & Treas. Wm. C. Willcox. Capital $40,000. Office, 69 Genesee st. 11 2

Deerfield & Utica. (See Deerfield.)

Utica & Mohawk R. R. Co. Elec. 3¾ m, 4-8½ g, 40, 45 lb T r, 14 c, of which 8 are m c and 6 t c. Edison system. Stephenson cars. Pres. & Gen. Man. Jas. F. Mann, V. Pres. R. W. Sherman, Sec. Wm. E. Lewis, Treas. Geo. D. Dimon. Supt. F. L. Everts. Capital $51,000. Bonds $75,000. Office Mann Bldg. 1 4

Utica Belt Line St. R. R. Co. Elec. (Operates Utica, Clinton & Binghamton St. R. R.) 23 m, 4-8½ g 40-85 T, girder and flat r, 25 m c, 6 h. T-H system. Receiver, C. E. Benton, Gen. Counsel & V. Pres. J. W. Boyle, Supt. R. G. Young. Capital, $150,000. Bonds, $570,000. 1 4

Utica, Clinton & Binghamton St. R. R. Pres. Jas J. Scollard, Sec. & Treas. Robt. S. Williams. Capital $849,485. Leased to and operated by Utica Belt Line St. R. R. Co. Office, 157 Genesee st. 1 4

V

VANCOUVER, B. C.—Vancouver Electric Ry. & Light Co. Ld. 7½ m, 4-8½ g, 40 lb T r, 10 c, of which 9 are m. c. and 1 t. c. T-H & Westinghouse systems Pres. J. Oppenheimer, V. Pres. T. Dunn, Sec. H. T Cepuley, Treas. & Business Manager, W. E. Brown Supt. C. F. Hutchings. Capital, $300,000; authorized $500,000; Bonds $300,000. Office, 523 Hastings st. W, 10 2

VANCOUVER, WASH.—Columbia Land & Improvement Co. 3 m, 3-6 g, 30 lb T r, 2 c, 7h. Pres. J Gibbon, V. Pres. & Gen. Man. L. M. Hidden, Sec. C Brown, Treas. 1st Nat. Bank. Capital $280,000. Address, P. O. Box 44. 3 2

VERNON, IND.—North Vernon & Vernon St. R. R. Co. 2 m, 5-2 g, 35 lb girder r, 3 c, 5 h, 2 mu. Laclede cars. Pres. S. H. Grinstead, Jr., V. Pres. L. T. Wilkerson, Sec. & Pur. Agt. E. L. Wagner, Treas. J. C. Cope. Capital $15,000. 1 4

VICTORIA, B. C.—National Electric Tramway & Lighting Co. 14 m, 4-8½ g, 40 lb girder & T r, 16 c of which 14 are m c and 2 t. c. T-H, Edison & Westinghouse systems. Pres. & Gen. Man. D. W. Higgins, V. Pres. T. L. Jones, Sec. C. T. Dupont, Supt. F. W. McCrady. Capital $205,000; authorized $1,000,000. Office Store st. 9 3

VICKSBURG, MISS.—Vicksburg consolidated Electric St. Ry. Co. Receiver T. M. Smedes, n 3 4

VINCENNES, IND.—Citizens' St. Ry. Co. 5 m, 5 m s, 4-8½ g, 40, 55 lb T & girder r, 16 c, of which 7 are m. c. and 9 t. c, 2 mu. Westinghouse system. Calumet and Ellis cars. Westinghouse engines. Pres. A. Tindolph, Sec., Gen. Man. Supt. Pur. Agt. & Elecn. E. F. Tindolph, Treas. B. G. Hudnut, Ch. Engr. & Ch. Engr. of Power Station, T. P. Agnew. Capital $15,050. Bonds $100,000. Office, 16 Fair View ave. 1 4

W

WACO, TEX.—Citizens' Ry. Co. 16 m, 14 m s, 4-8½ g, 30, 40 & 45 lb girder & T r, 13 m. c. Westinghouse system. St. Louis cars. Hamilton Engines. Pres. & Gen. Man. H. C. Scott, Sec. & Supt. J. L. Griffith. Capital, $350,000. Bonds, $350,000. Office, 4th & Washington sts. 1 4

Waco Electric Ry. & Lt. Co. 10 m, 4-8½ g, 35 lb T r, 10 c, of which 8 are m c and 2 t c. T-H system St. Louis cars. Armington & Sims and Sioux City engines. Pres. W. J. Hobson, V. Pres. B. Moore, Sec. & Supt. S. A. Hobson, Treas. & Gen. Man. C. W. Hobson. Capital, $250,000. Bonds, $200,000. 2 3

WAKEFIELD, MASS.—Wakefield & Stoneham St. Ry. Co., 10 m, 10 m s, 4-8½ g, 50 lb T r, 13 c, of which 8 are m c and 5 t c. Westinghouse system. Jones and Newburyport cars. Power is rented. Pres. & Gen. Man. C. F. Woodward, Sec. E. M. Southworth, Treas. J. F. Shaw, Pur. Agt. E. P. Shaw, Ch. Engr. J. A. Bancroft, Electr'n Robt. J. Lawder. Capital authorized $300,000; issued $100,000. Bonds authorized $300,000: issued none. 1 4

WALLA WALLA, WASH.—Walla Walla St. Ry. & Investment Co. 4 m. 3-6 g, 30 & 35 lb T r, 6 4-wheel box c. 24 h. Pres. W. P. Winans, V Pres. Miles C. Moore, Sec. J. W. Langdon, Treas., Supt. & Man. J. M. Hill. Capital $72,000; authorized $100,000. 1 4

WARREN, O.—Trumbull Electric R. R. Co. 7 m 7 m s, 4-8½g, 66, 70 lb girder r, 8 m c, T-H system. Brill and Ellis cars. Phœnix Iron Works engines. Pres. H. C. Christy, V. Pres. A. R. Silliman, Sec. & Treas. E. D. Kennedy, Gen. Man. & Pur. Agt. J. W. Packard, Supt. J. H. Donnelly, Elecn. & Ch. Engr. of Power Station —— Brocklehurst. Capital authorized $150,000. Bonds $88,000. 1 4

WARREN, PA.—Warren St. Ry. Co. 2 m, 4-8½ g, 45 lb T & girder r, 2 m c. Westinghouse system. New Castle cars. Pres. T. B. Clawson, Sec. J. Roy, Treas. & Gen. Man. D. H. Siggins. Capital $12,000; authorized $25,000. Office 342 Water st. 8 3

WASHINGTON, D. C.—Belt Ry. Co. 13½ m, 4-8 g, 80 lb girder r, 72 c. 308 h. Pres. H. Munnikhuysen, Sec. & Treas. H. K. Gray, Supt. Andrew Glass. Office, 3d & B sts. S. W. 3 4

Anacostia & Potomac River Ry. Co. 15.3 m, 4-8½ g, 62 lb. grooved girder r, 46 c, 200 h. Jones cars. Pres. Pur. Agt. & Supt. H. A. Griswold, Sec. & Tres. J. B. Pitcher. Capital $100,000. Bonds $300,000. Office, Anacostia, D. C. 1 4

Brightwood Ry. Co. 11.9 m, 5.5 m. s, 4-8½ g, 50 lb. T & 70 lb. girder r, 23 c of which 13 are m. c. and 10 t. c. Gen. Electric & Westinghouse systems. Laclede cars. Clark Bros. of Belmont N. Y., engines, Pres. H. S. Cummings, V. Pres. E. O. McNair, Sec. Victor B. Deyber, Treas. C. P. Williams, Supt. & Pur. Agt. Thomas O'Brien. Capital, $108,500. Bonds, $350,000. 1 4

Columbia R. R. Co. 6 m, 4-8½ g, 36 & 68 lb girder r, 44 c, 180 h. Pres. R. T. Baker, V. Pres. E. G. Davis, Sec. & Treas. James B. Adams, Supt. Wm. C. Bateler, Capital, $400,000. Office, 15th & H sts., N. E. 1 4

Eckington & Soldiers' Home Ry. Co. Elec. 9 m, of which 2⅛ are horse and 6¾ elec, 4-8½ g, 80 lb girder r, 39 c, of which 12 are h c, 14 m c and 13 t c, 54 h. T-H and Westinghouse systems. Brill, Robinson and Stephenson cars. Armington & Sims and Ball engines. Pres. H. Munnikhuysen, V. Pres. Gen Man. & Pur. Agt. W. K. Schoepf, Sec. & Treas. H. K. Gray, Supt. & Elecn. R. I. Todd. Capital, $352,000. Bonds, $129,000. Office, McGill Bldg., 908-914 G St., N. W. 1 4

Georgetown & Tenalleytown Ry. Co. Elec. 9½ m 4¾ m s, 4-8½ g, 45, 60 lb. groove & T r, 19 m. c. T-H system. Brill, Gilbert, Jones and Stephenson cars. Frick and Harrisburg Foundry & Machine Co.'s engines. Pres. M. W. Offutt, V. Pres. H. Bradley Davidson, Sec. & Treas. J. E. Beall, Supt. & Pur. Agt. & Elecn. J. H. Mills, Ch. Engr. Power Station L. J. Garner. Capital $200,000. Bonds $20,000. Office, Power House, 32d st. 1 4

Glen Echo R. R. Co. 6½ m, 3 m s, 4-8½ g, 40 lb T r 8 c, of which 6 are m c and 2 t c. Westinghouse system. Brill cars. Westinghouse engines. Pres. Edwin Balzley, V. Pres. F. W. Pratt, Sec. Edward Balzley, Treas. J. C. Pratt. Capital, $100,000. Office, Room 7 Sun Bldg. 1 4

Metropolitan R. R. Co. 19.44 m, 4-8½ g, 62 lb grooved r, 150 c, 653 h. Pres. & Pur. Agt. W. J. Stephenson, V. Pres. A. A. Wilson, Sec. & Treas. Wm. J. Wilson. Supt. W. E. Lowry. Capital $732,000; authorized $1,000,000. Office, 2411 P st. N. W. 1 4

Rock Creek Ry. Co. of District of Columbia. 15 m, 11½ m s, 4-8½ g, 50, 62 lb T & groove r, 22 c, of which 16 are m. c. and 6 t. c. Love conduit and T-H systems. Lamokin and Stephenson cars. Ball & Wood McIntosh & Seymour and N. Y. Safety engines. Pres. H. E. Davis, V. Pres. E. J. Stellwagen, Sec. H. S. Nyman, Treas. T. M. Gale, Supt. H. Claude, Elecn. R. M. Palmer, Ch. Engr. of Power Station W. D. Hogan. Capital $800,000. 2 4

Washington & Arlington Ry. Co. Elec. 3 m, 4-8½ g, 50 lb T r, 4 m c. Edison system. Brill cars. Phœnix engines. Pres. D. L. King, Sec. & Treas. W. Hazlett, Gen. Man. & Supt. W. Chapman. Capital $500,000. Bonds authorized $300,000. Office 95-96 Corcoran building. 1 3

Washington & Georgetown R.R. Co. Cable. 22 m 4-8½ g, 80 lb English groove girder r, 389 c, of which 94 are g c and 295 t c, 30 h. Pres. H. Hurt, V. Pres G. T. Dunlop, Sec. & Treas. C. M. Koones, Gen. Supt C. C. Sailer, Engr, D. S. Carll. Capital, $500,000. Bonds, $3,500,000. Offices Central Power Station 14th & E sts. N. W. 1 4

WASHINGTON, PA.—Washington Electric St Ry. Co. Elec. 3½ m, 5-2½ g, 45 lb girder r, 5 m. c Westinghouse system. Pres. A. E. Townsend, Sec. J. F. Bristor, Treas. Brit Hart, Supt. F. G. Marshall. Capital $40,000; authorized $60,000. Bonds $8,000. 8 3

WATERBURY, CONN.—Waterbury Traction Co. 6½ m, 4-8½ g, 40 lb T r, 29 c, 125 h. Brill, Lewis & Fowler and Stephenson cars. Pres. D. S. Plume, Sec. A. M. Young, Supt. & Gen. Man. E. A. Bradley. Capital $50,000; authorized $1,000,000. Bonds $50,000. 1 4

WATERLOO, IA.—Waterloo St. Ry. Co, 2 m, 3 g, 22, 35 lb T r, 3 c, 8 h. Pres. J. E. Sedgwick, V. Pres G A. Whitney, Sec. & Treas. A. A. Hungerford Capital, $40,000. Office, 183½ Bridge St. 4 4

WATERLOO, ONT.—Berlin & Waterloo St. Ry Co. 2¾ m, 4-8½ g, 25 & 30 lb flat & T r, 8 c, 16 h. Pres. & Treas. Thos. M. Burt, Sec. Alex. Millar. Office, Waterloo. Capital, $40,000. Bonds $20,000. 1 4

WATERLOO, N. Y.—See Seneca Falls, N. Y.

WATERTOWN, S. DAK.—Watertown & Lake Kampeska Ry. Co. Dummy. 6½ m, 4-8½ g, 30 lb T r 1 c, Pullman car. Baldwin engine. Ch. Engr. F. L. Burdeck. Office, Kemp ave. & Oak st. 4 4

WATERTOWN, N. Y.—Watertown St. Ry. Co 6 m, 6 m s, 4-8½ g, 50 lb girder & T r, 19 c, of which 11 are m c, and 8 t c. Edison system. Stephenson cars. Water power. Pres. J. C. Thompson, V. Pres C. A. Starbuck, Sec. & Treas. E. S. Goodale, Asst. Sec. & Treas. G. F. Clark, Gen. Man. Supt. & Pur. Agt. G. W. Adams. Ch. Engr. Elec. & Ch. Engr of Power Station E. A. Barber. Capital $40,000. Bonds $75,000. Office, 172 Main St. 2 4

WATERVILLE, ME.—Waterville & Fairfield Ry. & Lt. Co. Elec. 5m, 4-8½ g, 35 lb T r, 8 c, of which 3 are m c and 5 t c. Westinghouse system Pres. & Gen. Man. A. F. Gerald, Sec. H. M. Heath Treas. H. D. Bates. Capital, $200,000. Bonds, $175,000 Office, Fairfield. 9 2

WAXAHACHIE, TEX.—Waxahachie St. Ry Co 2 m, 4-8½ g, 20 lb T r, 3 c, 16 h. Pres. T. A. Ferris, V Pres. W. F. Lewis, Sec., Treas. & Gen. Man. O Goodwin. Capital, $24,000. 4 4

Lake Park St. Ry. Co. 2 m, 4-8½ g, 20 lb T r, 4 c 14 mu. Pres. & Gen. Man. J. F. Strickland, V. Pres. W. F. Lewis, Sec. J. F. Philips, Treas. W. G. Williams, Supt. W. J. Stevenson. Capital, $8,000; authorized, $20,000. 8 3

WEATHERFORD, TEX.—Weatherford City & Suburban R. R. Co. 3½ m, 2½ m s, 4-8½ g, 16 & 20 lb T r 6c, 17 mu. Pres. G. P. Levy, Supt. G. B. Willbanks. Capital, $100,000. 1 4

WEBB CITY, MO.—Southwest Missouri Electric Ry. Co. Connecting Joplin, Webb City, Carterville and Prosperity 10 m, 4-8½ g, 48, 75 lb T & girder r, 12 c. T-H and Westinghouse systems. Laclede cars, Cooper engines. Pres. A. H. Rogers, V. Pres. E. Z. Wallower, Sec. & Treas. W. M. Donaldson, Supt, J. M. Maret, Ch. Engr. of Power Station, E. J. Pratt. Capital, $500,000. Bonds, $100,000 authorized, $200,000. Offices Centerville, Mo., and Harrisburg, Pa. 1 4

WEST BAY CITY, MICH.—(See Bay City, Mich.)

WEST CHESTER, PA.—West Chester St. Ry Co. Elec. 6½ m, 1½ m s, 5-2½ g, T and flat r, 9 c, of which 5 are m. c. and 4 t. c. Edison and Westinghouse systems. Brill cars. Pres. W. M. Hayes, Sec. W. S. Harris, Treas. F. W. Wollerton, Gen. Man. & Pur. Agt. J. W. Andrews, Elecn. J. Early, Ch. Engr. of Power Station J. Pyle. Capital, $60,000. Bonds $60,000. 3 4

WEST NEWTON, MASS.—Newton St. Ry. Co 8½ m, 8½ m s, 4-8½ g, 45, 56 lb T r, 31 c, of which 28 are m c and 3 t c. T-H system. Jones and Newburyport cars. Armington & Sims engines, contract for power. Pres. H. B. Parker, V. Pres. E. Stearns, Sec. J. C. Lane, Treas. C. W. Smith, Supt. & Pur. Agt. F. G. L. Henderson. Capital $125,000. Bonds $100,000. Office, West Newton, Mass. 1 4

WEST SUPERIOR, WIS.—Superior Rapid Transit Ry. Co. Elec. 26 m, 3-6g, 35 lb T r, 35 c, of which 25 are m c and 10 t c. T-H system. Pres. & Gen. Man. S. T. Norvell, Treas. F. W. Hanson, Supt. H. M. Sloan. Capital, $1,000,000. 1 4

WESTFIELD, MASS.—Woronoco St. Ry. Co. 2.016 m, 1.70 m s, 4-8½ g, 52 lb T r, 6 c, 30 h. Jones cars. Pres. C. N. Yeamans. Sec. S. B. Campbell, Treas. O. B. Parke, Gen. Man. Supt. & Pur. Agt. J. Fennell. Capital, $25,000. 4 4

WESTPORT, CONN.—Westport & Saugatuck Horse R. R. Co. 1¾ m, 4-8 g, 40 lb r, 4 c, 6 h. Pres. A. S. Huributt, Sec. and Treas. B. L. Woodworth Supt A. F. Downes. 3 2

WHEELING, W. VA.—Wheeling Ry. Co. 17 m, 15 m s, 5-2 g, 35, 78, 85 lb girder r, 35 c, of which 30 are m c and 5 t c. T-H system. Brill & St. Louis cars. Ball engines. Pres. W. Erskine, Sec. & Treas. W. A. Shirley, Gen. Man. & Pur. Agt. A. M. Jolly, Supt. M. Loftus, Elecn. W. H. Tucker, Ch. Engr. of Power Station W. S. Wright. Capital, $700,000. Bonds $500,000. 2 4

Wheeling & Elm Grove R. R. Dummy. 8½ m, 4-8½ g, 60 lb T r, 23 c, of which 20 are pass. c, 2 freight c and 1 baggage c, 4 Baldwin motors, 1 h. Pres. A. Reymann, Sec. & Treas. J. Roemer, Gen. Man. H. E. Weisgerber Capital, $250,000; authorized, $300,000. Office, 16th st 6 3

WHITMAN, MASS.—(See Brockton, Mass.)

WICHITA, KAN.—Wichita Electric Ry. & Lt. Co. 25 m, 4-8½ g, 35 & 46 lb T & Johnson r, 30 c, of which 22 are m c and 8 t c. T-H system. Pres. C. E. Dustin, V. Pres. A. T. Batchelder, Sec. & Gen Man. J. W. O'Neill. Treas. G. A. Litchfield, Supt. F. W. Sweet. Capital, $450,000. Office, 100 W. Douglas Ave. 1 4

WILKESBARRE, PA.—Wilkesbarre & Wyoming Valley Traction Co. (Owns and operates all lines in the city). 41 m, 4.8½ g, 40, 60, 70 lb T and girder r, 88 c. Baxter, Gen. Elec., Short and Westinghouse systems. Brill & St. Louis cars. Pres. B. F. Myers, Sec. W. G. Eno. Treas. & Gen. Man. J. Graham, Supts. (East Side division) J. Clifford, (West Side division) J. C. Meixell, Elec. Engr. J. Fagan. 1 4

WILLIAMSPORT, PA.—Williamsport Pass. Ry. Co. 7¾ m, 6¼ m s, 4-8½ g, 60 lb c b r, 12 m c. Westinghouse system. Lamokin cars. Westinghouse engines. Pres. ———— Sec. J. F. Starr, Treas. J. Lawshe, Supt. & Elecn. H. C. Young. Capital $250,000; authorized $600,000. Bonds $125,000. Office 760 W. 4th st. 2 4

WILLIAMSVILLE, N. Y.—Buffalo & Williamsville Electric Ry. Co. 5 m, 4-8½ g, 60 lb T r, 6 c, of which 4 are m c and 2 t c. T-H system. Laclede cars. Noyes engines. Pres. Gen. Man. & Supt. J. Blocher, V. Pres. J. Chalmers, Sec. A. C. Rinewalt. Treas. L. L. Grove, Ch. Engr. of Power Station C. Summers. Capital, $75,000 1 4

WILMINGTON, DEL.—Front & Union St. Pass. Ry. Co. (Operated by Wilmington City Ry.) 1¾ m, 5-2 g, 32 & 63 lb tram & girder r, 10 c, 80 h. Pres. W W. Pusey, V. Pres. P. Lea, Sec. & Treas. F. L. Kurtz Capital, $50,000. Office, Front & Union sts. 2 [3

Wilmington City Ry. Co. Elec. 22 m, 5-2 g, 58, 90 lb. T and girder r, 61 m c. Westinghouse system. Pres. P. Lea, V. Pres. W. Saulsbury, Sec., Gen. Man. & Pur. Agt. W. S. Heger, Treas. C. G. Blandy. Office, Delaware ave. & Dupont st. 4 4

WILMINGTON, N. C.—The Wilmington St. Ry. Co. 6 m, of which 1½ m is steam and 4½ elec., 5 m s, 4-8½ g, 45, 60 lb T & girder r, 16 c of which 12 are m c and 4 t c. T-H system. Lewis & Fowler and Stephenson cars. Ball engines. Pres. C. A. Lieb, V. Pres. & Gen. Man. J. H. Barnard, Sec. B. F. O'Connor, Treas. C. H. Wilson, Supt. M. T. Heiskell, Ch. Engr. G. Hires. Capital, $100,000; authorized, $400,000. Bonds $250,000. Office 29 Broadway, New York. 2 4

WINDSOR, ONT.—Windsor Electric St. Ry. Co. 1½ m, 3-6 g, 25 lb T r, 1 motor, 4 c, 9 h. T-H system. Steam power. Pres. W. M. Boomer, Sec. & Treas. M. A. S. Boomer. Office, cor. Mercer & Sandwich sts. W. 11 2

Sandwich, Windsor & Amherstburg Ry Co. Elec 10 m, 4-8½ g, 56 lb girder & T r, 14 c, of which 10 are m. c. and 4 t. c. Westinghouse system. Brill, Laclede, Ottawa and St. Louis cars. Brown & Robb engines. Pres. J. Coventry, V-Pres. G. M. Hendrix, Sec. & Treas. W. I. Pulling, Supt. R. Canfield. Capital, $315,000; authorized $500,000. 9 3

WINFIELD, KAN.—Union St. Ry. Co. 5 m, 4 g, 16-20-35 lb T & Johnson r, 5 c, 20 mu. Pres. Wm Matthewson, Sec. W. J. Kennedy, Treas. Geo. M Robinson, Gen. Man. W. J. Kennedy Capital 25,000. 1 4

WINNIPEG, MAN.—The Winnipeg Electric St. Ry. Co. 9 m, of which 5 are horse & 4 elec, 4-8½ g, 35 40 lb r, 23 c, of which 15 are h c, 5 m c and 3 t c, 80 h. Edison system. Pres. Jas. Austin, Sec. & Man. Albert W. Austin, Supt. Geo. A. Young. Capital $100,000. 1 3

WINONA, MINN.—Winona City Ry. Co. (Owned by Winona General Electric Co.) Elec. 4 m, 4-8½ g, 40 lb r, 7 m c. T-H system. Pres. G. C. Duffie, Sec. & Treas. W. H. Moore. Office, 403 Sibley st., St. Paul. 3 3

WINSTON, N. C.—Winston-Salem Ry. & Elec. Co. (Operated and leased by Twin City Construction Co.) 8.2 m, 8 m s, 4-8½ g, 45 lb Johnson girder r, 12 c, of which 9 are m c and 3 t c. Edison system. Brill cars. Ball engines. Pres. J. H. McClement, V. Pres. F. J. Sprague, Sec. & Treas. R. G. Day, Asst. Sec., Treas. & Pur. Agt. W. H. Barham, Supt. Ch. Eng. Elecn. & Ch. Engr. of Power Station, F. W. McClement. Capital, $100,000; authorized, $200,000. 2 4

WOODLAND, CAL.—Woodland St. Ry. Co. 1 m, 3 g, 30 lb T r, 3 c, 3 h. Pres. T. Ross, V. Pres. G D. Fiske, Sec. L. W. Hilliker, Treas. T. Armstrong Gen. Man. M. McCutcheon, Supt. J. D. Lawson. Capital $30,000. 4 4

WOONSOCKET, R. I.—Woonsocket St. Ry. Co. 6.65 m, of which 2.65 are horse and 4 elec. 4-8½ g, 35 to 50 lb T r, 17 c, of which 2 are h c, 6 m c and 9 t c 20 h. T-H system. Pres. J. P. Ray, Sec. W. Kent Treas. W. Whittlesey, Gen. Man. E. K. Ray, Supt H. M. Young. Capital, $100,000. Bonds, $160,000. Office, 6 S. Main St. 4 4

WORCESTER, MASS.—Worcester Consolidated St. Ry. Co. (Controlled by Worcester Traction Co.) 30½ m, 25 m s, 4-8½ g, 90 lb girder r, 125 c, of which 62 are h c and 63 m c, 25 h. General Electric and Westinghouse systems, Laclede, Jones and Stephenson cars. Lake Erie engines. Pres. Chas. B. Pratt, Sec. T. C. Barr, Asst. Sec. & Treas. A. H. Stone, Gen. Man. J. N. Akarman. Capital $700,000. Bonds $650,000. Office, 15 Market st. 4 4

North End St. Ry. Co. Elec. 5½ m, 4-8½ g, 45, 55, 65 lb T r, 12 c, of which 11 are m. c. and 1 t. c. Westinghouse system. Jones, Lewis & Fowler and Stephenson cars. Pres. & Gen. Man. W. P. Searls, V. Pres. G. A. Barnard, Sec. G. F. Barnard, Treas. G. A. Smith, Supt. C. L. West. Capital, $80,000; authorized, $110,000. 6 3

Worcester & Millbury St. Ry. Co. 7.439 m, 4-8½ g, 70 lb girder & T r, 14 c, of which 8 are m c and 6 t c. T-H system. Pres. S. Winslow, Sec. & Treas. T. T Robinson, Supt. J. B. Gorman. Capital, $150,000. 9 3

Worcester & Shrewsbury St. Ry. Co. 3,300 ft. 3,300 ft. s, 4-8½ g, 58 lb T r, 2 m c. Edison system. Lewis & Fowler cars. Pres. & Treas. H. H. Bigelow, Supt. & Pur. Agt. I. E. Bigelow. Capital $20,000. Office 19 Foster st. 2 4

Worcester, Leicester & Spencer St. Ry. Co. Elec. 13 m, 4-8½ g, 48 lb T r, 26 c, of which 23 are m. c. and 3 t. c. T-H & Detroit systems. Pres. & Gen. Man S. Winslow, Treas. & Clerk, T. T. Robinson, Supt. J. B. Gorman. Capital $250,000. 9 3

Worcester Traction Co. (Owns all the stock of the Worcester Consolidated St. Ry. Co.) Pres. C. B. Pratt, Sec. T. C. Barr, Treas. A. H. Stone, Gen. Man. J. N. Akarman. Capital $5,000.000. Bonds $150,000. 4 3

WYMORE, NEB.—Wymore & Blue Springs Ry. Co. 3½ m, 3½ m s, 3-6 g, 22 lb T r, 4 4-wheel box c, 10 h. Pres. J. H. Reynolds, V. Pres. Gen. Man. & Ch. Engr. A. Stewart, Sec. Treas. & Pur. Agt. E. P. Reynolds, Jr., Supt. T. Bauman. Capital, $36,700; authorized $50,000. 1 4

Y

YARMOUTH, N. S.—Yarmouth St. Ry. Co. 2 m, 4 g, 45 lb T r, 5 c, of which 2 are m c and 3 t c. Edison system. Pres. R. Cale, V. Pres. W. D. Lovitt, Sec., Treas. & Gen. Man. B. B. Law, Supt. J. W. Burton. Capital $40,000; authorized, $100,000. 1 3

YONKERS, N. Y.—Yonkers St. Ry. Co. Elec. 8½ m, 7¼ m s, 4-8½ g, 42-48 lb r, 24 c, of which 9 are h c, 12 m c and 3 t c, 88 h. Field and Westinghouse systems. Stephenson cars. Ball & Wood engines, Pres Gen. Man. & Pur. Agt. C. H. Montague, Sec. T. W. Smith, Treas. G. E. Ketcham, Supt. Ch. Engr. & Elecn. S. L. Montague 2d, Ch. Eng. of Power Station C. A. Lewis. Capital, $125,000; authorized $200,000. Bonds $125,000. 2 4

YORK, PA.—York St. Ry. Co. 8½ m, 6½ m s, 4-8½ g, 45, 70 lb girder r, 25 c, of which 17 are m c and 8 t c. T-H system. Brill and Lamokin cars. Russell Corliss engines. Pres. W. H. Lanius, V. Pres. D. K. Trimmer, Sec. G. S. Schmidt, Treas. Geo. W. Bell, Supt. & Pur. Agt. C. E. Long, Elecn. F. D. Connelly. Capital, $141,150; authorized, $200,000. Office, 27 E. Market St. 2 4

YOUNGSTOWN, O.—Youngstown St. Ry. Co. 15 m, 13 m s, 4-8½ g, 48, 70 lb girder r, 49 c, of which 34 are m c. and 15 t. c. Sperry system. New Castle and Pullman cars. Allis and Hamilton-Corliss engines. Pres. James Parmelee, V. Pres. H. M. Garlick, Sec. Treas. Gen. Man. & Pur. Agt. A. A. Anderson, Supt. S. F. Hazlerigg. Capital $300,000. Bonds, $300,000. 1 4

Z

ZANESVILLE, O.—Zanesville St. Ry. Co. Elec 8 m, 5-2½ g, 48½, 50 lb. girder & T r, 21 c, of which 11 are m c and 10 t c. Edison system. Lamokin cars. Pres. A. L. Conger, V. Pres. F. M. Atterholt, Sec. F. A. Wilcox, Treas. & Gen. Man. F. A. Seiberling, Supt. A. H. Johnson. Capital $200,000. Bonds $180,000. 2 3



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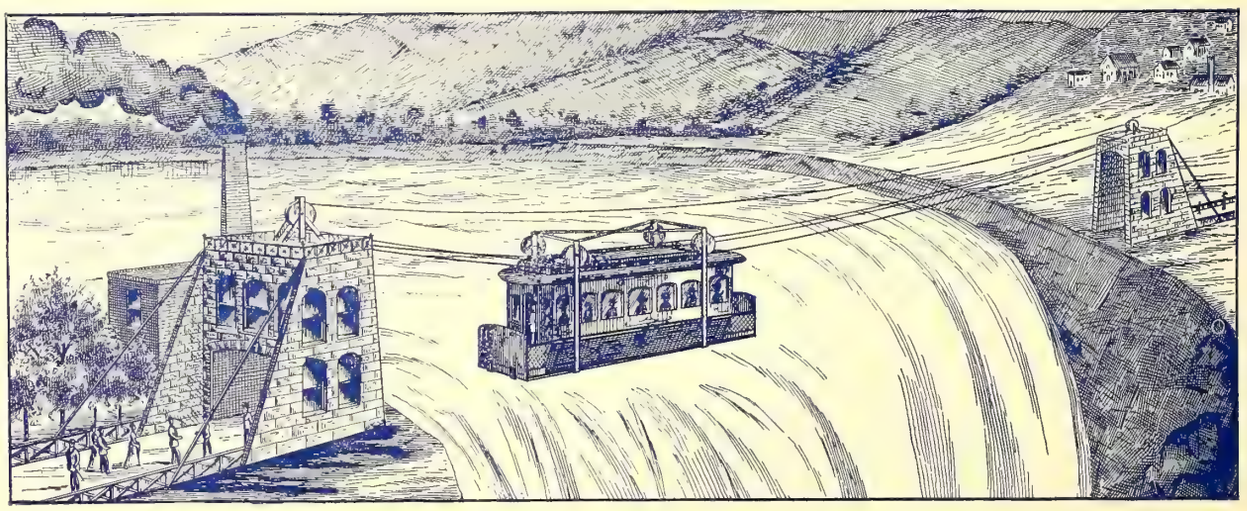
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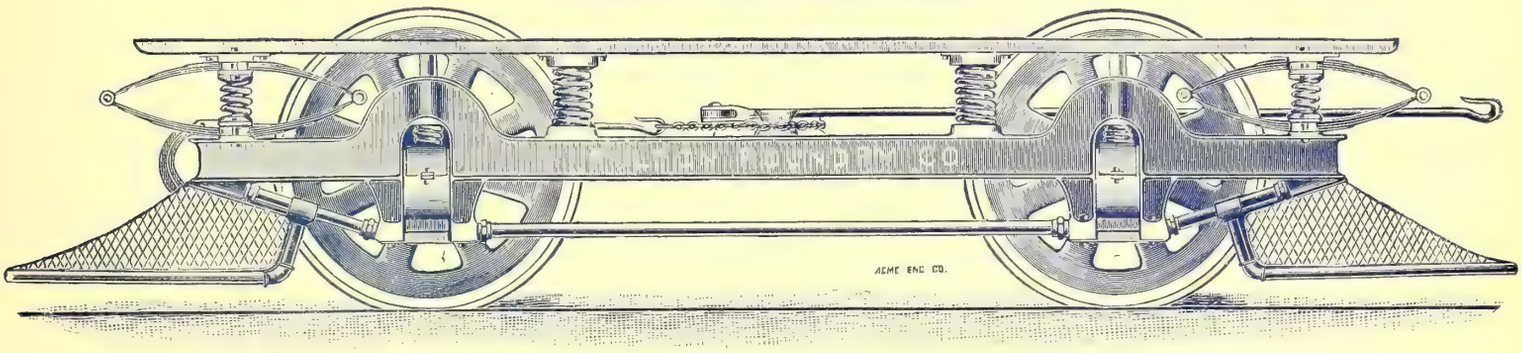
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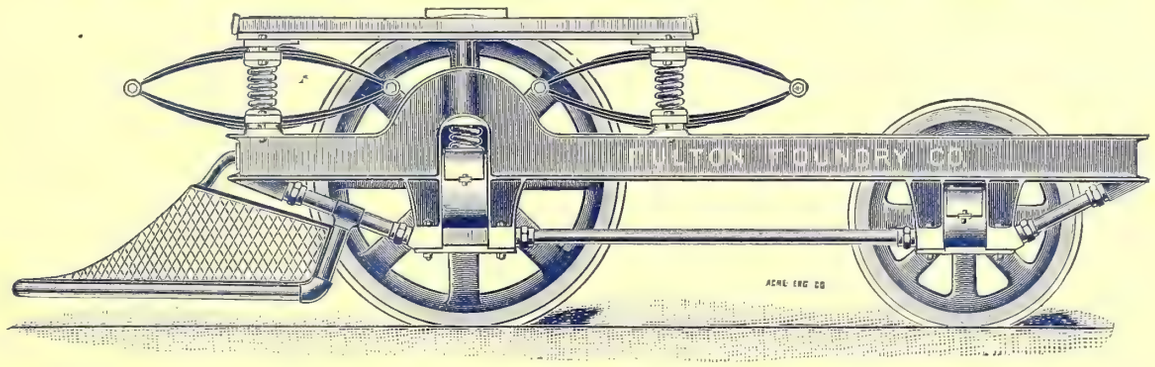
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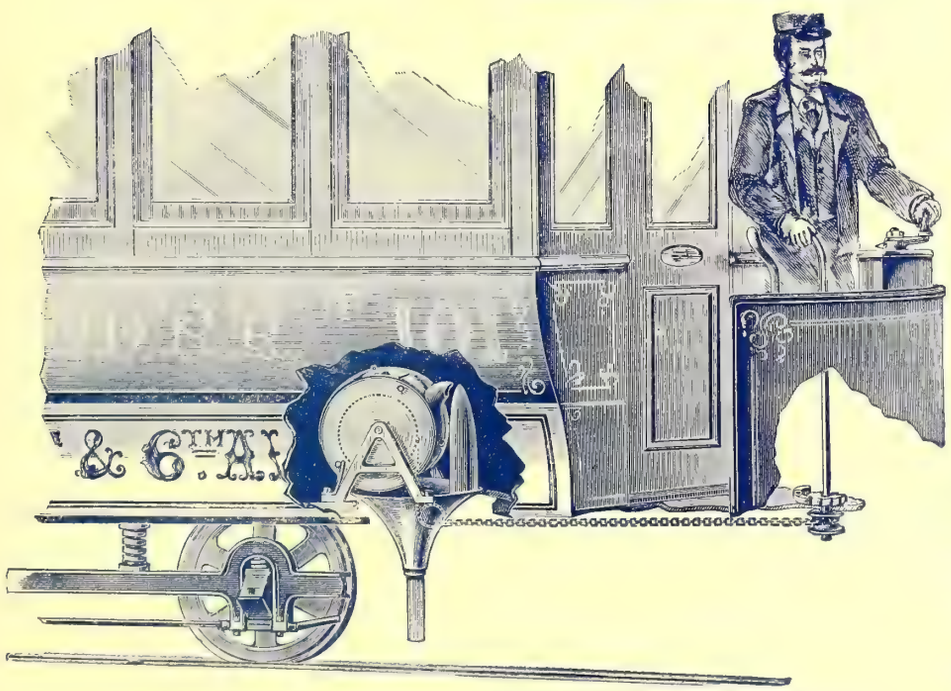
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This Truck has no Equal for Strength, Durability and Easy Riding.

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Troy Sand Box,

(Patented June 22, 1893.)

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TROY, N. Y., Nov. 8, 1893.

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Wales Manufacturing Co., Syracuse, N. Y.

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White Manufacturing Co., The, New York.

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Schieren, Chas. A., & Co., New York.
Smith, J. D., New York.

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Heine Safety Boiler Co., St. Louis, Mo.
Jarvis Engineering Co., Boston, Mass.
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Pennsylvania Iron Works Co., Philadelphia, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
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Wetherill, Robert, & Co., Chester, Pa.
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St. Louis Car Co., St. Louis, Mo.
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West End Street Railway Co., Boston, Mass.

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Ralston & Co., Philadelphia, Pa.
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Deane Steam Pump Co., Holyoke, Mass.
Davidson, M. T., Brooklyn, N. Y.
Wheeler Condenser & Engineering Co., New York.

CONDUCTORS' CAPS.
Brill J. G., Co., Philadelphia, Pa.
French, S. A., New York.
Wales Manufacturing Co., Syracuse, N. Y

CONTRACTORS.
Ashley, Frank M., New York.
Bickford, J. H., Salem, Mass.
Cleveland Construction Co., Akron, O.
Complete Electric Construction Co., New York.
Comstock, The Louis K., Co., Chicago, Ill.
Conway, M. W., Brooklyn, N. Y.
Craig, Wm. P., East Orange, N. J.
Creaghead Engineering Co., The, Cincinnati, O.
Davis, Lewis K., New York.
Dick, Kerr & Co., London, England.
Electric Railway Equipment Co., Cincinnati, O.
Electrical & Mechanical Engineering & Trading Co., New York.
Field, C. J., New York.
Fowler, Geo. L., New York.
Hall, J. P., New York.
Hampson, Edw. P., & Co., New York.
Hutchinson, A. J., New York.
Huxley & Hoffman, Boston, Mass.
Lane & Bodley Co., The, Cincinnati, O.
Leonard, H. Ward, & Co., New York.
Livingston, Chas. Ludlow, Pittsburgh, Pa.
Loss, C. E., & Co., Chicago, Ill.
McCarthy, F. E., & Co., Boston, Mass.
McNally, Thomas, Pittsburgh & Indianapolis.
Mailloux, C. O., New York.
Meyer, Julius, New York.
Murray, J. D., New Brunswick, N. J.
Neftel, O'Connor & Co., Incorp., New York.
Parker, J. W. & Co., Philadelphia, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa.
Ralston & Co., Philadelphia, Pa.
Reed & McKibbin, New York.
Smith, Thos. G., Jr, Cincinnati, O.
Stern & Silverman, Philadelphia, Pa.
Wakefield Electrical Engineering Co., Philadelphia, Pa.
Westinghouse, Church, Kerr & Co., New York.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.
White-Crosby Co., Baltimore, Md.
Woodbridge & Turner Engineering Co., New York.
Yeats Engineering Co., Chicago, Ill.

CONVEYORS, COAL AND ASHES.
Hunt, C. W., Co., New York.
Link-Belt Engineering Co., Nicetown, Pa.

CRANES, TRAVELING.
Box, Alfred, Philadelphia, Pa.
Harrington, Edwin, Son & Co., Incorporated, Philadelphia, Pa.
Phœnix Iron Works, Cleveland, O.
Shriver, T., & Co., New York.

CROSSINGS, FROGS AND SWITCHES.
Barbour, Stockwell Co., Cambridgeport, Mass.
Dick, Kerr & Co., London, Eng.
Dorner & Dutton Mfg. Co., Cleveland, O.
Floyd, James R., & Sons, New York.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
White Manufacturing Co., The, New York.

CURVED RAILS.
Barbour, Stockwell Co., Cambridgeport, Mass.
Craig, Wm. P., East Orange, N. J.
Floyd, James R., & Sons, New York.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Steel Rail Supply Co., The, New York.
Wharton, Wm. Jr., & Co., Philadelphia, Pa.

DETECTIVE SERVICE.
National Railroad Detective Agency, Newark, N. J.
Reliable Detective Agency, The, New York.
Thiel's Detective Service, New York.

DERMAGLUTINE.
Groetzinger, A., & Sons, Allegheny, Pa.

DROP FORGINGS.
Billings & Spencer Co., Hartford, Conn.
Strieby & Foote, Newark, N. J.

ECONOMIZERS.
Brightman Stoker Co., The, Cleveland, O.
Fuel Economizer Co., The, Matteawan, N. Y.

ELECTRIC RAILWAYS.
Bickford, J. H., Salem, Mass.
Cleveland Construction Co., Akron, O.
Complete Electric Construction Co., New York.
Comstock, The Louis K., Co., Chicago, Ill.
Creaghead Engineering Co., Cincinnati, O.
Dick, Kerr & Co., London, Eng.
General Electric Co., Schenectady and New York.
McCarthy, F. E., & Co., Boston, Mass.
McNally, Thomas, Pittsburgh & Indianapolis.
Murray, J. D., New Brunswick, N. J.
Neftel, O'Connor & Co., Incorporated, New York.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Ralston & Co., Philadelphia, Pa.
Reed & McKibbin, New York.
Smith, Thos. G., Jr., Cincinnati, O.
Wakefield Electrical Engineering Co., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
White-Crosby Co., Baltimore, Md.
Woodbridge & Turner Engineering Co., New York.
Yeats Engineering Co., Chicago, Ill.

ELECTRICAL INSTRUMENTS.
General Electric Co., Schenectady and New York.
Weston Electrical Instrument Co., Newark, N.J.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

ELECTRICAL SUPPLIES
Anderson, A. & J. M., Boston, Mass.
Billings & Spencer Co., Hartford, Conn.
Blackwell, Robert W., London, England.
Creaghead Engineering Co., Cincinnati, O.
Curtis Electric Mfg. Co., Jersey City, N. J.
Dick, Kerr & Co., London, Eng.
Dudley, Julius T., & Co., New York.
Eastern Electric Cable Co., Boston, Mass.
Eddy Electric Manufacturing Co., Windsor, Conn.
Electric Railway Equipment Co., Cincinnati, O.
Fiberite Co., The, Mechanicville, N. Y.
General Electric Co., Schenectady and New York.
Glenwood Works, Yonkers, N. Y.
Groetzinger, A. & Sons, Allegheny, Pa.
Hill, W. S., Electric Co., Boston, Mass.
Hubley Manufacturing Co., Lancaster, Pa.
Johns, H. W., Manufacturing Co., New York.
Mason Electric Co., Chicago, Ill.
Moore, Alfred F., Philadelphia, Pa.
Mosher Electric Co., Chicago.
Neftel, O'Connor & Co, Incorporated, New York.
New York Electrical Works, New York.
New York Equipment Co., New York.
Ohio Brass Co., Mansfield, O.
Okonite Co. (Ltd.), The, New York.
Partridge, Arthur S., St. Louis, Mo.
Ralston & Co., Philadelphia, Pa.
Rumrill, Charles M., & Bro., New York.
Solar Carbon & Mfg. Co., Pittsburgh, Pa.
Standard Paint Co., New York.
Steel Motor Co., The, Cleveland, O.
United Columbian Electric Co., New York.
Van Nuis, C. S., New York,
Wales Manufacturing Co., Syracuse, N. Y.
Wallace Electric Co., Chicago, Ill.
Washburn & Moen Mfg. Co., Worcester, Mass.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Weston Electrical Instrument Co., Newark, N.J.
Woodridge & Turner Engineering Co,, New York.

ELECTROTYPING.
Field & Beattie, New York.

ELEVATORS.
Link-Belt Engineering Co., Nicetown, Pa.
Morse, Williams & Co., Philadelphia, Pa.

ENGINEERS, ELECTRICAL.
Anthony, W. A., Vineland, N. J.
Arnold, B. J., Chicago, Ill.
Ashley, Frank M., New York.
Bickford, J. H., Salem, Mass.
Blackwell, Robert W., London, England.
Cleveland Construction Co, Akron, O.
Complete Electric Construction Co., New York.
Comstock, The Louis K., Co., Chicago, Ill.
Creaghead Engineering Co., Cincinnati, O.
Davis, Lewis K., New York.
Dick, Kerr & Co., London, Eng.
Electrical & Mechanical Engineering & Trading Co., New York.
Field, C. J., New York.
General Electric Co., Schenectady and New York.
Hall, J. P., New York.
Higgins, Edward E., New York.
Hutchinson, A. J., New York.
McCarthy, F. E., & Co., Boston, Mass.
Leonard, H. Ward, & Co., New York.
Livingston, Chas. Ludlow., Pittsburgh, Pa.
Mailloux, C. O., New York.
Malochee, H. J., New Orleans, La.
Meyer, Julius, New York.
Murray, J. D., New Brunswick, N. J.
Neftel, O'Connor & Co., Incorporated, New York.
Parker, J. W., & Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa.
Ralston & Co., Philadelphia, Pa.
Reed & McKibbin, New York.
Siemens & Halske Electric Co. of America, Chicago
Smith, Thos. G., Jr., Cincinnati, O.
Stern & Silverman, Philadelphia, Pa.
Thayer, William C., Cleveland, O.
Van Nuis, C. S., New York.
Wakefield Electrical Engineering Co., Philadelphia, Pa.
Walker Manufacturing Co., Cleveland, O.
White-Crosby Co., Baltimore, Md.
Woodbridge & Turner Engineering Co., New York.
Yeats Engineering Co., Chicago, Ill.

ENGINEERS, MECHANICAL.
Ashley, Frank M., New York.
Bickford, J. H., Salem, Mass.
Colby, C. B. & W. H., Philadelphia, Pa.
Dick, Kerr & Co., London, Eng.
Electrical & Mechanical Engineering & Trading Co., New York.
Fowler, Geo. L., New York
Hampson, Edw. P., & Co., New York.

HABIRSHAW Insulated Wires and Cables, GLENWOOD WORKS, YONKERS, N. Y.

Hutchinson, A. J., New York.
Lane & Bodley Co., The, Cincinnati, O.
McCarthy, F. E., & Co., Boston, Mass.
Meyer, Julius, New York.
Parker, J. W., & Co., Philadelphia, Pa.
Pepper & Register, Philadelphia, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Shook, Anderson Mfg. Co., Pittsburgh, Pa.
Smith, Thos. G., Jr., Cincinnati, O.
Walker Manufacturing Co., The, Cleveland, O.
Westinghouse, Church, Kerr & Co., New York.
Wheeler Condenser & Engineering Co., New York.
Woodbridge & Turner Engineering Co., New York.
Yeats Engineering Co., Chicago, Ill.

ENGINEERS' SETS.
Wilmot & Hobbs, New York, and Bridgeport, Conn

ENGINES.
Allis, The Edward P. Co., Milwaukee, Wis.
Altoona Manufacturing Co., Altoona, Pa.
Ames Iron Works, Oswego, N. Y.
Ball & Wood Co., The, New York.
Ball Engine Co., Erie, Pa.
Bates Machine Co., Joliet, Ill.
Buckeye Engine Co., Salem, O.
Cooper, C. & G., & Co., Mt. Vernon, O.
Currier, Mayo & Co., Boston, Mass.
Dickson Manufacturing Co., Scranton, Pa.
Fishkill Landing Machine Co., Fishkill-on-Hudson
Fleming, W. R. & Co., New York.
Hampson, Edw. P. & Co., New York.
Harrisburg Foundry & Machine Co., Harrisb'g, Pa.
Hoffman & Billings Mfg. Co., Milwaukee, Wis.
Hooven, Owens & Rentschler, Hamilton, O.
Ide, A. L., & Son, Springfield, Ill.
"L. P. & B." Transmitter Co., Montpelier, Vt.
Lane & Bodley Co., The, Cincinnati, O.
McEwen, J. H., Mfg. Co., Ridgway, Pa.
McIntosh, Seymour & Co., Auburn, N. Y.
New York Equipment Co., New York.
Otto Gas Engine Works, Philadelphia, Pa.
Parker, J. W., & Co., Philadelphia, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Philadelphia Engineering Works (Ltd.), Phila., Pa.
Phœnix Iron Works, Cleveland, O.
Phœnix Iron Works Co., Meadville, Pa.
Pierce & Miller Engineering Co., New York.
Southwark Foundry & Machine Co., Phila., Pa.
Walker Manufacturing Co., The, Cleveland, O.
Westinghouse, Church, Kerr & Co., New York.
Wetherill, Robert, & Co., Chester, Pa.
Woodbridge & Turner Engineering Co., New York.

ENGINES, BLOWING.
Philadelphia Engineering Works (Ltd.), Phila., Pa

ENGINES, HOISTING.
Dickson Manufacturing Co., Scranton, Pa.
Walker Manufacturing Co., The, Cleveland, O.

ENGRAVING.
Field & Beattie, New York.

EYE BOLTS.
Billings & Spencer Co., Hartford, Conn.
Creaghead Engineering Co., Cincinnati, O.

FANS, STEAM.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant, B. F., & Co., Boston, Mass.

FARE BOXES.
Brill, J. G. Co., Philadelphia, Pa.
Brownell Car Co., St. Louis, Mo.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Stephenson, John, Co., Ld., New York.
Wales Manufacturing Co., Syracuse, N. Y.

FARE COLLECTORS.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.

FARE REGISTERS.
Ames Register Co., Boston, Mass.
Brill, J. G. Co., Philadelphia, Pa.
Fowler, J. W., Car Co., Elizabethport, N. J.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Meaker Mfg. Co., Chicago, Ill.
New Haven Car Register Co., New Haven, Conn.
Railway Register Mfg. Co., New York.
St. Louis Car Co., St. Louis, Mo.
St. Louis Register Co., St. Louis, Mo.
Sterling Supply & Manufacturing Co., New York.
Wales Manufacturing Co., Syracuse, N. Y.

FEED WATER HEATERS.
Fuel Economizer Co., The, Matteawan, N. Y.
Goubert Manufacturing Co., The, New York.
Hoppes Manufacturing Co., Springfield, O.
Philadelphia Engineering Works (Ltd.), Phila., Pa
Webster, Warren, & Co., Camden, N. J.

FEED WATER PURIFIERS (Live Steam).
Davis, I. B., & Son, Hartford, Conn.
Goubert Manufacturing Co., New York.
Hoppes Manufacturing Co., Springfield, O.
Webster, Warren, & Co., Camden, N. J.

FENDERS AND GUARDS.
Clarke, F. H., Springfield, O.
Crawford, R. A., Mfg. Co., Pittsburgh, Pa.
Field Life Guard Co., Providence, R. I.
Foster Automatic Safety Guard Co., New York.
Leonhardt Pneumatic Safety Car Fender Co., Baltimore, Md.
Pflngst, Louis, Boston, Mass.

FIBRE CONDUIT.
Fibre Conduit Co., New York.

FORGINGS.
Dorner & Dutton Mfg. Co. Cleveland, O.

FRICTION CLUTCHES AND COUPLINGS.
Falls Rivet & Machine Co., Cuyahoga Falls, O.
Lake, J. H. & D., Co., Massillon, O.
Walker Manufacturing Co., Cleveland, O.

FURNACES.
Fleming, W. R., & Co., New York.
Philadelphia Engineering Works (Ltd.), Phila., Pa

GEARING.
Chester Steel Castings Co., Philadelphia, Pa.
Dickson Manufacturing Co., Scranton, Pa.
Dorner & Dutton Mfg. Co., Cleveland, O.
Electric Railway Equipment Co., Cincinnati, O.
Fulton Truck & Foundry Co., Cleveland, O.
General Electric Co., Schenectady and New York.
Groetzinger, A. & Sons, Allegheny, Pa.
Horsburgh & Scott, Cleveland, O.
Mertes, A., Manufacturing Co., Allegheny, Pa.
New Process Raw Hide Co., The, Syracuse, N. Y.
Nuttall, R. D. Co., Allegheny, Pa.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Shriver, T., & Co. New York.
Steel Motor Co., The, Cleveland, O.
Walker Manufacturing Co., The, Cleveland, O.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
Woodbridge & Turner Engineering Co., New York.

GENERATORS.
Complete Electric Construction Co., New York.
Creaghead Engineering Co., Cincinnati, O.
Curtis Electric Mfg. Co., Jersey City, N. J.
Eddy Electric Mfg Co., Windsor, Conn.
General Electric Co., Schenectady and New York.
Hill, W. S., Electric Co., Boston, Mass.
Mosher Electric Co., Chicago, Ill.
New York Equipment Co., New York.
Siemens & Halske Electric Co. of America, Chicago
Steel Motor Co., The, Cleveland, O.
United Columbian Electric Co., New York.
Walker Manufacturing Co., Cleveland, O.
Wallace Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

GONGS, CABLE AND CAR.
Bevin Bros. Manufacturing Co., East Hampton, Conn.
Brill, J. G., Co., Philadelphia, Pa.
Fowler, J. W., Car Co., Elizabethport, N. J.
Johnson Electric Co., Cleveland, O.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Pittsburgh Steel Hollow Ware Co., Allegheny, Pa.

GRATE BARS, SECTIONAL.
Tupper, W. W., & Co., New York.

GRATES, SECTIONAL.
Tupper, W. W., & Co., New York.

GRIP DIES.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Walker Manufacturing Co., The, Cleveland, O.

GRIPS.
Pennsylvania Iron Works Co., Philadelphia, Pa.

GUTTERS.
Barbour, Stockwell Co., Cambridgeport, Mass.
Dorner & Dutton Mfg. Co., Cleveland, O.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

HEADLIGHTS.
Brill, J. G., Co., Philadelphia, Pa.
Changeable Elec. Hdlight Co., The, Syracuse, N. Y.
New York Equipment Co., New York.
Ohio Brass Co., Mansfield, O.
Rumrill, Charles M., & Bro., New York.
Smith, J. D., New York.
Wales Manufacturing Co., Syracuse, N. Y.
Wheeler Reflector Co., Boston, Mass.

HEATERS, CAR.
Brill, J. G. Co., Philadelphia, Pa.
Central Electric Heating Co., New York.
Consolidated Car Heating Co., Albany, N. Y.
Fowler, J. W., Car Co., Elizabethport, N. J.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Safety Car Heating & Lighting Co., New York.
Sterling Supply Co., New York.

HEATERS, ELECTRIC.
Brill, J. G., Co., Philadelphia, Pa.
Central Electric Heating Co., New York.
Consolidated Car Heating Co., Albany, N. Y.

HYDRAULIC JACKS.
Schaffer, The J. T., Mfg. Co., Rochester, N. Y.
Walker Manufacturing Co., The, Cleveland, O.
Watson & Stillman, New York.

INDICATORS.
Hine & Robertson, New York.
Ohio Brass Co., Mansfield, O.

INSPECTORS.
Colby, C. B. & W. H., Philadelphia, Pa.

INSULATORS.
Anderson, A. & J. M., Boston, Mass.
Blackwell, Robert W., London, England.
Burnham & Duggan Railway Appliance Co., Boston, Mass.
Creaghead Engineering Co., Cincinnati, O.
Curtis Electric Mfg. Co., Jersey City, N. J.
Delaware Hard Fibre Co., Wilmington, Del.
Electric Railway Equipment Co., Cincinnati, O.
Fiberite Co., The, Mechanicville, N. Y.
Fibre Conduit Co., New York.
General Electric Co., Schenectady and New York.
Hammond Cleat & Insulator Co., Boston, Mass.
Johns, H. W., Manufacturing Co., New York.
Mason Electric Co., Chicago, Ill.
Mosher Electric Co., Chicago, Ill.
Ohio Brass Co., Mansfield, O.
Rumrill, Charles M., & Bro., New York.
Standard Paint Co., New York.
Steel Motor Co., The, Cleveland, O.
Wales Manufacturing Co., Syracuse, N. Y.
Wallace Electric Co., Chicago, Ill.
Walworth Mfg. Co., Boston, Mass.

INSULATORS, MICA.
Creaghead Engineering Co., Cincinnati, O.
Johns, H. W., Manufacturing Co., New York.

IRON STRUCTURAL WORK.
Berlin Iron Bridge Co., East Berlin, Conn.

KNEES AND OTHER TRACK CASTINGS.
Barbour, Stockwell Co., Cambridgeport, Mass.
Craig, Wm. P., New York.
Dorner & Dutton Mfg. Co., Cleveland, O.
Floyd, James R., & Sons, New York.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

LAMPS.
Brill, J. G., Co., Philadelphia, Pa.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Smith, J. D., New York.
Stephenson, John, Co., Ltd., New York.
Wheeler Reflector Co., Washington, D. C.
Wilmot & Hobbs, New York, and Bridgeport, Conn.

LAMPS, ELECTRIC.
Creaghead Engineering Co., Cincinnati, O.
General Electric Co., Schenectady and New York.
General Incandescent Arc Light Co., New York.
Mosher Electric Co., Chicago, Ill.
Wallace Electric Co., Chicago, Ill.
Wheeler Reflector Co., Boston, Mass.

LAW.
Eppley, Francis M., New York.

LIGHTNING ARRESTERS.
General Electric Co., Schenectady and New York.
Hill, W. S., Electric Co., Boston, Mass.
Mason Electric Co., Chicago, Ill.
Ohio Brass Co., Mansfield, O.
Van Nuis, C. S., New York.

LOCK NUTS.
Young Lock Nut Co., New York.

LOCOMOTIVES.
Dickson Manufacturing Co., Scranton, Pa.
Steel Rail Supply Co., The, New York.

LUBRICANTS.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Wadhams Oil & Grease Co., Milwaukee, Wis.

LUMBER, CAR BUILDERS'.
Rankin, W. L., & Bro., Latta, S. C.
Wetmore, A. B., New York.

MACHINE TOOLS
Garvin Machine Co., New York.
Harrington, Edwin, Son & Co., Incorporated, Philadelphia, Pa.
Lodge & Davis Machine Tool Co., Cincinnati, O.
Ralston & Co., Philadelphia, Pa.
Schaffer, The J. T., Mfg. Co., Rochester, N. Y.

MAGNESIA SECTIONAL COVERINGS.
Keasbey, Robert A., New York.

MAGNETIC CUT-OUTS.
General Electric Co., Schenectady and New York.

MATTING, WOOD.
Brill, J. G. Co., Philadelphia, Pa.
Lewis, Samuel, Brooklyn, N. Y.

MEDBERY INSULATION.
Fiberite Co., The, Mechanicville, N. Y.

METERS, ELECTRIC.
General Electric Co., Schenectady and New York.

MICA.
Munsell, Eugene, New York.

MOTORS, ELECTRIC.
Complete Electric Construction Co., New York
Creaghead Engineering Co., Cincinnati, O.
Curtis Electric Mfg. Co., Jersey City, N. J.
Eddy Electric Manufacturing Co., Windsor, Conn.
General Electric Co., Schenectady and New York.
Hill, W. S., Electric Co., Boston, Mass.
Mason Electric Co., Chicago, Ill.
Mosher Electric Co., Chicago, Ill.
New York Equipment Co., New York.
Siemens & Halske Electric Co. of America, Chicago
Steel Motor Co., The, Cleveland, O.
United Columbian Electric Co., New York.
Walker Manufacturing Co., Cleveland, O.
Wallace Electric Co., Chicago, Ill.
Warfield, Louis, Detroit, Mich.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Woodbridge & Turner Engineering Co., New York.

OFFICE SPECIALTIES.
Office Specialty Manufacturing Co., New York.

OILERS.
Wilmot & Hobbs, Manufacturing Co., New York, and Bridgeport, Conn.

ROUND LEATHER "BELL CORD" Oak Tanned for Street Cars. Chas. A. Schieren & Co. MANUFACTURERS. New York, 47 Ferry St. Philadelphia, 226 N. 3d St. Boston, 149 High St. Chicago, 46 & 48 S. Canal St.

PAINT, GRAPHITE.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

PAINT, PRESERVATIVE, FOR IRON.
Standard Paint Co., New York.

PAINTS.
Johns, H. W., Manufacturing Co., New York.
Valentine & Co., New York.

PATENT SOLICITORS, ETC.
Rosenbaum, Wm. A., New York.
Ruff, W. H., Washington, D. C.

PEDESTALS.
Brill, J. G. Co., Philadelphia, Pa.
Fowler, J. W., & Co., Elizabethport, N. J.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.,
Stephenson, John, Co., Ld., New York
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
White Manufacturing Co., The, New York.

PERFORATED METALS.
Mundt & Sons, New York.

PHOSPHOR BRONZE.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

PINIONS, METALLIC.
Chester Steel Castings Co., Philadelphia, Pa.
Dickson Manufacturing Co., Scranton, Pa.
Dorner & Dutton Manufacturing Co., Cleveland, O.
Electric Railway Equipment Co. Cincinnati, O.
General Electric Co., Schenectady and New York.
Horsburgh & Scott, Cleveland, O.
Mertes, A., Manufacturing Co., Allegheny, Pa.
Nuttall, R. D., Co., Allegheny, Pa.
Pennsylvania Iron Works, Philadelphia, Pa.
Steel Motor Co., The, Cleveland, O.
Walker Manufacturing Co., Cleveland, O.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.

PIPES.
Shook, Anderson Mfg. Co., Pittsburgh, Pa.

POLE BRACKETS.
Creaghead Engineering Co., Cincinnati, O.
Ohio Brass Co., Mansfield, O.
Simmons, John, Co., New York.

POLES, METAL.
Berlin Iron Bridge Co., East Berlin, Conn.
Blackwell, Robert W., London, England.
Creaghead Engineering Co., Cincinnati, O.
Electric Railway Equipment Co., Cincinnati, O.
Morris, Tasker & Co., Philadelphia, Pa.
Neitel, O'Connor & Co., Incorporated, New York.
New York Electrical Works, New York.
New York Equipment Co., New York.
Nuttall, R. D., Co., Allegheny, Pa.
Ohio Brass Co., Mansfield, O.
Partridge, Arthur S., St. Louis, Mo.
Ralston & Co., Philadelphia, Pa.
Simmons, John, Co., New York.
Wrought Iron Bridge Co., Canton, O.

POLES, WOODEN.
Creaghead Engineering Co., Cincinnati, O.
Hallowell, Eli B. & Co., Philadelphia, Pa.
Loud, H. W., & Sons Lumber Co., Au Sable, Mich.
New York Equipment Co., New York.
Nuttall, R. D., Co., Allegheny, Pa.
Ohio Brass Co., Mansfield, O.
Ralston & Co., Philadelphia, Pa.
Rankin, W. L., & Bro., Latta, S. C.
White-Crosby Co., Baltimore, Md.

POWER TRANSMISSION.
General Electric Co., Schenectady and New York.
"L. P. & D." Transmitter Co., Montpelier, Vt.
Link-Belt Engineering Co., Nicetown, Pa.
Walker Manufacturing Co., Cleveland, O.
Washburn & Moen, Mfg. Co., Worcester, Mass.

PRESSES, COPYING.
Shriver, T. & Co., New York.

PRESSES, LEVER, HYDRAULIC, ETC.
Schaffer, J. T., Manufacturing Co., Rochester, N. Y.
Walker Manufacturing Co., The, Cleveland, O.
Watson & Stillman, New York.

PRESSES, WHEEL.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fulton Truck & Foundry Co., Cleveland, O.
Hathaway, Alfred G., Cleveland, O.
Schaffer, J. T., Manufacturing Co., Rochester, N.Y.
Watson & Stillman, New York.

PULLEYS.
"L. P. & D." Transmitter Co., Montpelier, Vt.
Lane & Bodley Co., The, Cincinnati, O.
Shriver, T., & Co., New York.
Walker Manufacturing Co., The, Cleveland, O.

PULLEYS, CABLE.
Walker Manufacturing Co., The, Cleveland, O.
Wharton, Wm., Jr. & Co., Philadelphia, Pa.

PUMPS.
Davidson, M. T., Brooklyn.
Deane Steam Pump Co., Holyoke, Mass.
Dickson Manufacturing Co., Scranton, Pa.
Schaffer, J. T., Manufacturing Co., Rochester, N.Y.
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Wheeler Condenser & Engineering Co., New York.

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Electrical & Mechanical Engineering & Trading Co., New York.
General Electric Co., Schenectady and New York.
Keithley, H. R., Chicago, Ill.
New York Electrical Works, New York.
New York Equipment Co., New York.
Ohio Brass Co., Mansfield, O.
Rumrill, Charles M., & Bro., New York.

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Cambria Iron Co., Philadelphia, Pa.
Harrington, Robinson & Co., Boston, Mass.
New York Equipment Co., New York.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Wharton, Wm Jr. & Co., Philadelphia, Pa.

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Dick, Kerr & Co., London, Eng.
Harrington, Robinson & Co., Boston, Mass.
Hirsch, L. K., Chicago, Ill.
Lewis & Fowler Girder Rail Co. Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Ralston & Co., Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
Wharton, Wm., Jr., & Co., Philadelphia, Pa.
Woodbridge & Turner Engineering Co., New York.

RAILS, SECOND HAND.
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New York Equipment Co., New York.
Ralston & Co., Philadelphia, Pa.

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Cambria Iron Co., Philadelphia, Pa.
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Dick, Kerr & Co., London, Eng.
Dorner & Dutton Mfg. Co., Cleveland, O.
Fulton Truck & Foundry Co., Cleveland, O.
Harrington, Robinson & Co., Boston, Mass.
Hirsch, L. K., Chicago, Ill.
Lewis & Fowler Girder Rail Co., Brooklyn, N. Y.
Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
New York Equipment Co., New York.
Pennsylvania Iron Works Co., Philadelphia, Pa.
Ralston & Co., Philadelphia, Pa.
Steel Rail Supply Co., The, New York.
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Electric Railway Equipment Co., Cincinnati, O.
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Mason Electric Co., Chicago, Ill.
New York Equipment Co., New York.
Okonite Co., The, Ltd., New York.
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Roebling's, John A., Sons Co., Trenton, N. J.
Wallace Electric Co., Chicago, Ill.
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Philadelphia Engineering Works (Ltd.), Phila., Pa

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Wheeler Reflector Co., Washington, D. C.

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Robinson Electric Truck & Supply Co., Boston, Mass.
St. Louis Car Co., St. Louis, Mo.
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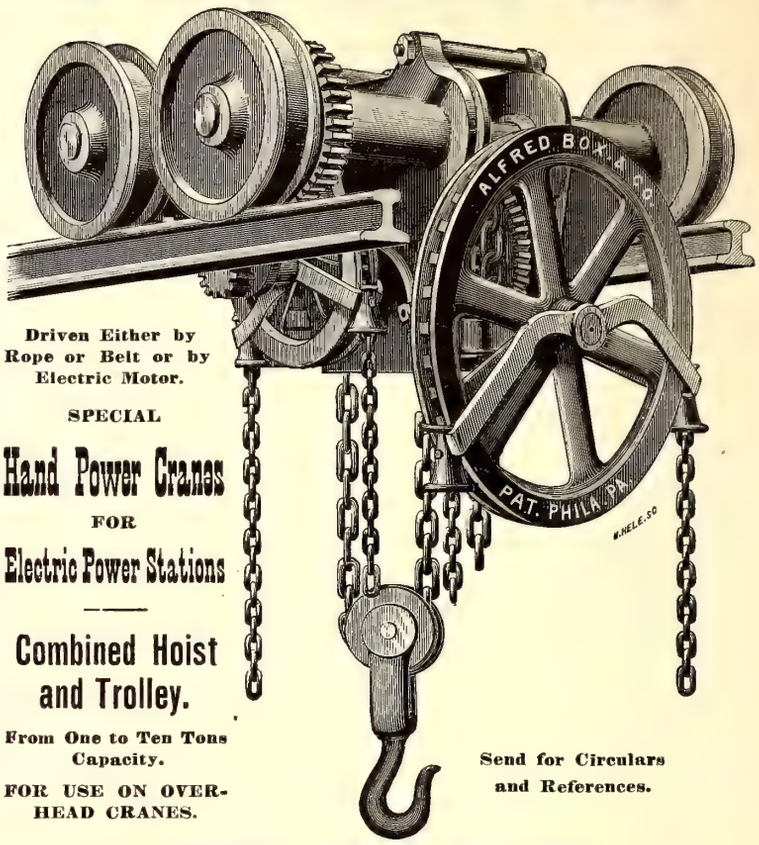
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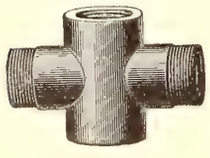
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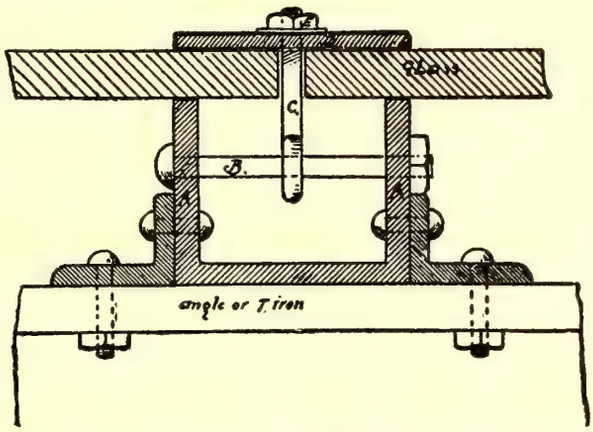
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DESCRIPTION.

The astragal or channel bar is made of strong steel, varying in width from one to two inches, depending on the distance between the roof purlins to which said astragals are bolted by means of angles, as shown in sketch.

About every fifteen inches apart, one-quarter inch square holes are made in the sides of the steel skylight bar into which is secured the cross bolt "B" and eye bolt "C." These bolts secure the glass in place by means of cap "D" and the



DESCRIPTION.

nut "E." This *cap* can be made of a bent piece of sheet copper or other metal or narrow pieces of flat iron covered with lead, like sketch.

The *cross bars*, which can be made of copper or other sheet metal, are fitted into slots cut in the sides of the steel channel bars, 1½ inches long by ½ inch deep, and they are made the exact width of the glass, and lap over the channel bar so that all condensation, water, etc., finds it way into the main channel bar.

A FEW REASONS WHY

Engineers, Architects and others may decide to adopt the new "Paradigm" Skylight System.

1. The main bar being made of strong steel, greater strength is necessarily obtained than in the cheaply constructed sheet metal bars now being used all over the country.

2. The steel bars are not exposed to the weather at all, being entirely and completely covered by the glass and "caps," and they can be kept painted and will last as long as the building.

3. The "caps" are the only part of the patent "Paradigm" Skylight System exposed to the weather, and as these can be made of strong copper or lead, it will be readily conceded that a skylight or glass roof constructed on this system should outlast an ordinary galvanized iron skylight many years.

4. It is the most economical skylight system, by reason of the fact that we can supply the steel bar, lead cap, and copper cross bars at a price that will almost compete with the cheaply constructed and galvanized iron skylights. The cost of maintenance and repairs is reduced to a minimum.

5. As the steel channel bar is so strong, averaging from one-eighth to one-quarter inch thick, a less number of roof purlins are required; for instance, purlins need not be less than five to eight feet centers.

6. Broken panes of glass can be replaced more easily and quickly than by any other method.

7. The skylight bars are usually made in one length, up to forty feet if necessary, so that defects, through careless soldering and consequent leakage, as in the sheet metal bars, are an impossibility.

8. The method used for making a watertight joint at the junction where two panes of glass meet, which permits the glass to be butted instead of being lapped, will commend itself to all. The cross bar is usually made of strong copper or other sheet metal.

The Engineers for the Trustees of the New York and Brooklyn Bridge have adopted the "Paradigm" Skylight System for the big skylights on the new Terminal Stations now being built on each side of the East River—New York and Brooklyn—about 45,000 sq. ft., and contracts have been made with General Contractors for the work.

PARADIGM CONSTRUCTION COMPANY,

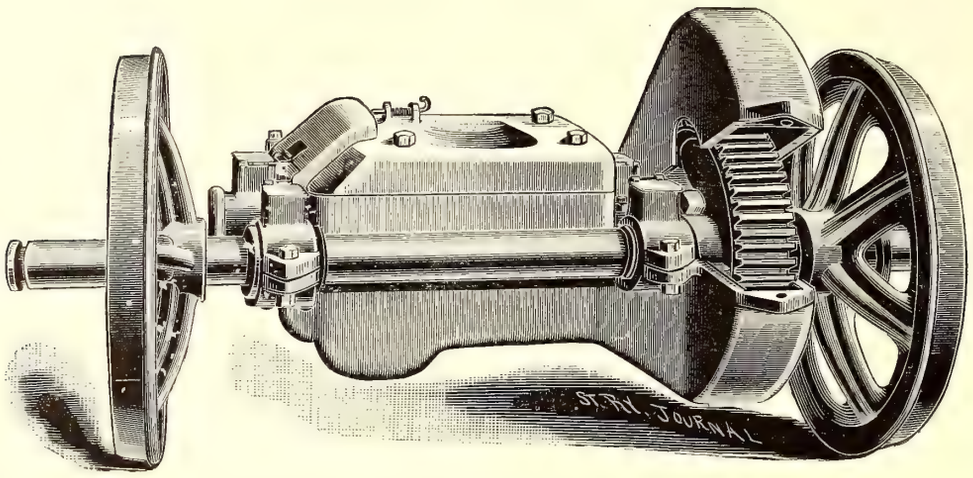
Caution Infringements will be Vigorously Prosecuted.

41 Pine Street, New York.

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CURTIS ELECTRIC MANUFACTURING CO.

Electric Motor Car Equipments.



CURTIS STANDARD (30 H. P.) MOTOR

The Brooklyn City Railroad Co. has had 25 Double 30 H. P. Curtis Equipments in service with hundreds of motors of two other leading makes. They have recently ordered 120 additional Curtis Motors and Controlling Apparatus.

These Motors, and the Curtis Series Multiple Platform Controllers, etc., have been in constant service on many street railroads, and have invariably given perfect satisfaction. We refer, among others, to

Brooklyn City Railroad Co.,	**Brooklyn, N. Y.**
Consolidated Traction Co.,	**Jersey City, N. J.**
Citizens' Passenger Railway Co.,	**Norristown, Pa.**
Reading & Southwestern Railway Co.,	**Reading, Pa.**
Portsmouth Street Railroad & Light Co.,	**Portsmouth, O.**
Oil City Street Railway Co.,	**Oil City, Pa.**

EFFICIENCY.—Tests made officially by two railway companies have shown that the Curtis equipments are more efficient—consume less current—than either of the other well-known types of street car equipment.

The Improved Motor made by this Company, and shown above, is lighter per unit of guaranteed horse power capacity than any so called light weight motor now in the market.

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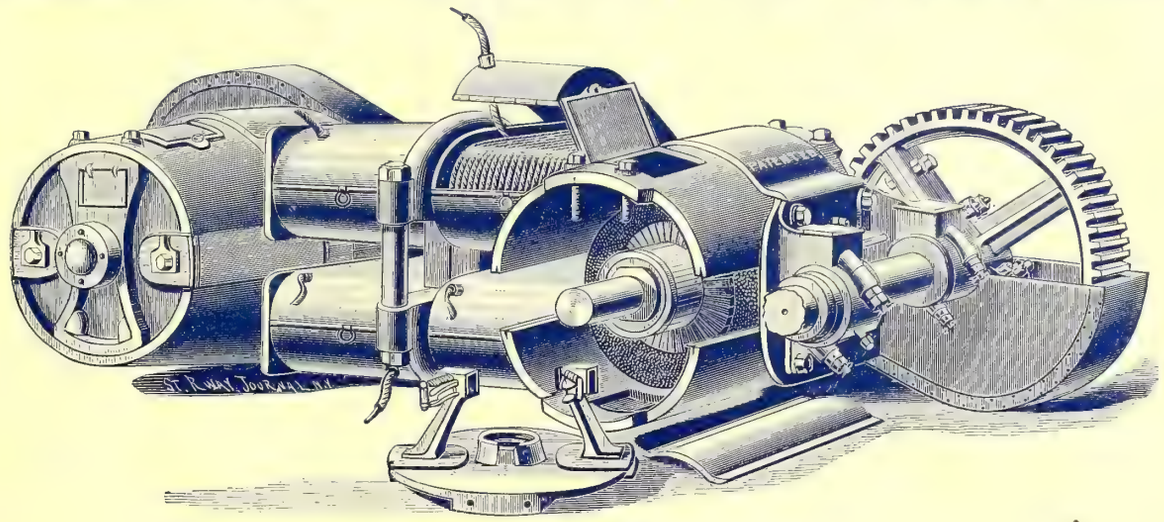
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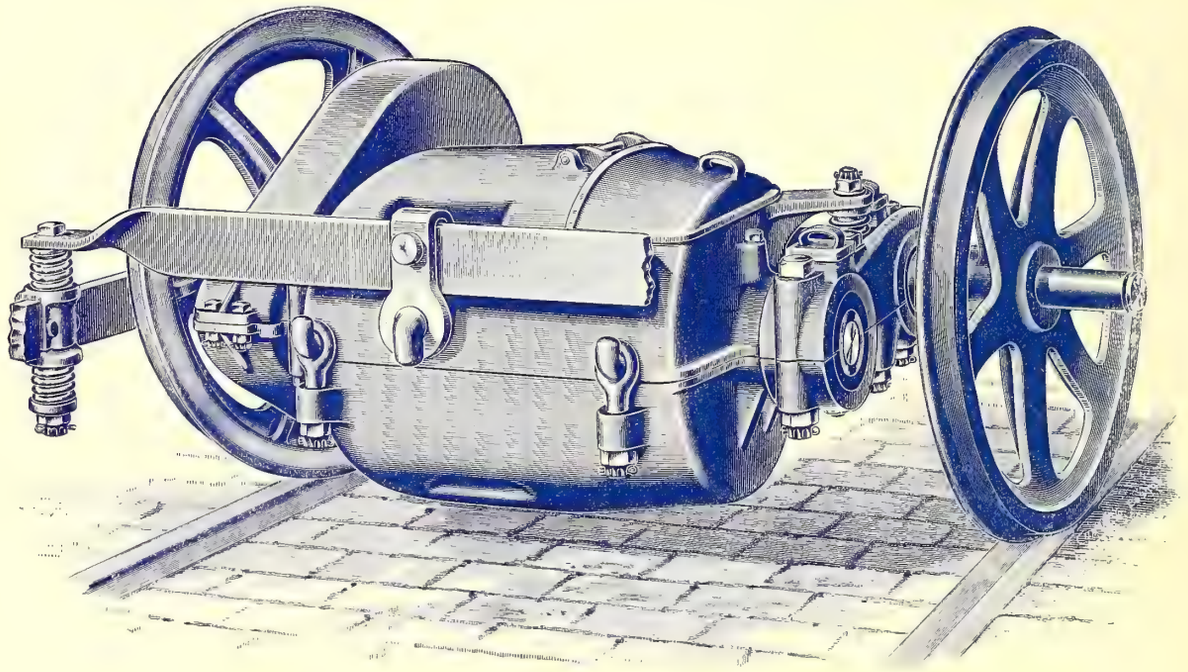
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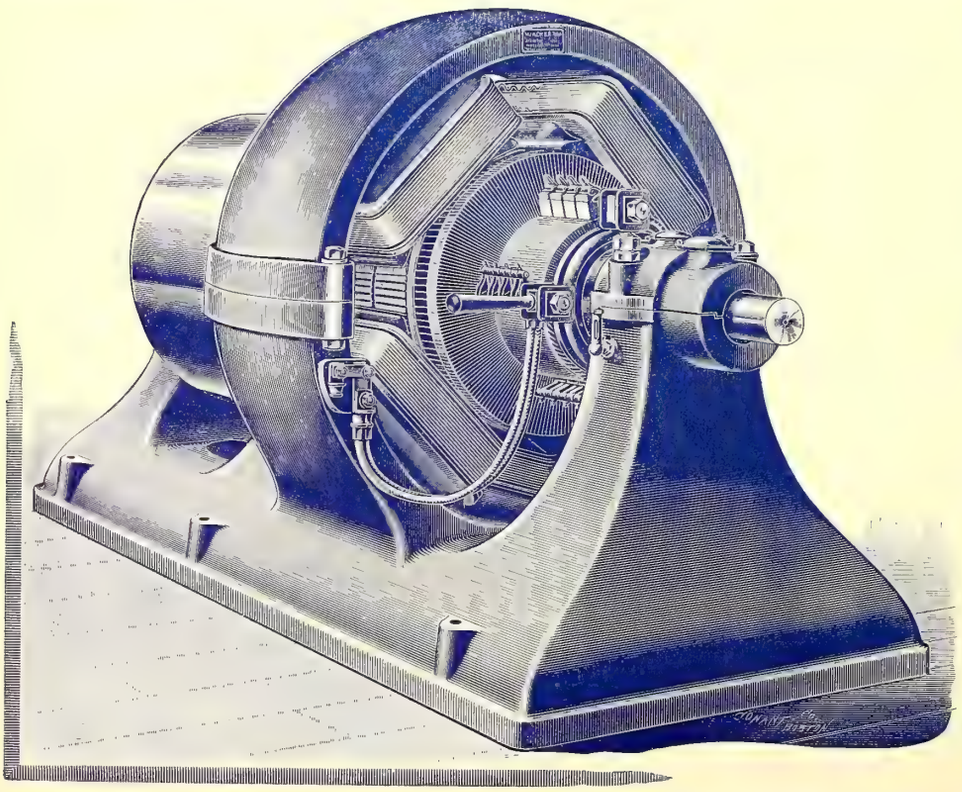
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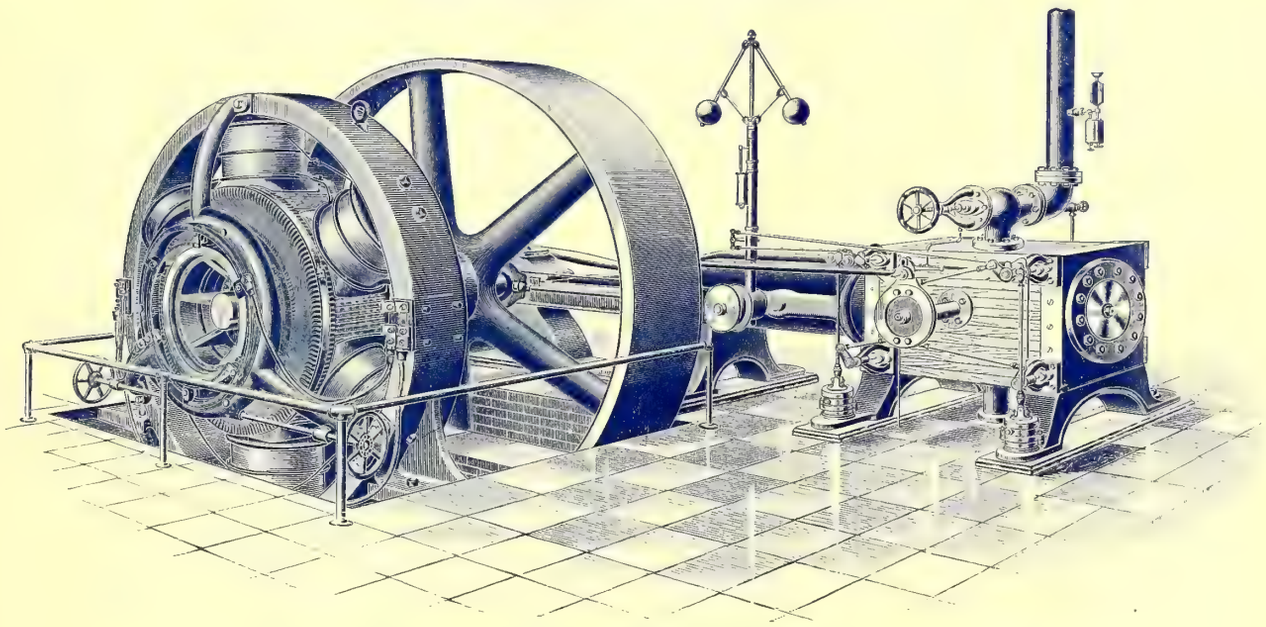
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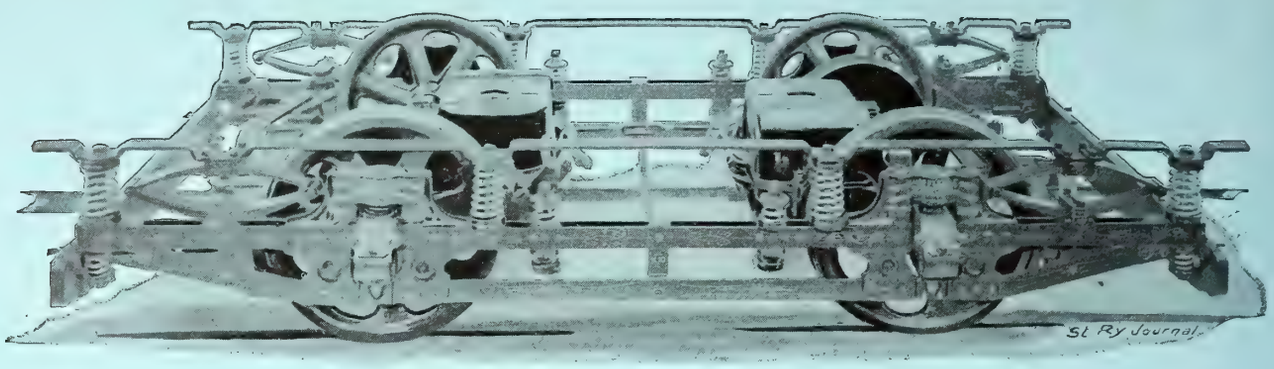
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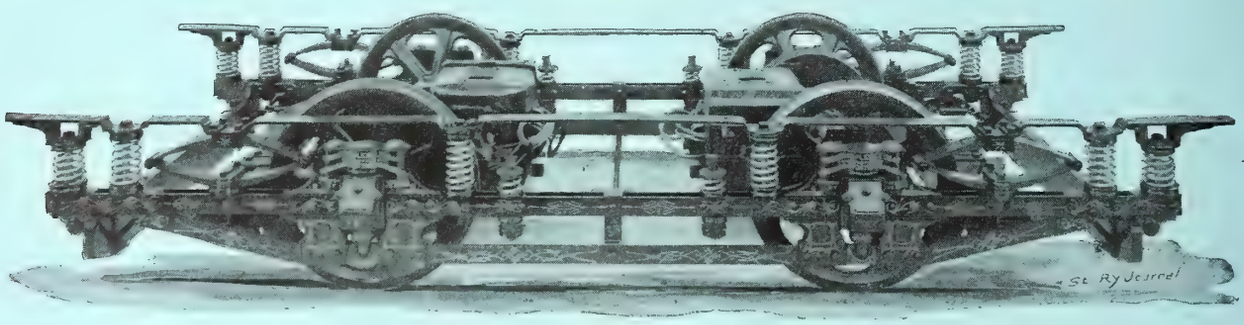
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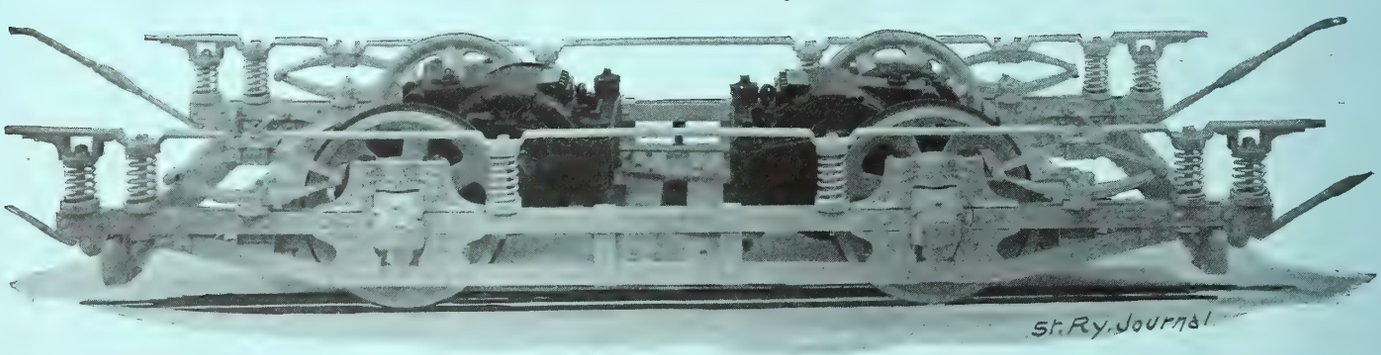
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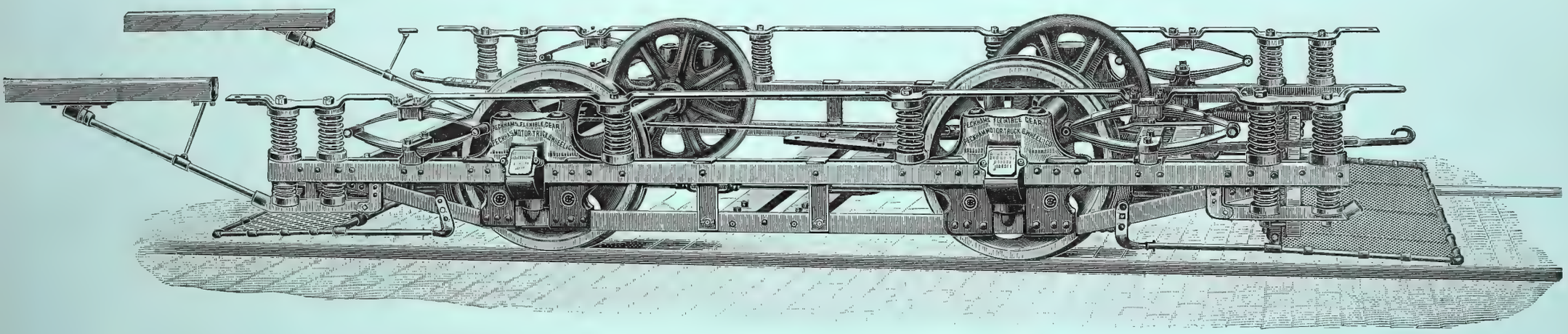
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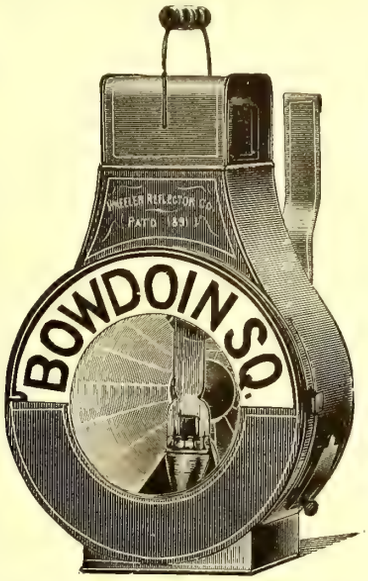
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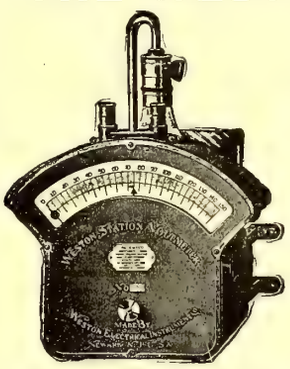
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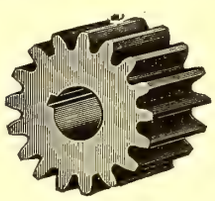
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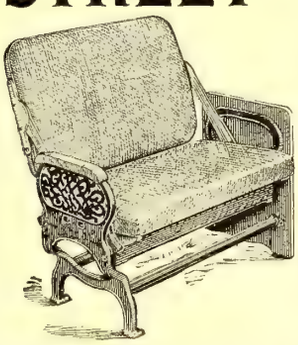
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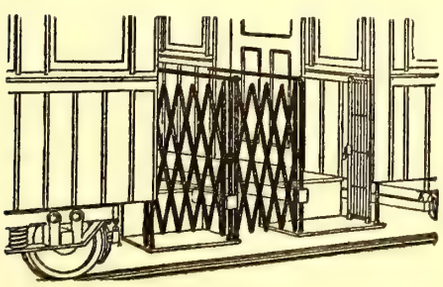
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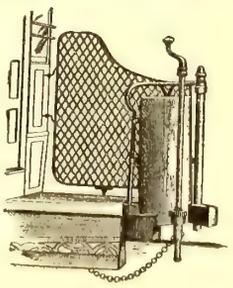


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Next regular meeting, Syracuse, third Tuesday in September, 1894.

OHIO STATE TRAMWAY ASSOCIATION.

ALBION E. LANG, Toledo, President; W. J. KELLY, Columbus, Vice-President; J. B. HANNA, Cleveland, Secretary and Treasurer; W. A. LYNCH, Canton, Chairman Executive Committee.

Next meeting, Toledo, fourth Wednesday in September, 1894.

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THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, THOS. C. BARR, Newark; vice-President, W. S. SCULL, Camden; Secretary and Treasurer, CHARLES Y. BAMFORD, Trenton; Executive Committee, OFFICERS and C. B. THURSTON, Jersey City; H. ROMAINE, Paterson.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

President, ————; first vice-president, Williamsport; R. L. JONES, Secretary, S. P. LIGHT, Lebanon; treasurer, W. H. LANIUS, York.

Next meeting, Reading, first Wednesday in September, 1894.

THE MAINE STREET RAILWAY ASSOCIATION.

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The midsummer meeting (1894) will be held in Rockland.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION.

President, H. H. WOOD, Derby; Vice-Presidentt, H. S. PARMELEE, New Haven; Secretary, R. A. FOSDICK, Stamford; Treasurer, E. S. GOODRICH, Hartford. Executive Committee, A. M. YOUNG, Waterbury; G. A. W. DODGE and I. A. KELSEY, New Haven. Next meeting, New Haven, third Wednesday in November, 1894.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. SINCLAIR, Galveston; vice-president, J. K. URIE, Austin; secretary and treasurer, S. A. HOBSON, Waco. Executive Committee and officers: A. W. CHILDRESS, Dallas; W. H. WEISS, San Antonio. Committee on Membership: C. DRAKE, Laredo; J. K. URIE, Austin; A. W. CHILDRESS, Dallas; C. A. MCKINNEY, Houston.

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Bulk Electrical Contractors and Consulting Electrical Engineers

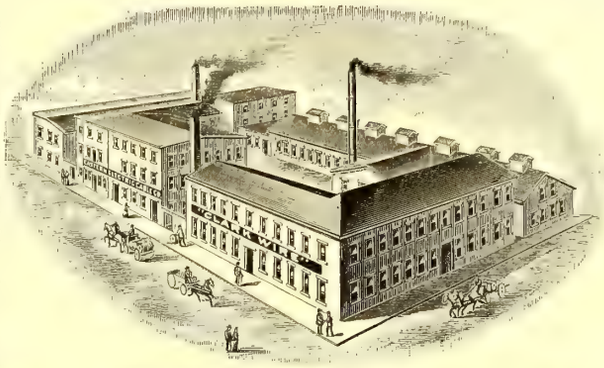
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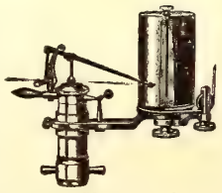
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Operation.—Year ending June 30,

	1892.	1893.
Receipts from passengers	$263,953	$407,854
" other sources	1,940	7,337
" total	265,893	415,191
Operating expenses	161,111	241,459
Earnings from operation	$104,782	$173,732
Deductions from earnings	59,216	87,420
Net income	$45,566	$86,312
Dividends paid, 6 per cent	45,000	52,499
To surplus account	566	33,813
Total surplus account,	def. 16,166	surp. 17,002
Per cent. O. E. to total receipts	60.5	58.1

Balance Sheet.—Date June 30, 1893.

Assets.		Liabilities.	
Cost of road and equip.	$1,802,633	Capital stock	$1,000,000
		Funded debt	730,000
Cash assets	36,261	Bills and accounts payable	91,015
Other assets	1,757	Other liabilities	2,633
		Profit and loss	17,002
Total	1,840,650	Total	1,840,650

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Miles of main line	12.6	8.4
" second track and sidings	4.0	7.1
" track (electricity)	16.6	15.5

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LOUISVILLE, KY.

MUNICIPAL STATISTICS AND INFORMATION.

Location.—Louisville is situated in the northern central part of Kentucky, on the Ohio River—the dividing line between Kentucky and Indiana. It is the county seat of Jefferson County.

Suburbs.—The townships of Crescent Hill, Parkland and South Louisville are connected with Louisville by street railway lines. The cities of New Albany and Jeffersonville are across the river in Indiana, but are not connected with Louisville.

Population.—The population in 1880 was 123,758, and in 1890, 161,129, an increase of 30 per cent. The total present population of the city and suburbs named is approximately 200,000.

Railroad Connections.—The Newport News & Mississippi Valley R. R., the Louisville & Nashville R. R., the Louisville, Evansville & St. Louis R. R., the Louisville, New Albany & Chicago R. R., the Ohio & Mississippi R. R., the Louisville, St. Louis & Texas R.R., the Louisville Southern, the Queen & Crescent route (to New Orleans and all Southern points) and the Pennsylvania Company connect Louisville with all parts of the country. A number of river steamers ply between Louisville and the different points on the Ohio and Mississippi River.

Manufacturing and Commercial Interests.—A capital of about $31,000,000 is employed in the various industries of the city, the principal productions being chewing and smoking tobacco, cigars, sole leather, furniture, agricultural implements, water and gas pipes, wagons and manufactured iron. Louisville is the largest whiskey market in the world, the taxes alone amounting to over $20,000 per day, and the city's commerce exceeds $150,000,000 per annum. About 25,000 hands are employed in the manufacturing industries, receiving in wages about $11,000,000 per annum, and the value of the manufactured product is about $45,000,000 per annum.

Banking Capital.—There are now (1894) 9 national banks, with a combined capital and surplus of about $5,000,000; 12 state banks, with capital and surplus of about $9,000,000; 1 loan and investment company, with capital and surplus of about $715,000, and 2 savings banks, with surplus of about $39,000. The total banking capital is approximately $15,000,000, equivalent to about $93 per capita.

Assessed Valuation.—The assessed valuation of real estate is (1893) $84,600,000 the property being assessed at about 80 per cent. of its real value. The assessed valuation of the personal property is $5,725,000. The total valuation of real and personal property is $90,325,000, equivalent to $561 per capita.

Municipal Debt.—The municipal debt of the city less sinking funds is (1893) $9,212,000, equivalent to $57 per capita.

Tax Rate.—The tax rate is (1893) $23.05 per $1,000.

STREET RAILWAY SYSTEM—Descriptive.

Louisville is built on a plateau about 70 ft. above the river, and is laid out upon a regular geometrical pattern. The city covers an area of about 35 square miles, the population density being about 4,600 inhabitants per square mile. The street railway system is extensive and well developed, is under the control of a single corporation, and gives an excellent service to every part of the city and suburbs. Of the 160 miles of track 100 miles are operated by electricity and 60 miles by horses.

STREET RAILWAY SYSTEM—Present Companies.

Louisville Railway Co.—Chartered, April 9, 1893. Annual meeting third Wednesday in Feb. This is a consolidation of the following companies: Louisville City Ry. Co., Central Passenger R. R. Co., Kentucky Street Ry. Co., Beargrass Ry. Co. and Crescent Hill Ry. Co. This company owns and operates the entire street railway system of Louisville.

Capital Stock.—Common stock, authorized and issued (Jan. 1894), $4,000,000; par value $100 per share. Preferred stock, authorized and issued, $2,000,000; par value $100 per share. Condltions of preference, 5 p. c. cumulative dividends.

Funded Debt.—First consolidated mortgage gold bonds, authorized, $6,000,000; issued, $4,600,000; in escrow, $1,400,000 (see Note), coupon, but may be registered; dated July 1,1890, due 1930; denom. $1,000; int. 5 p. c., payable Jan. and July in Louisville and New York (Seligman & Co.); trustee of mortgage, Fidelity Trust & Safety Vault Co. of Louisville, Ky.

Note.—The company has reserved $1,400,000 of consolidated mortgage bonds to retire an equal amount of prior issues as follows:

First mortgage bonds Louisville City Ry. Co., original issue, $300,000, now outstanding, $137,000; dated July 1864, due 1894; denom. $500; int. 6 p. c., payable Jan. and July, at office of Continental Nat'l Bank, New York, and in Louisville; trustee of mortgage, J. G. Barrett, of Louisville.

Mortgage bonds Louisville City Ry Co., original issue $250,000, now outstanding, $79,000; dated July 1877, due 1897; denom. $100 and upwards; int. 6 p. c., payable Jan. and July, at office of Continental Nat'l Bank, New York, and in Louisville; trustee of mortgage, William Mix, of Louisville.

Mortgage bonds Louisville City Ry. Co., original issue and now outstanding, $609,000; dated July 1884, due 1909; denom. $50 and upwards; int. 6 p. c., payable Jan. and July, at office of Louisville Trust & Safety Vault Co., trustee of mortgage,

First mortgage bonds Central Passenger Ry. Co., authorized $400,000, now outstanding, $95,000; dated Nov. 1883, due 1902; denom. $1,000; int. 6 p. c., payable May and Nov. in Louisville; trustee of mortgage, Fidelity Trust & Safety Vault Co. of Louisville.

Mortgage bonds Central Passenger Ry. Co., authorized, $400,000, now outstanding, $305,000; dated Nov. 1888, due 1908; denom. $1,000; int. 6 p. c., payable May and Nov., in Louisville; trustee of mortgage, Louisville Safety Vault & Trust Co.

First mortgage bonds Citizens' Passenger Ry Co., original issue, $200,000, now outstanding, $175,000; dated Jan. 1867, due 1897; denom. $1,000; int. 6 p. c., payable Jan. and July in Louisville; trustee of mortgage, J. M. Duncan, of Louisville.

Franchises.—The franchises for a part of the system are granted for 99 years from 1893, the balance are granted without time limit.

Operation.—Year ending Dec. 31, 1893.

Receipts from passengers	$1,265,202
" " other sources	16,791
" total	1,281,993
Operating expenses and taxes, 63 p. c	807,056
Earnings from operation	474,937
Interest on bonds	314,000
Net income	160,937
Dividends paid	87,500
To Surplus account	73,437

Balance Sheet.—Date, Dec. 31, 1893.

Assets.		Liabilities.	
Cost of road	$11,559,17	Capital stock	$6,000,000
" equipment	1,376,175	Funded debt	6,000,000
Cash assets	163,106	Bill payable	10,000
Other assets	220,124	Other liabilities	333,347
		Surplus	975,235
Total	13,318,582	Total	13,318,582

Plant and Equipment.

Miles of main line 90, of second track 60, of sidings and other track 10, total track 160; track operated by horses 60, by electricity 100. Gauge, 5 ft., 100 miles 78 and 100 lb girder rail construction, 30 miles T rail construction, 30 miles miscellaneous construction; no. of horses, 1,258, of horse cars, 180, of motor cars, 200, of trail cars, 100; horse power of engines, 3,000, Gen. Elec. dynamos and motors.

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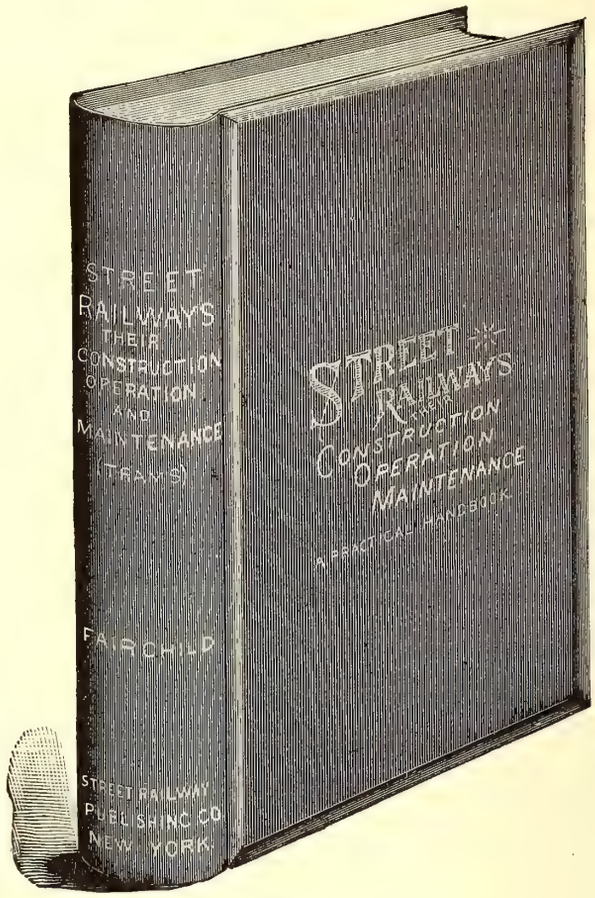
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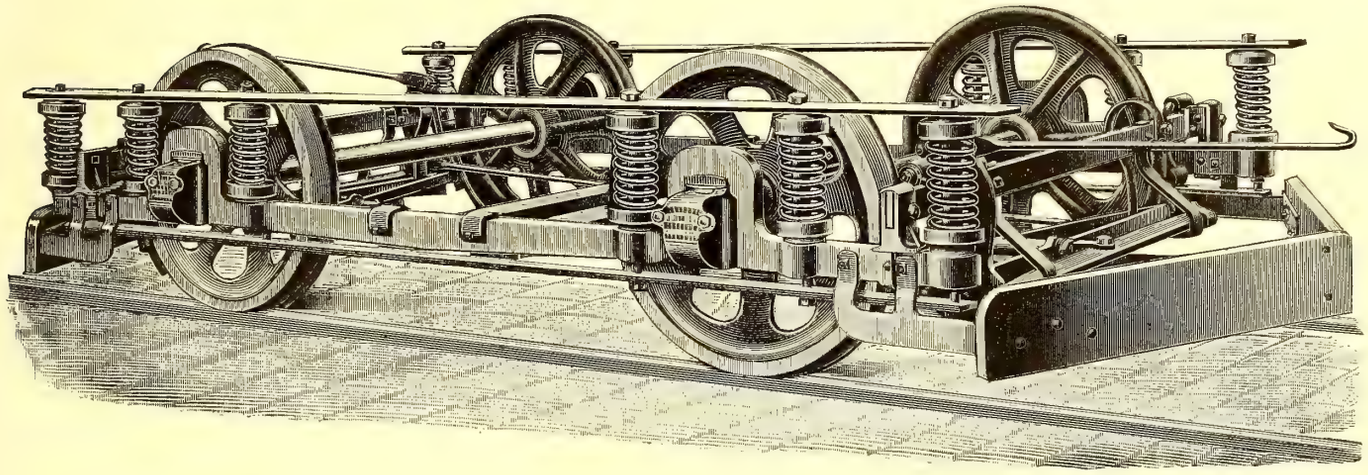
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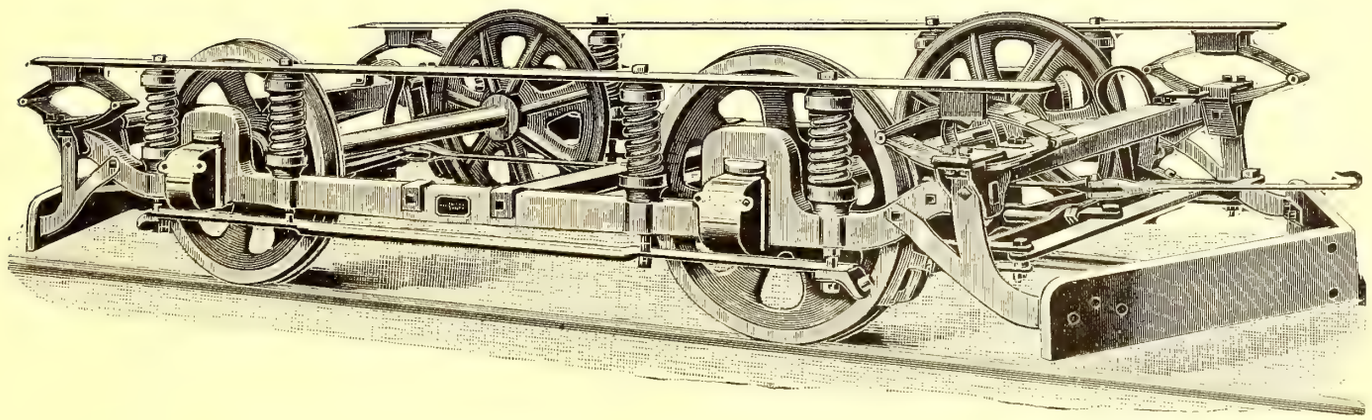
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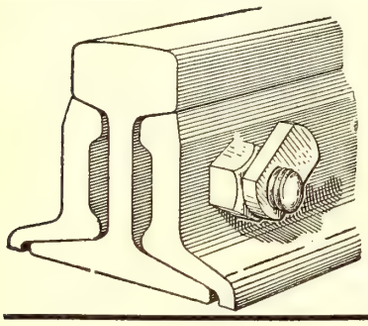
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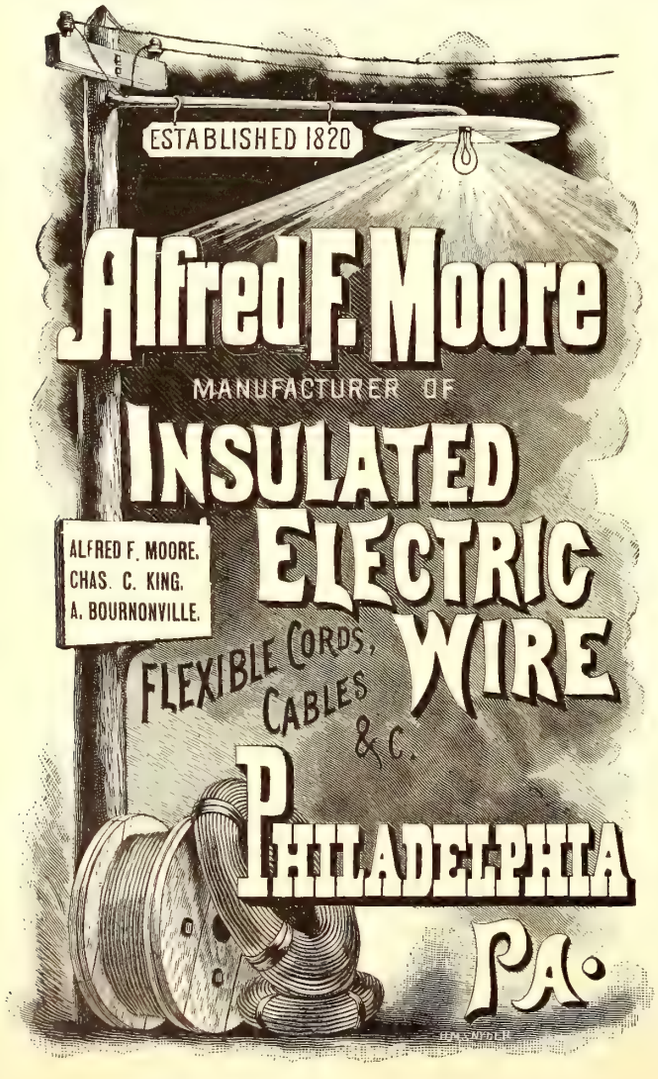
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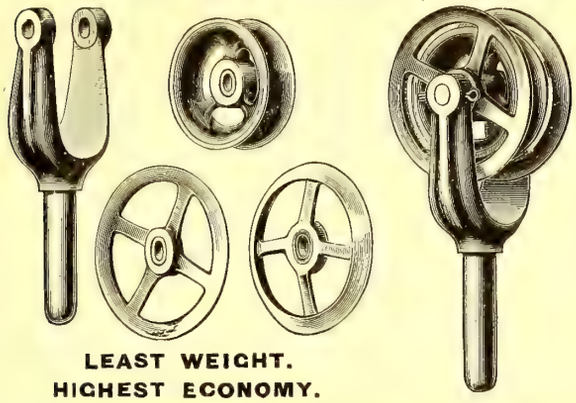
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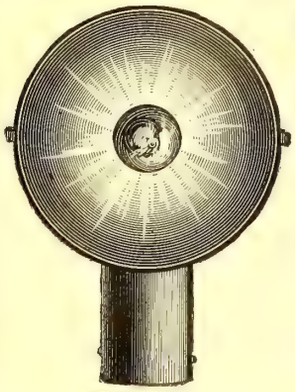
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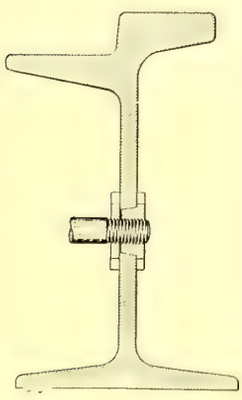
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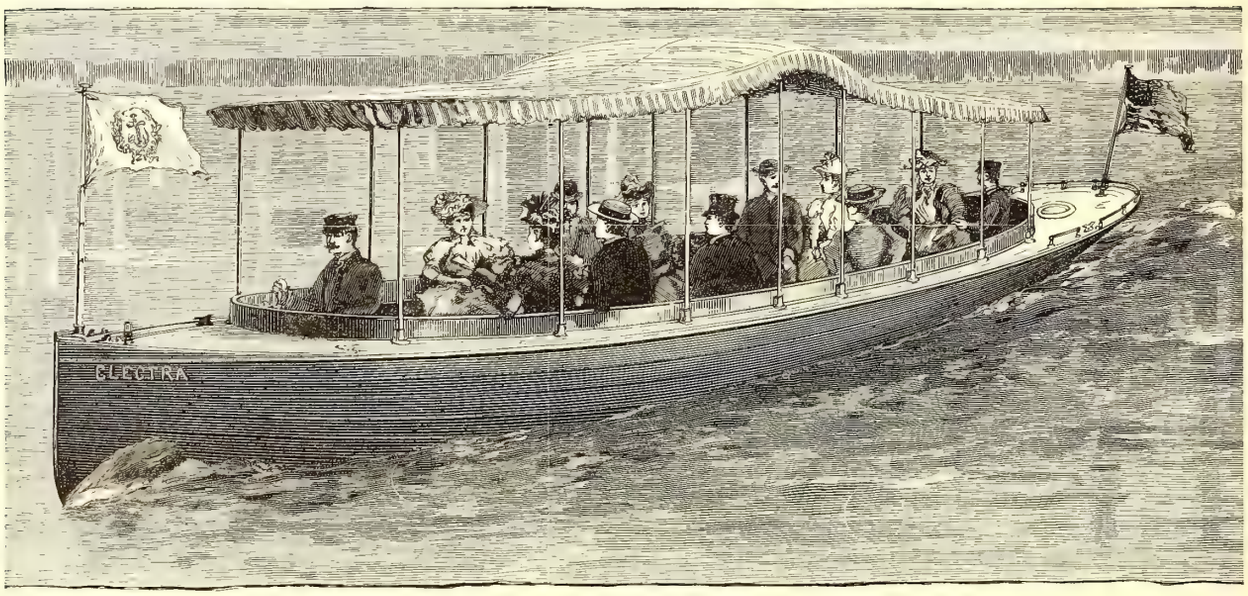
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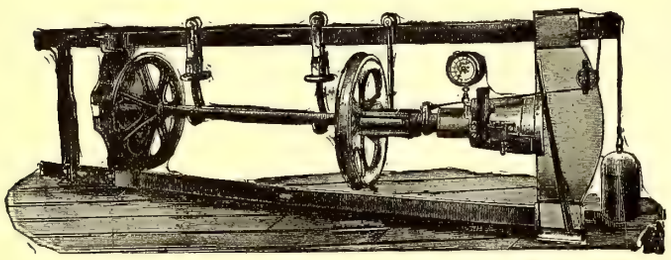
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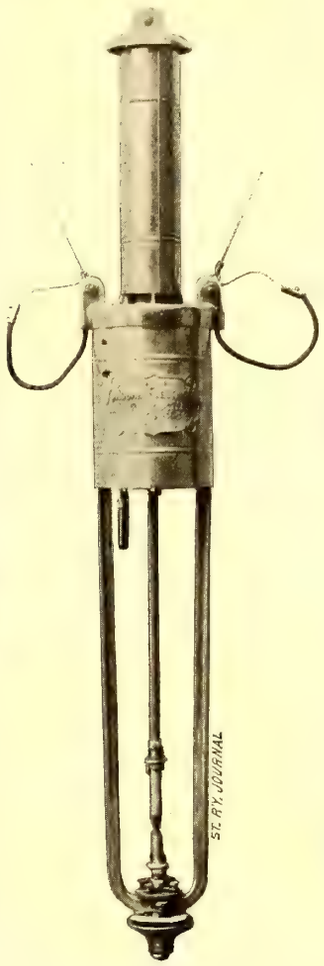


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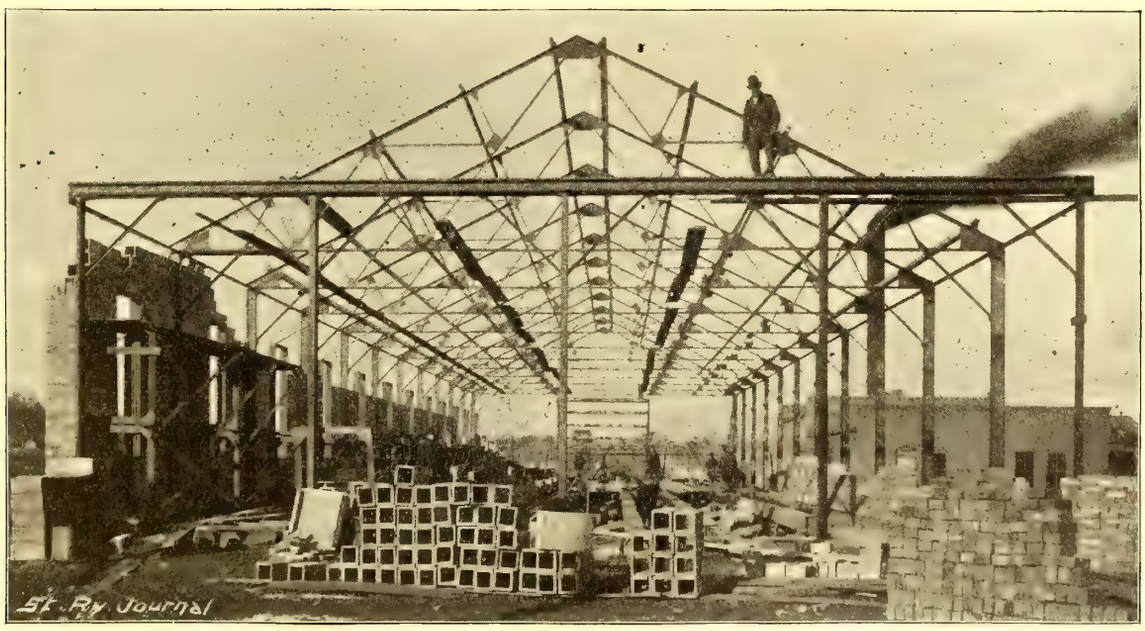
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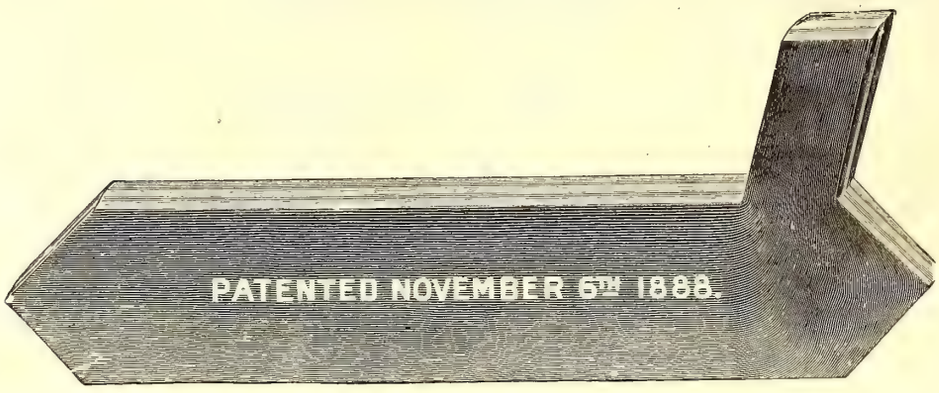
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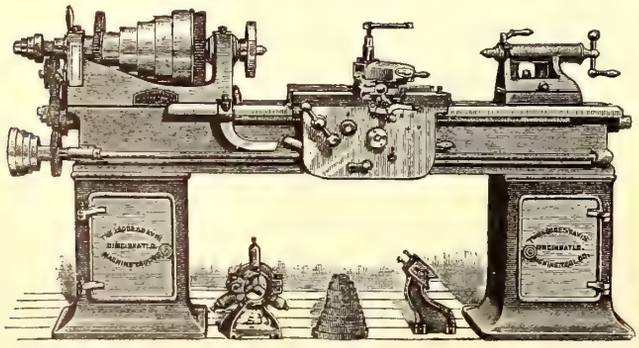
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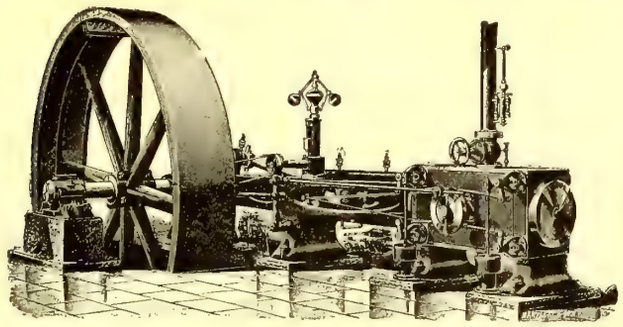
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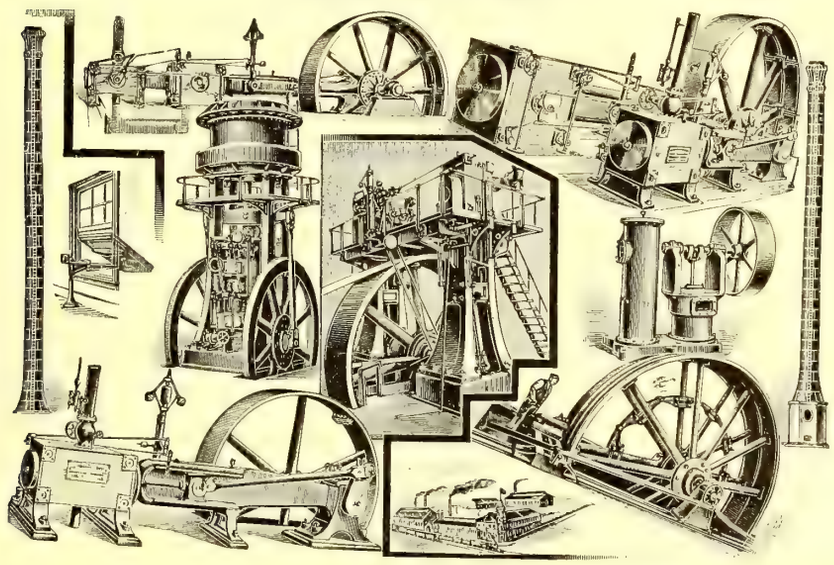
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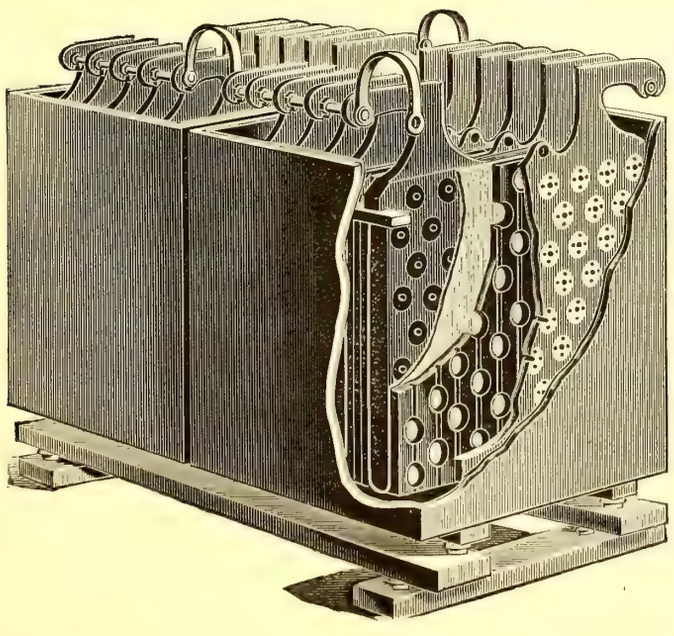
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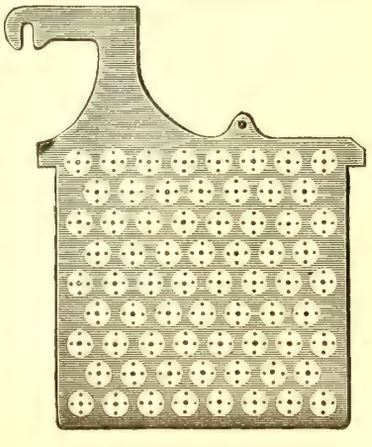
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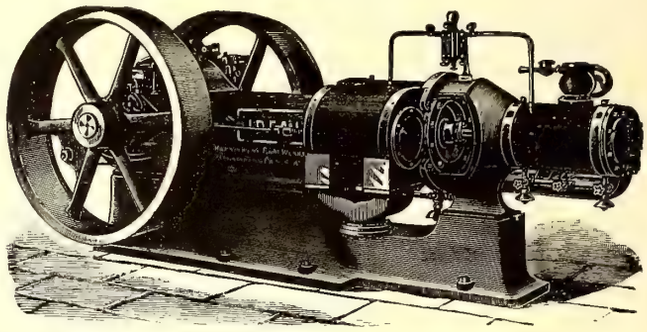
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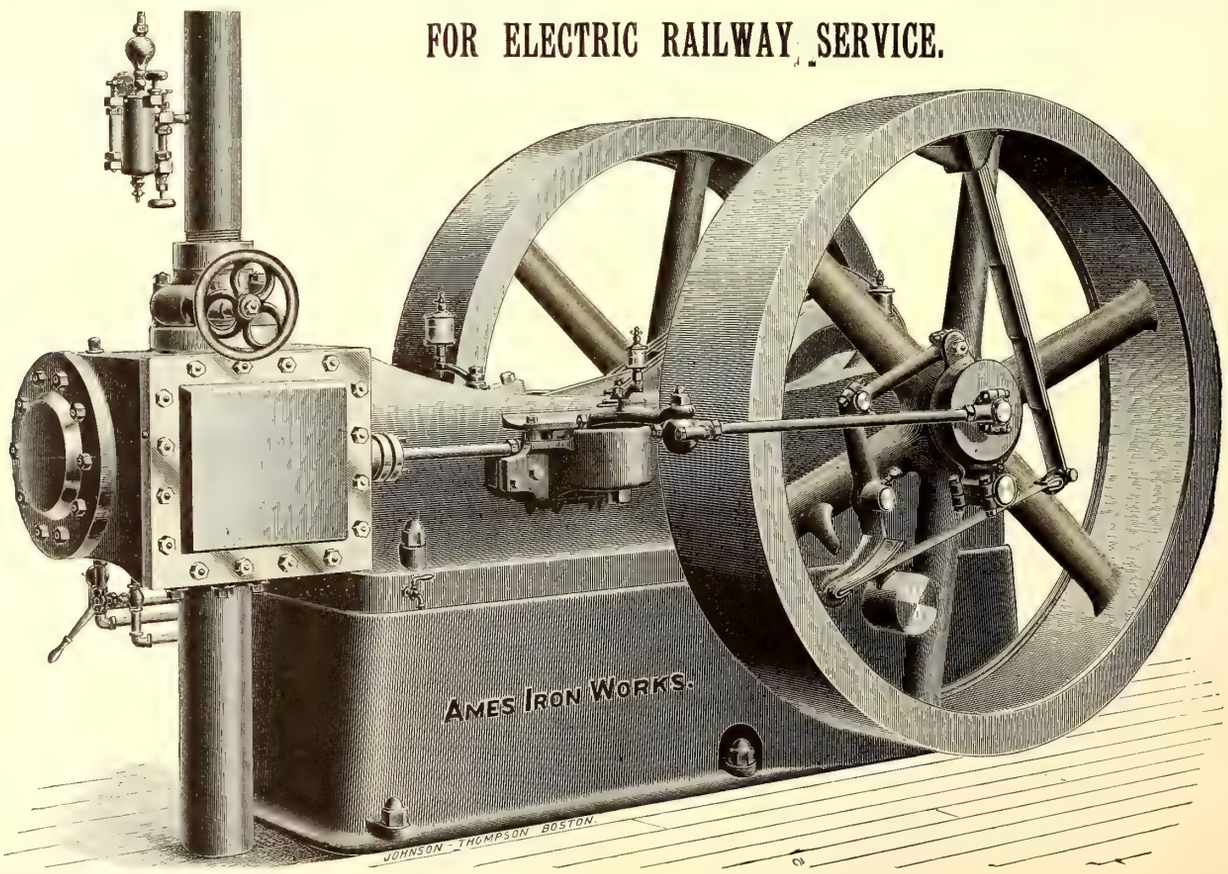
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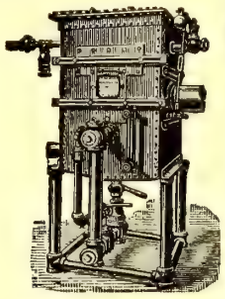
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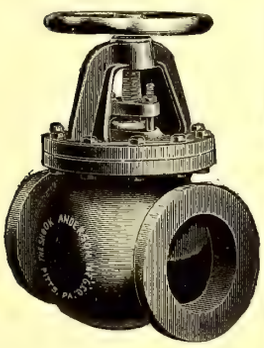
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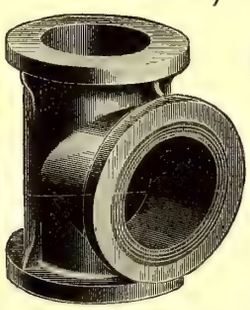
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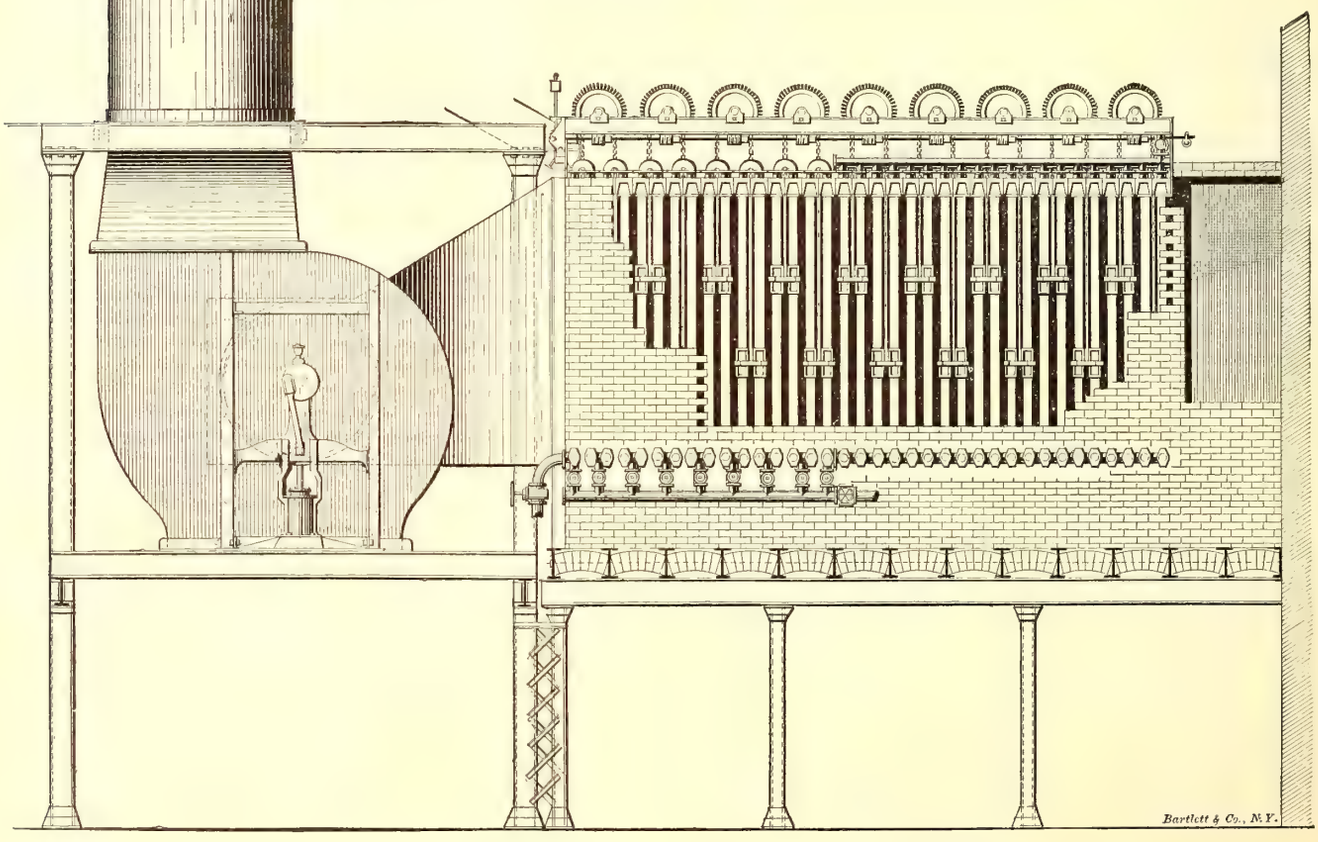
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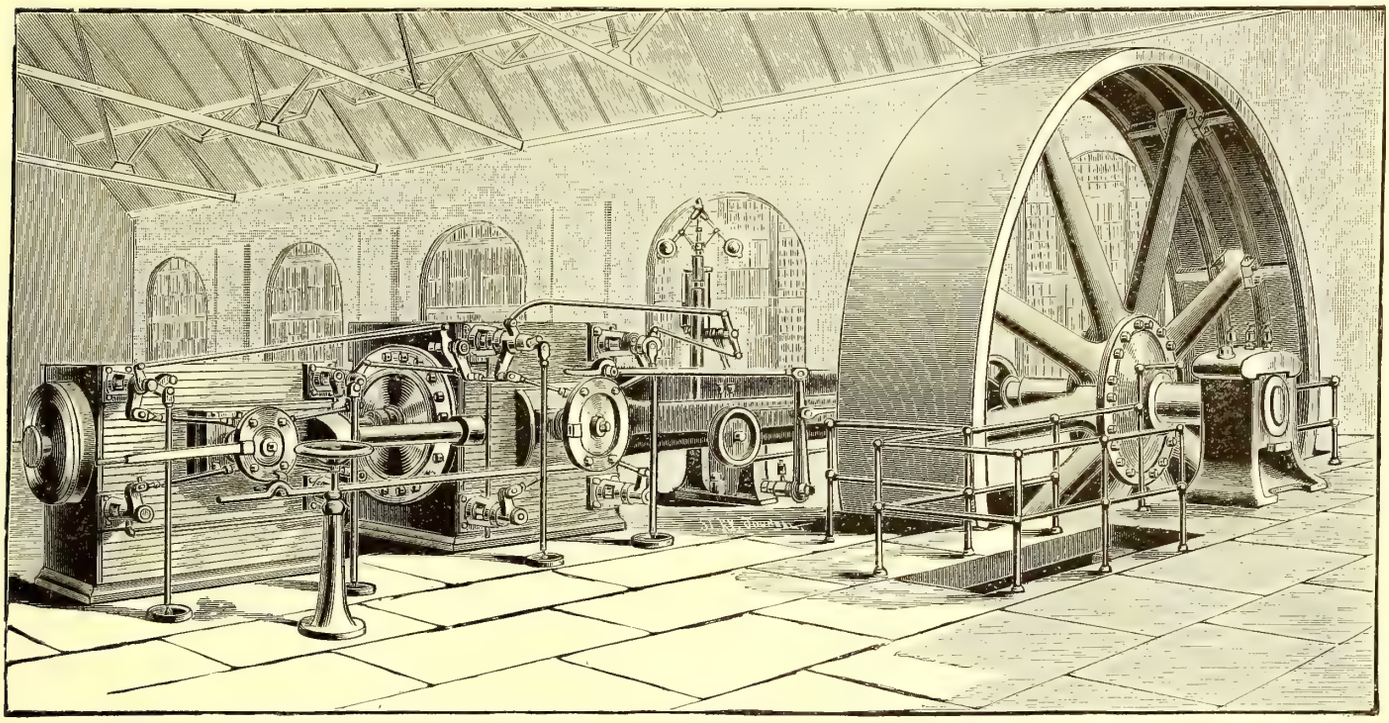
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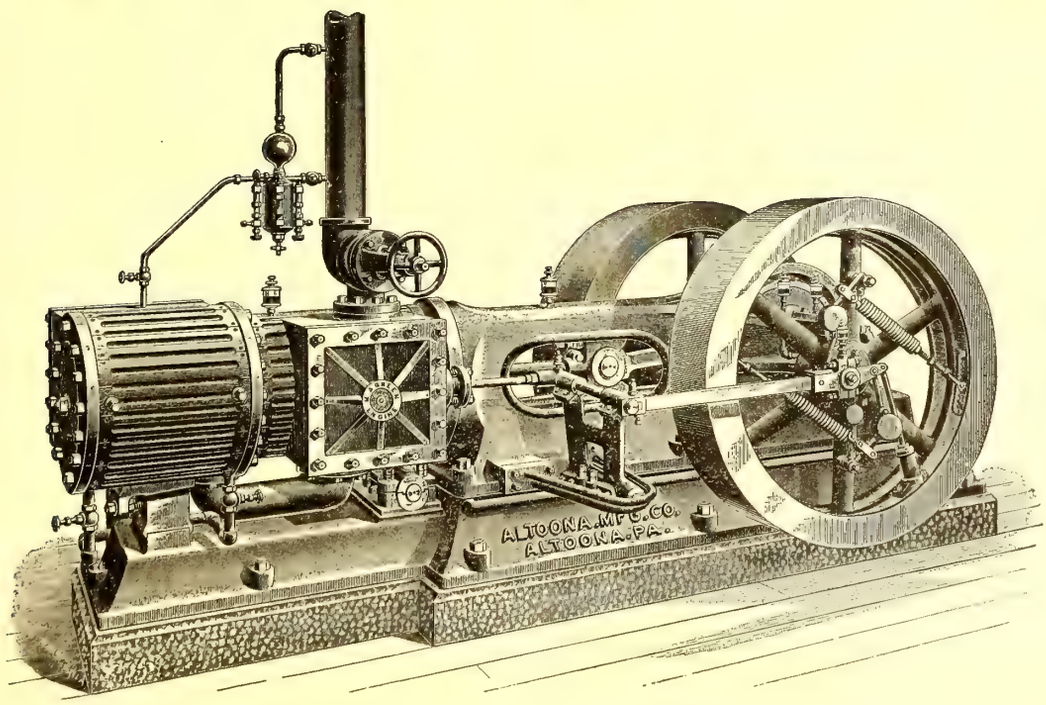


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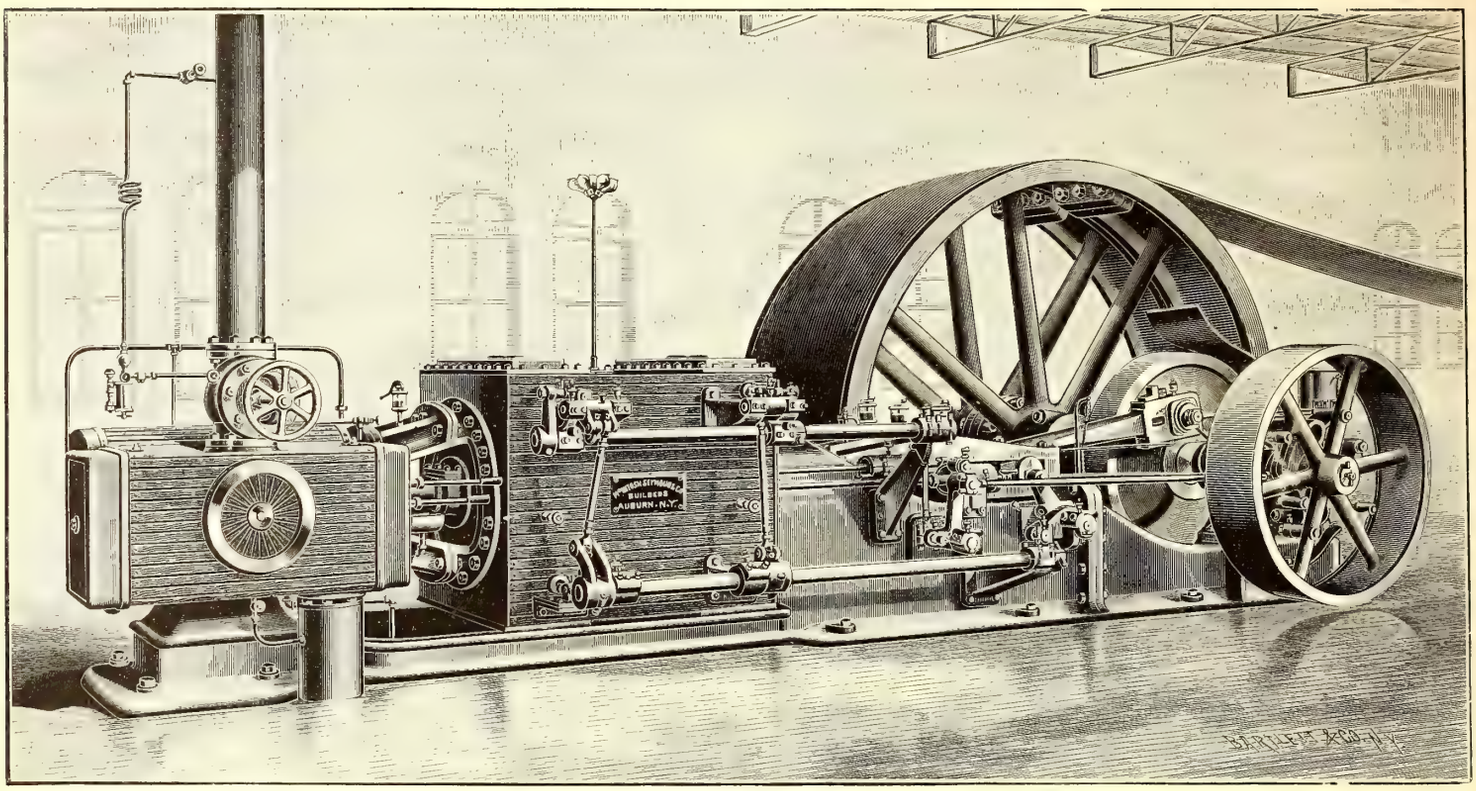
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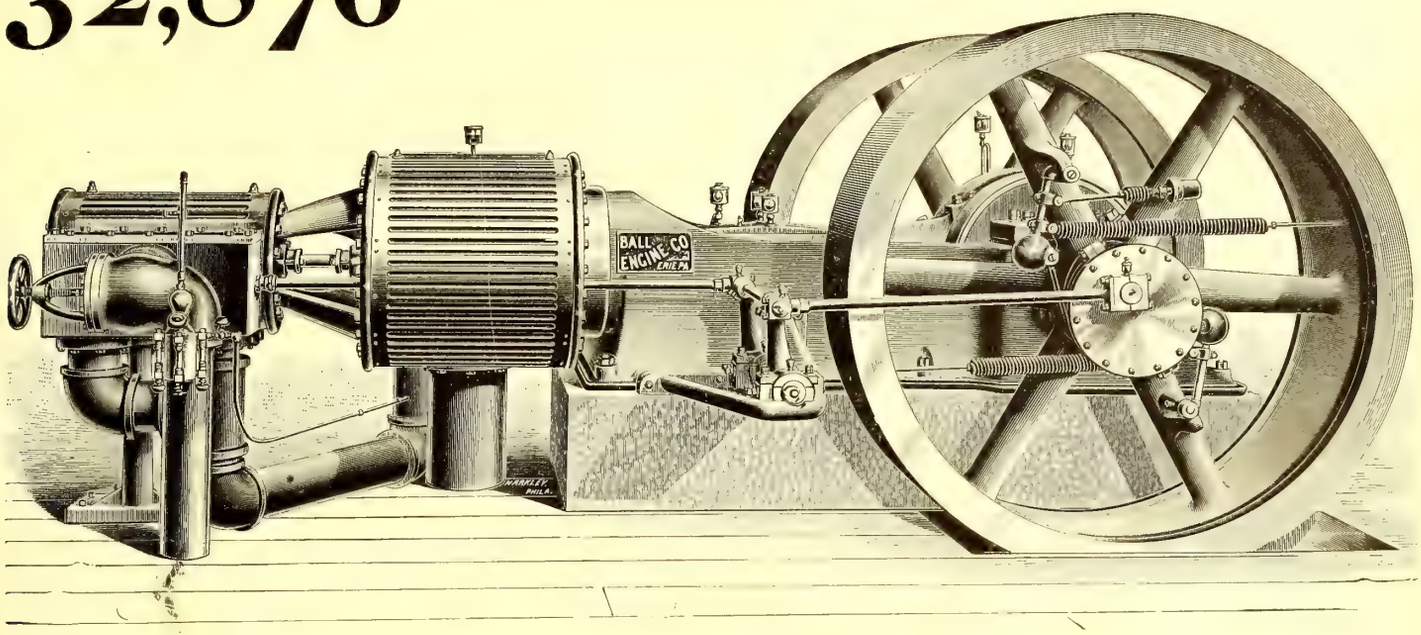
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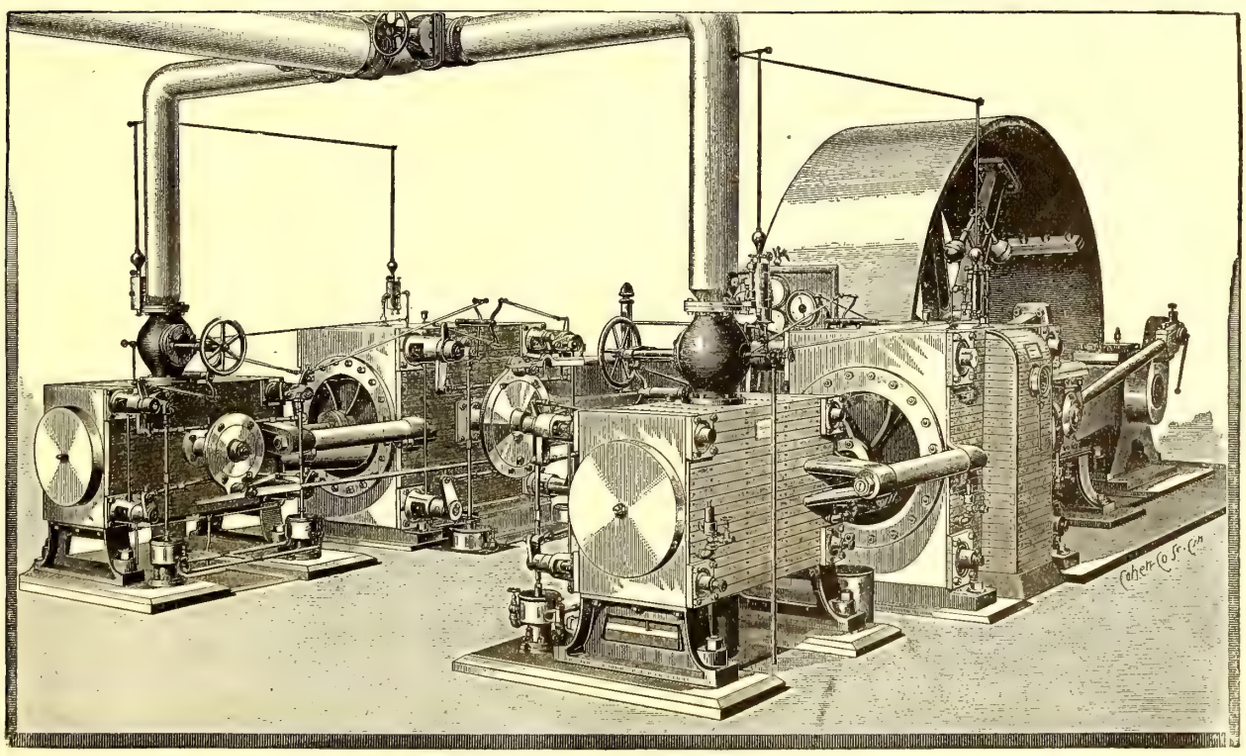
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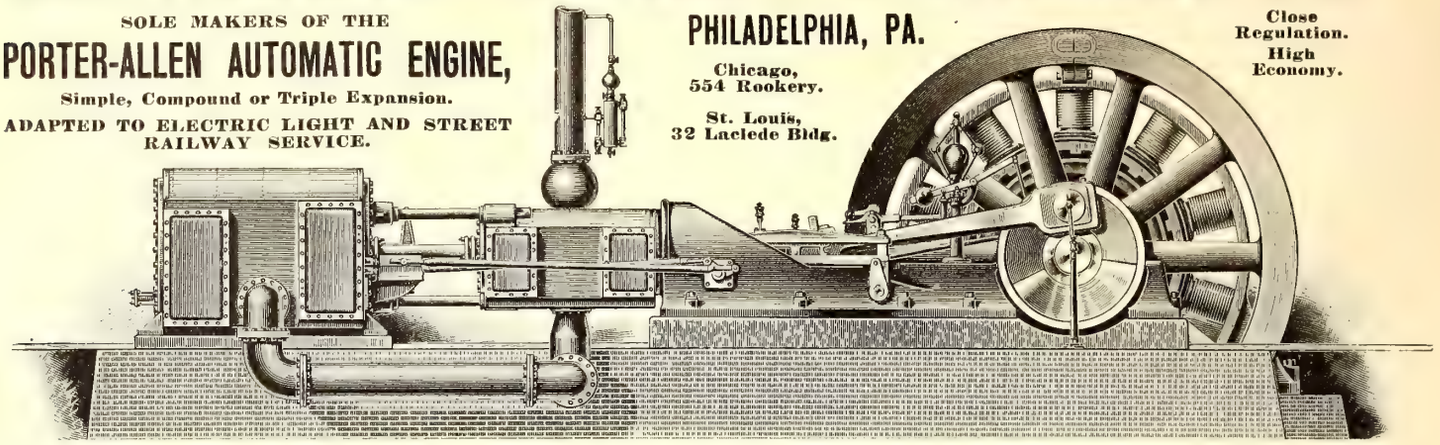
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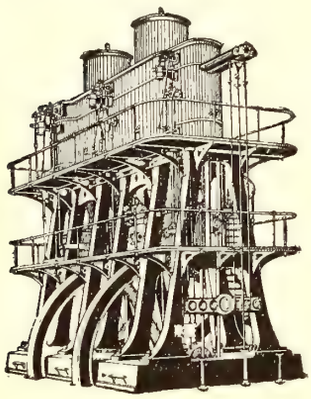
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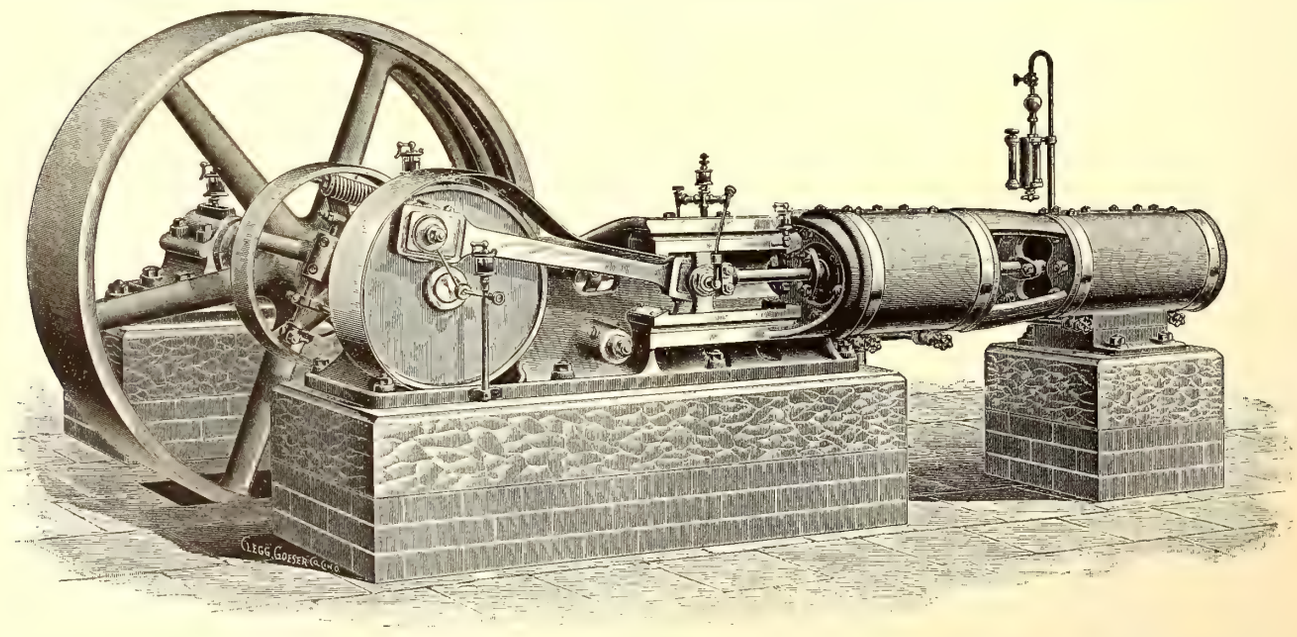
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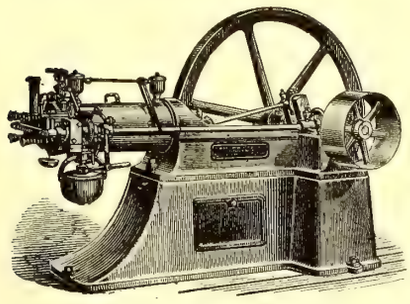
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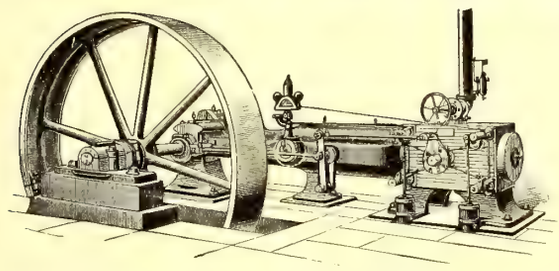
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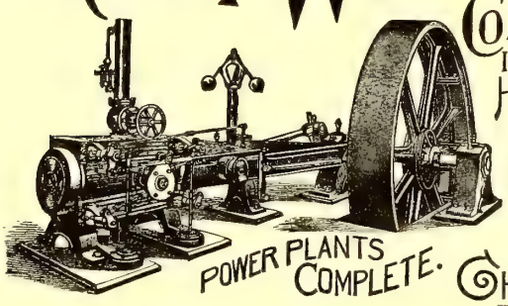
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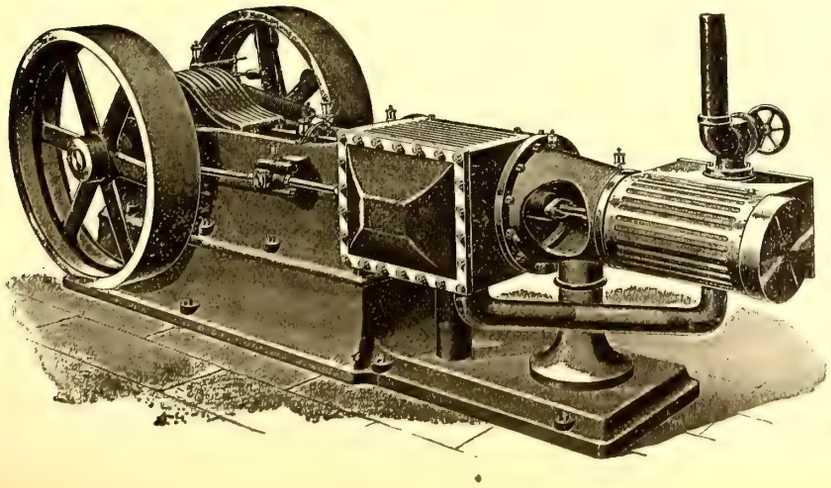
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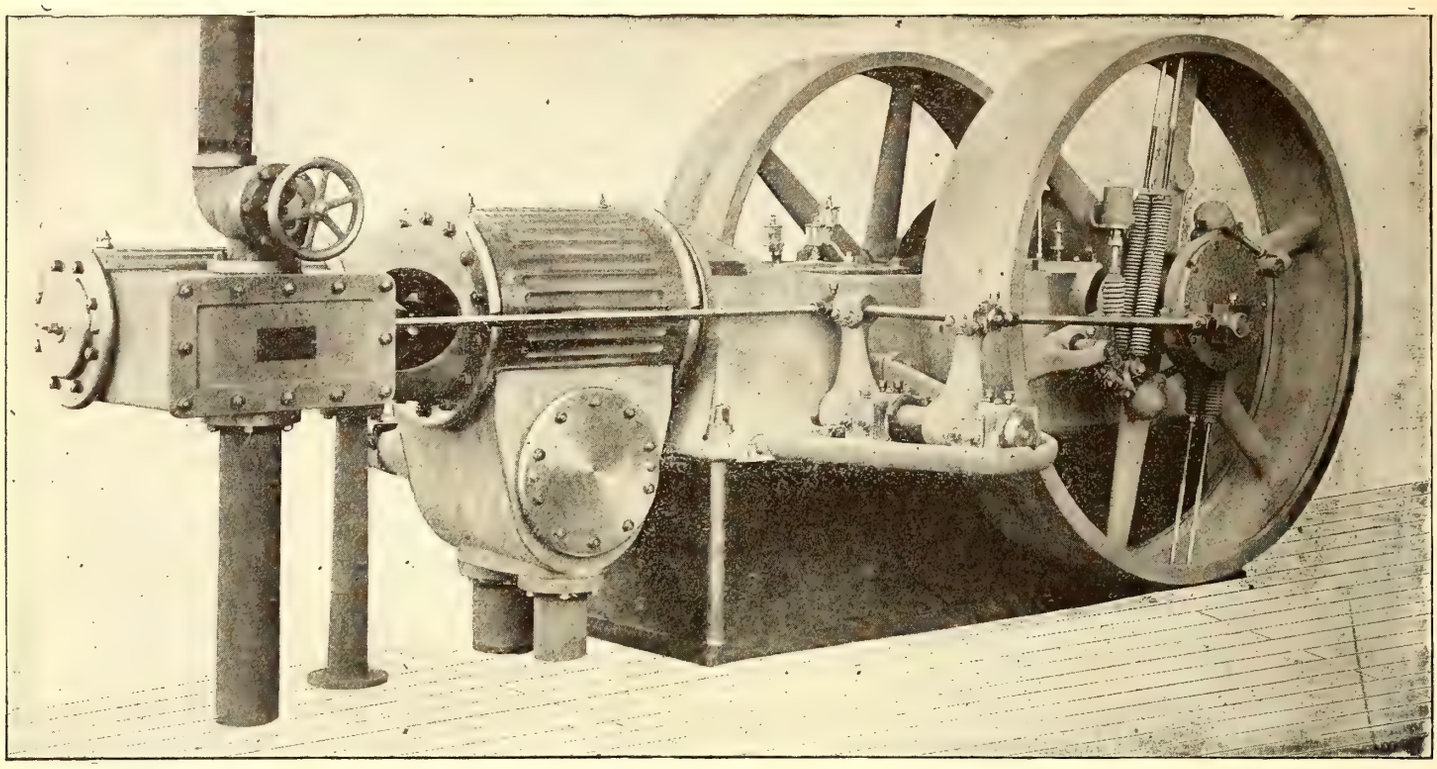
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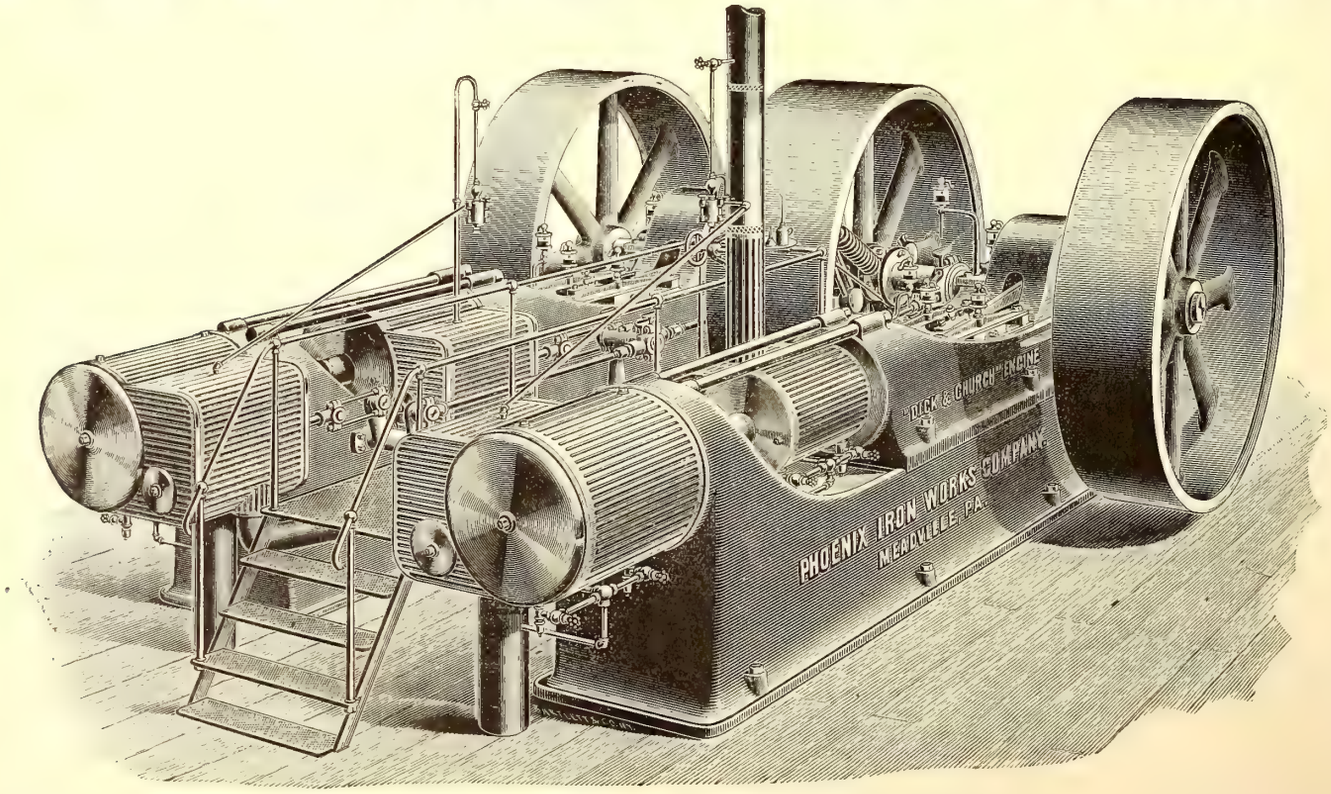
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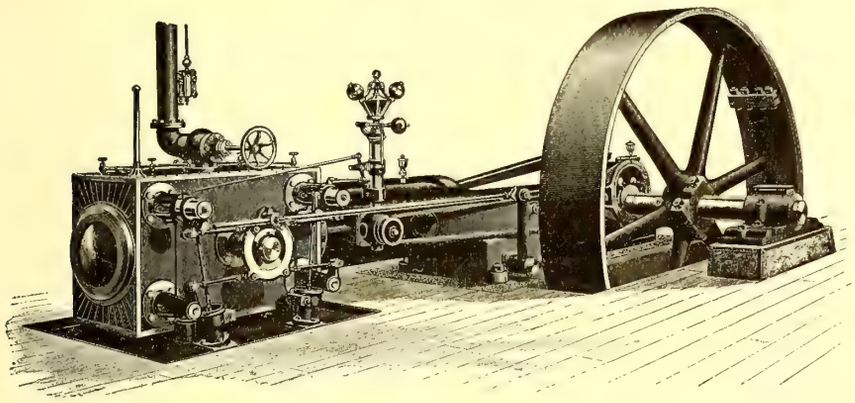
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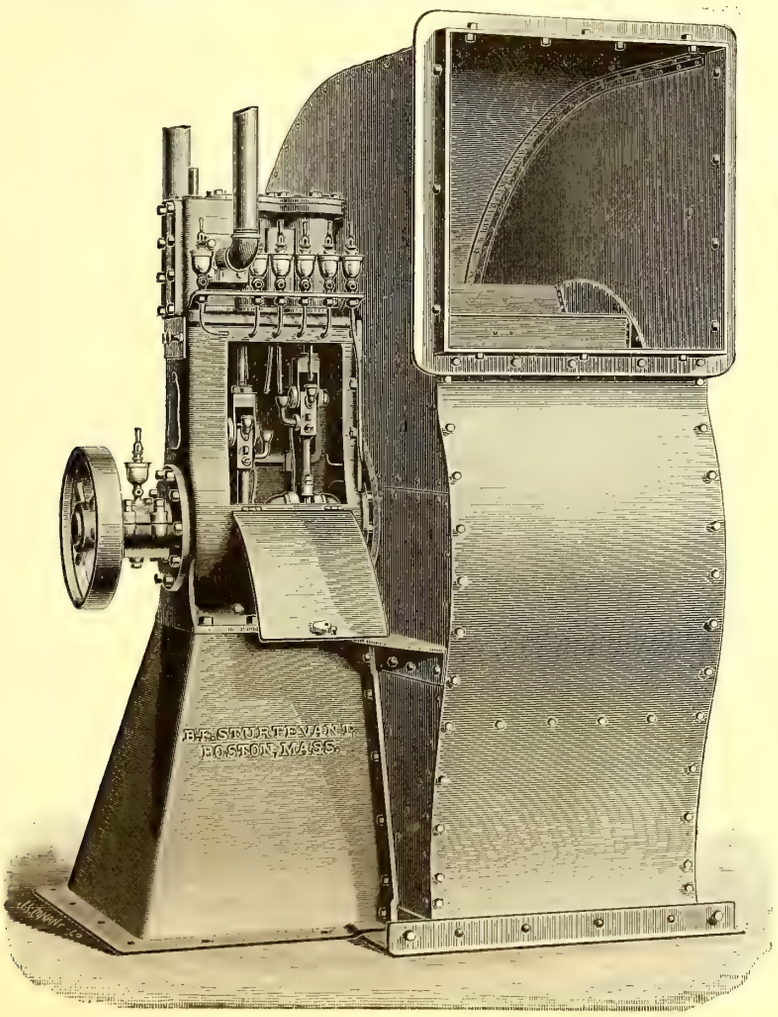
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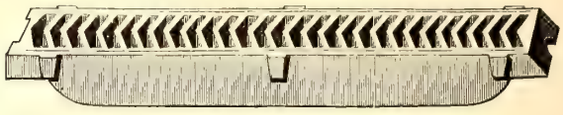
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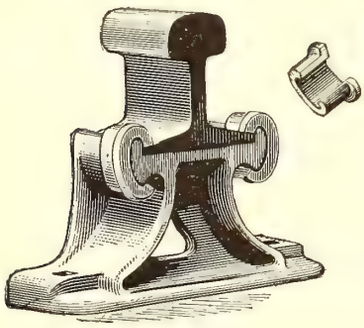
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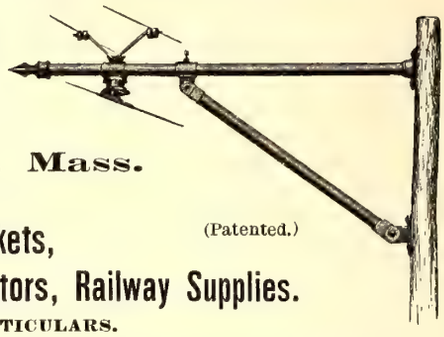
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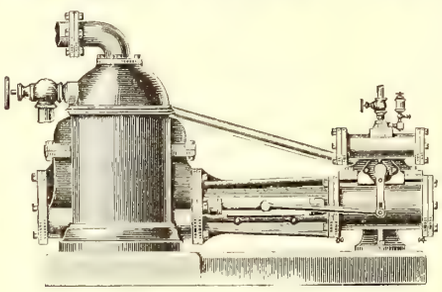
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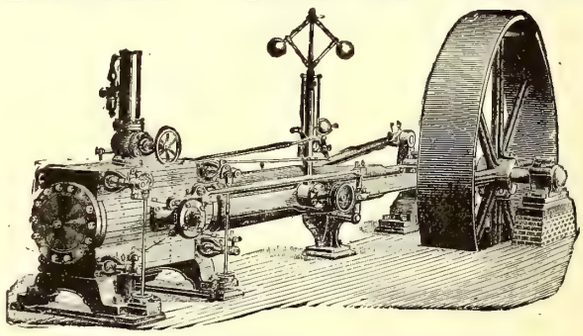
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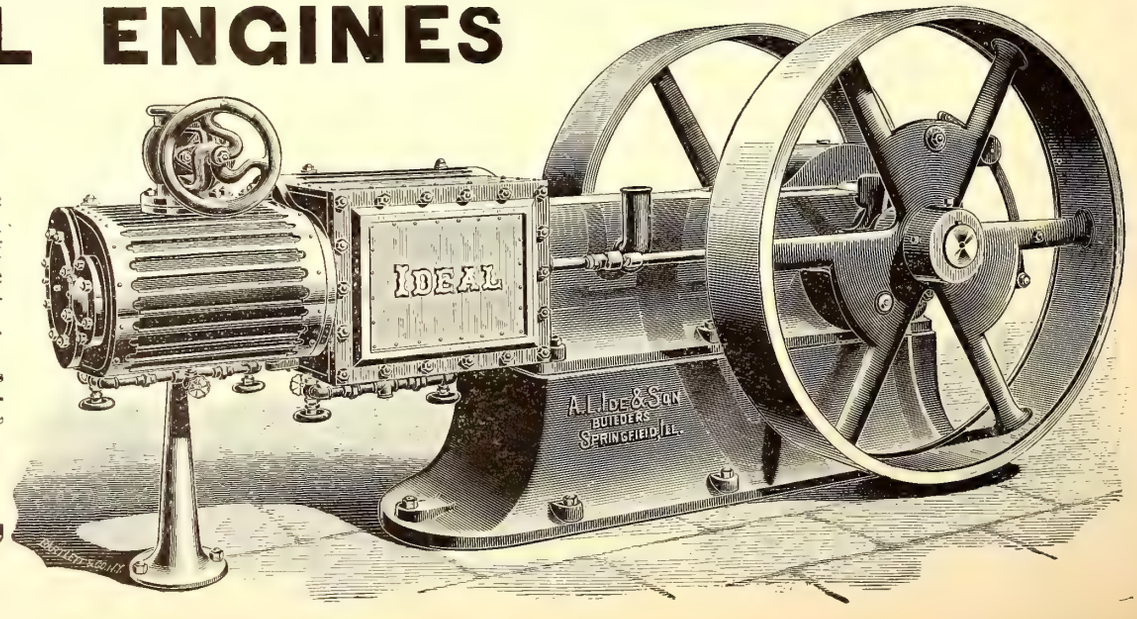
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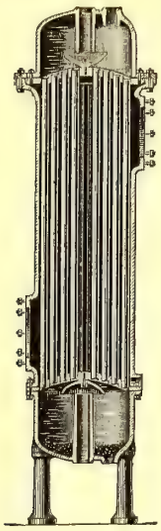
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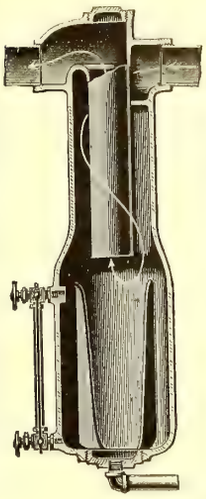
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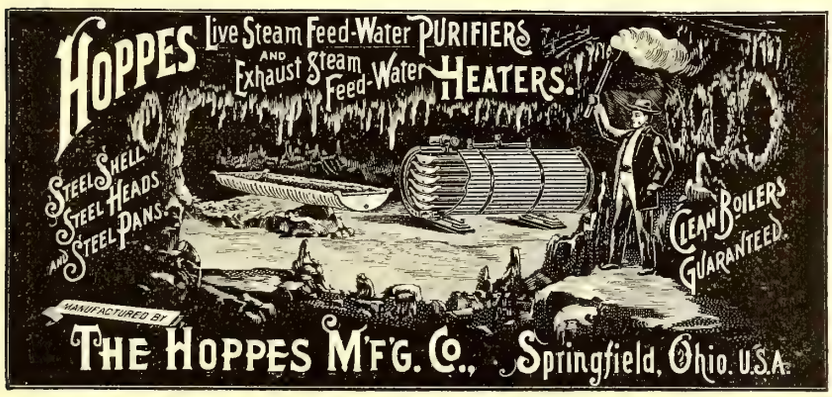
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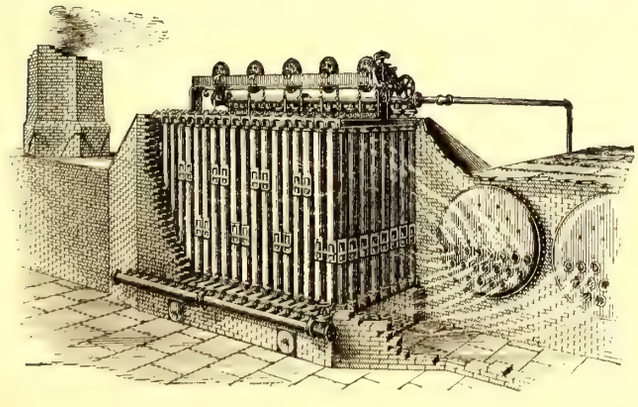
HOPPES PURIFIERS.

Rochester (N. Y.) Railway Co.	2000 H. P
Columbus (O.) Street Railway Co.	1000 "
Calumet Electric Street Railway Co., Burnside Crossing, Ills.	1000 "
Springfield (O.) Railway Co.	300 "
Cincinnati (O.) Street Railway Co.	300 "
Cincinnati (O.) Incline Plane Railway Co.	250 "
Bay City (Mich.) Union Railway Co.	400 "
Topeka (Kans.) Railway Co.	500 "
Kansas City (Mo.) Cable Railway Co.	800 "
City Electric Railway Co., Little Rock, Ark.	750 "
Rapid Transit Street Ry., San Antonio, Tex.	250 "
San Antonio Street Ry. Co., San Antonio, Tex.	250 "
Houston (Tex.) City Railway Co.	200 "

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Sole Makers in the United States of



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Being Applied to Work with NATURAL DRAFT by the Following Electric Railroad Companies.

Brooklyn City Railroad Co., Brooklyn, N. Y.	12,000 H. P.
Intramural Railroad Co., World's Fair	3,500 "
Montreal Street Railroad Co., Montreal, P. Q.	3,000 "
Union Railroad Co., Providence, R. I.	2,000 "
South Chicago City Railroad Co., Chicago, Ill.	900 "
Terre Haute Street Railroad Co., Terre Haute, Ind.	250 "
Lake Cities Electric Railroad Co., Michigan City	150 "

Head Office and Works, Matteawan, N. Y.



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BABCOCK AND WILCOX BOILERS

In use on Electric and Cable Railroads, Nov. 1, 1893.

		H. P.
West End Ry. Co., Boston	4 orders, '89-'92	9,500
The Albany Ry. Albany, N. Y.	3 orders, '89-'92	1,000
The Crosstown St. Ry. Co., Buffalo, N. Y.	3 orders, '90-'93	4,500
Cincinnati St. Ry. Co., Cincinnati, O.	5 orders, '90-'93	3,300
Pittsburgh & Birmingham Traction Co., Pittsburgh, Pa.	July, 1890	1,000
Columbus Elec. St. Ry. Co., Columbus, O.	4 orders	1,807
Aurora St. Ry. Co., Aurora, Ill.	2 orders, '90-'92	832
People's St. Ry. Co., St. Joseph, Mo.	2 orders, '89-'93	1,040
Duluth St. Ry. Co., Duluth, Minn.	4 orders, '90-'93	1,312
Brooklyn City Ry. Co., Brooklyn, N. Y.	6 orders, '91-'93	16,500
Rochester St. Ry. Co., Rochester, N. Y.	2 orders, '91-'92	808
Merrimac Valley R. R. Co., Lawrence, Mass.	3 orders, '91-'93	896
Citizens' Ry. Co., Indianapolis, Ind.	August, 1891	600
Union R. R. Co., New York	2 orders, '91-'92	1,500
Lynn & Boston R. R., Boston, Mass.	3 orders, '91-'92	4,000
Globe St. Ry. Co., Fall River, Mass.	February, 1892	675
Houston City Ry. Co., Houston, Tex.	2 orders, '90-'92	492
City & Suburban Ry. Co., Savannah, Ga.	March, 1892	500
Seashore Elec. Ry., Asbury Park, N. J.	May, 1892	640
Atlantic Ave. Ry. Co., Brooklyn, N. Y.	3 orders, '92-'93	3,000
Carrollton Elec. Ry. Co., New Orleans, La.	May, 1892	624
Intramural Elec. Ry. Co., World's Fair	1892-1893	3,500
Market Street Elec. Ry. Co., San Francisco, Cal.	3 orders	2,208
Cincinnati, Newport & Covington Ry. Newport, Ky.		600
Union Ry. Co., Providence, R. I.	December, 1892	1,500
Atlantic Improvement Co., Long Island City, N. Y.	February, 1893	1,000
Philadelphia Traction Co., Philadelphia	March, 1893	6,000
Camden, Gloucester & Woodbury Elec. Co., Gloucester, N. J.		750
Union Depot Ry. Co., St. Louis, Mo.		1,000
Haverhill & Groveland St. Ry. Co., Haverhill, Mass.	1892	630
Columbus Elec. Ry. Co., Columbus, O.	1890	692
New York & Brooklyn Bridge, Brooklyn	3 orders, '82-'91	1,248
Washington & Georgetown R. R., Washington, D. C.	4 orders	1,923
Cleveland City Cable Ry. Co., Cleveland, O.	March, 1890	1,086
Valley City St. & Cable Ry. Co., Grand Rapids, Mich.		781
Chicago City R. R. Co., Chicago, Ill.	April, 1881	1,000
Grand Ave R. R. Co., Kansas City, Mo.	2 orders, '86-'88	800
Metropolitan St. Ry. Co., Kansas City, Mo.	3 orders, '86-'88	1,800
Denver City Cable Ry. Co., Denver, Colo.	2 orders, '89-'91	1,600
The Melbourne Tramways, Melbourne, Australia	1884-1885	1,040

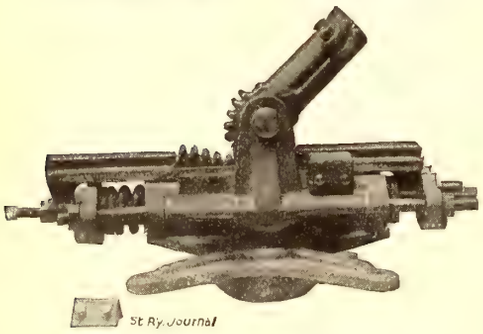
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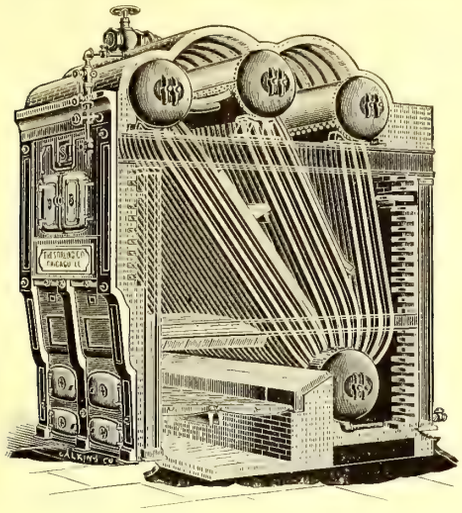
It treats fully of Electric, Cable, Horse and other Surface Roads, including those operated by Steam, Air and Gas Motors, also Elevated, Inclined Plane and Rack Rail Systems. A whole chapter is devoted to track construction for each method of traction; with an itemized bill of cost. Another treats of Franchises and Corporations and Laws relating to the same. A third relates to Discipline, and gives a classified set of rules for the guidance of conductors and drivers, which have been compiled from the best practice.

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" " " " " ...Second order,	2000
Toledo Consolidated Street Ry., Toledo, O.....First order,	600
" " " " " .....Second order,	600
Waco Electric Ry. & Light Co., Waco, Tex.....First order,	300
" " " " " .....Second order,	150
" " " " " .....Third order,	150
Second Avenue Electric Ry., Pittsburgh.....	200
Jamestown Street Ry., Jamestown, N. Y.....	300
San Francisco & San Mateo Railway, San Francisco.....	1250
Los Angeles Consolidated Electric Ry., Los Angeles, Cal.....	1500
Cleveland City Cable Railway.....	750

	H. P.
Ottumwa Electric Railway, Ottumwa, Ia.....	750
Evansville Street Railway, Evansville, Ind.....	750
St. Joe & Benton Harbor Street Railway, St. Joseph, Mich,...	400
Pittsburgh & West End Electric Railway, Pittsburgh.....	612
South Chicago City Railway, South Chicago.....	900
The Lafayette Street Railway, Lafayette, Ind.....	500
Union Railway, New York City.....	1000
The Compton Heights & Union Depot, St. Louis, Mo.....	2700
Union Street Railway, Providence, R. I.....	500
Portland Street Railway, Portland, Me.....	250
Cincinnati, Covington & Newport, Cincinnati, O.....	500

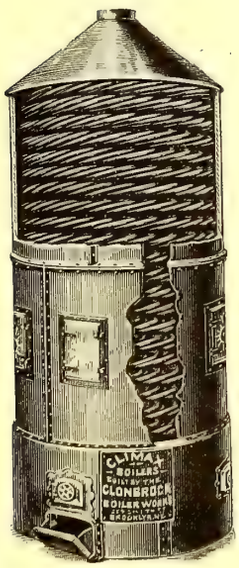
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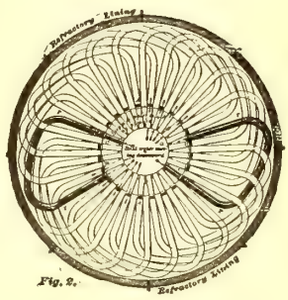


Fig. 2.

HAS BEEN ADOPTED BY THE FOLLOWING TRACTION COMPANIES:

The Baltimore Traction Co., Baltimore, Md.....	3 orders.....	4,000	H P.
Brooklyn City & Newtown R. R. Co., Brooklyn, N. Y.....	3 orders.....	4,000	"
Coney Island & Brooklyn R. R. Co., Brooklyn, N. Y.....	3 orders.....	1,400	"
Essex County Electric Railway Co., Orange, N. J.....	3 orders.....	800	"
Fort Lee Electric Railway Co., Fort Lee, N. J.....	2 orders.....	800	"
Newark Electric Street Ry. Co., Mechanic St., Newark, N. J....	3 orders.....	5,000	"
New Britain Electric Street Railway Co., New Britain, Conn...	2 orders.....	1,000	"

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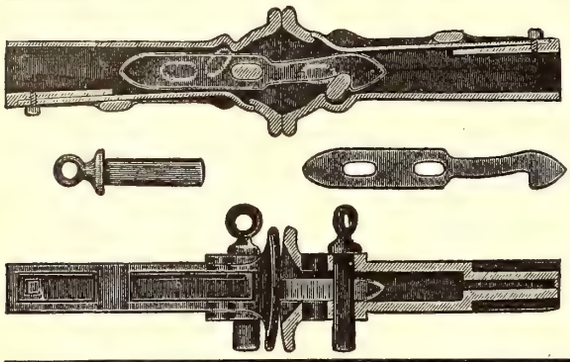
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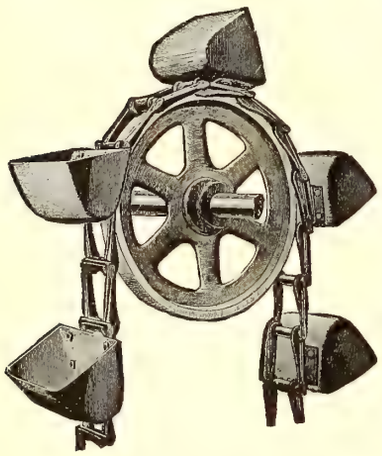
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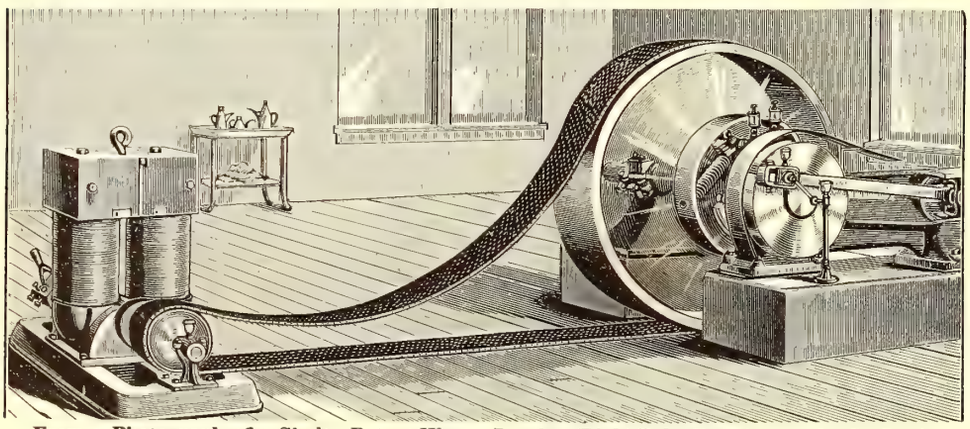
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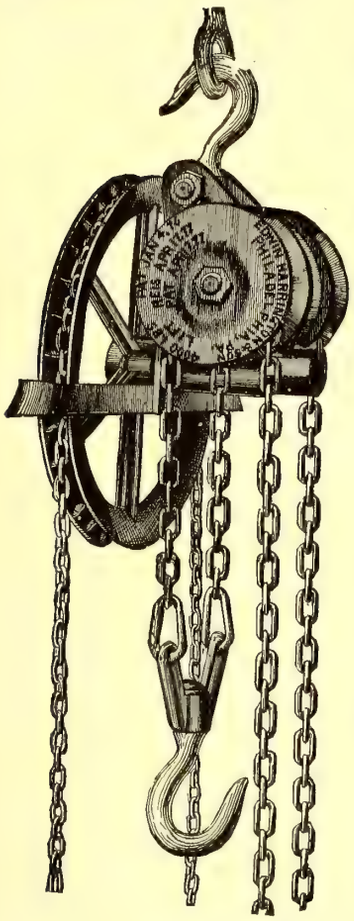
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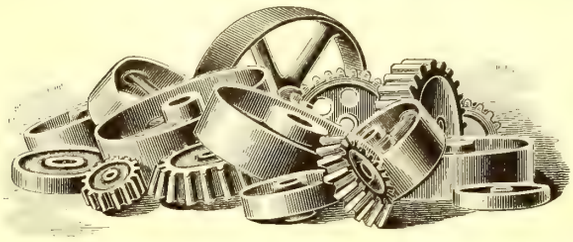
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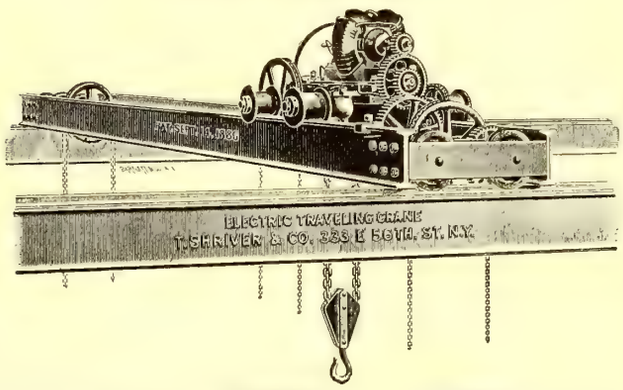


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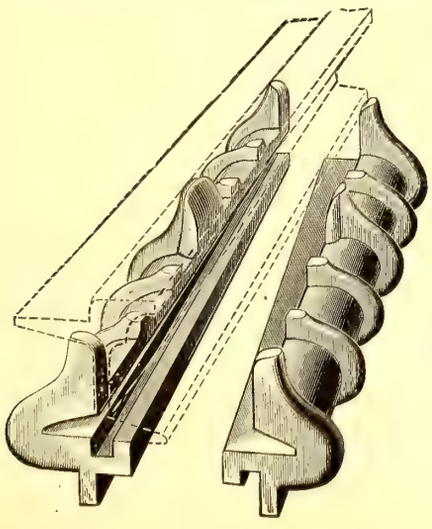
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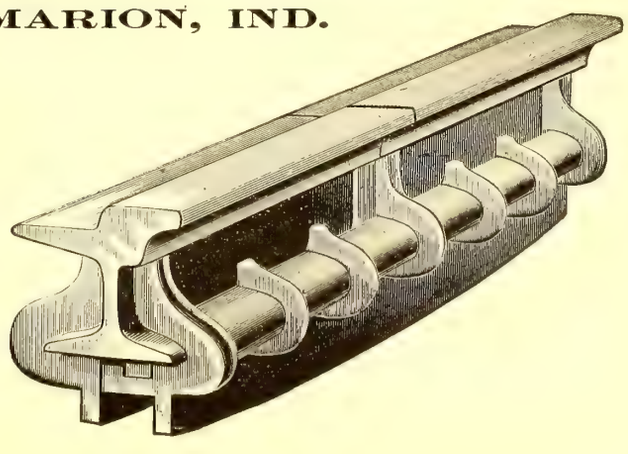
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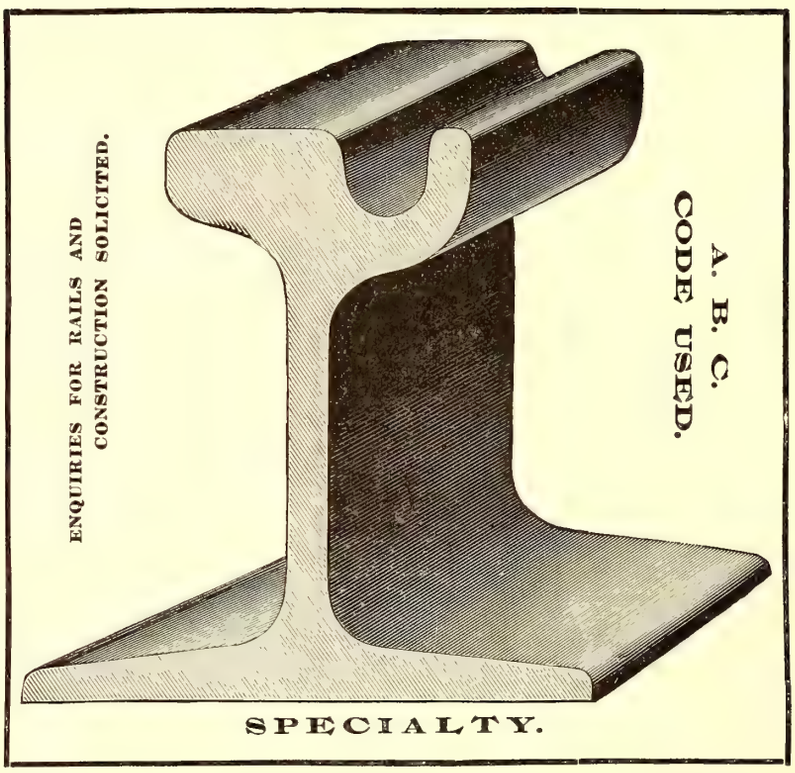
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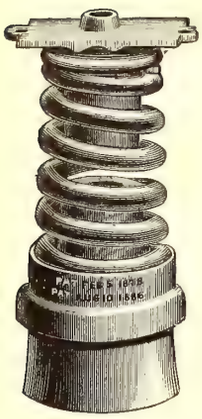
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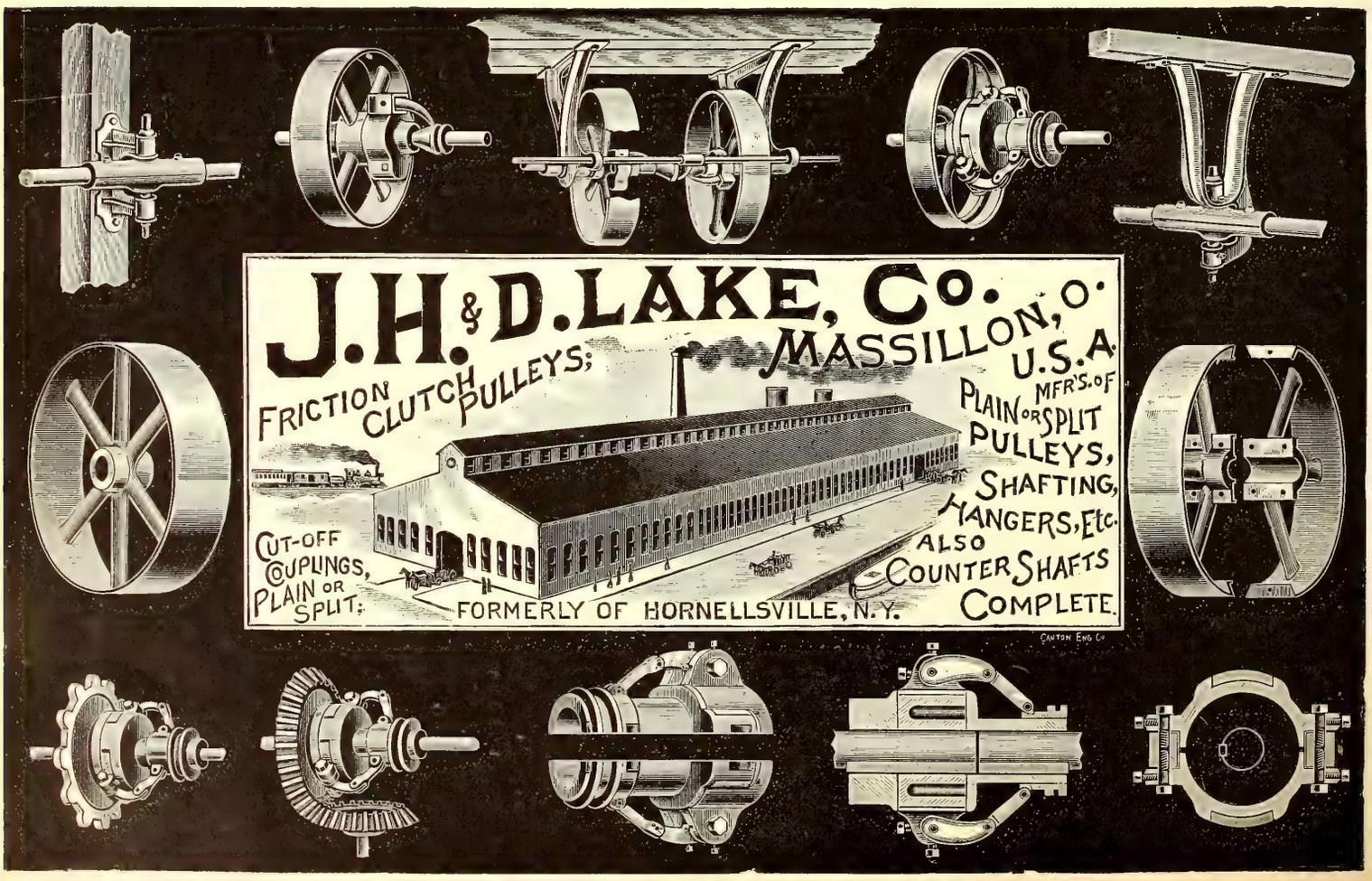
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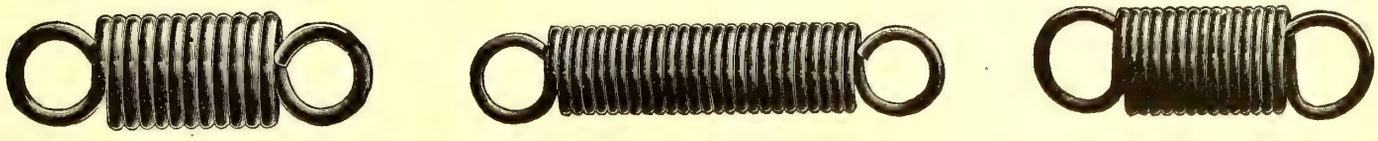
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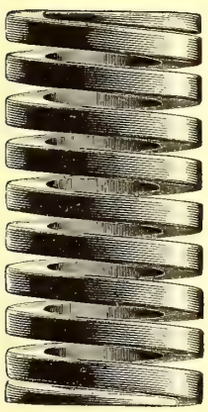




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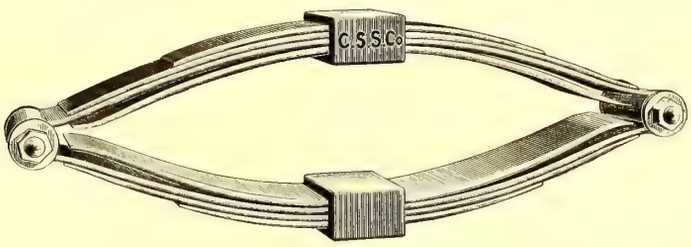


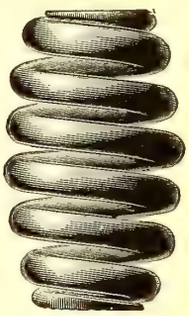
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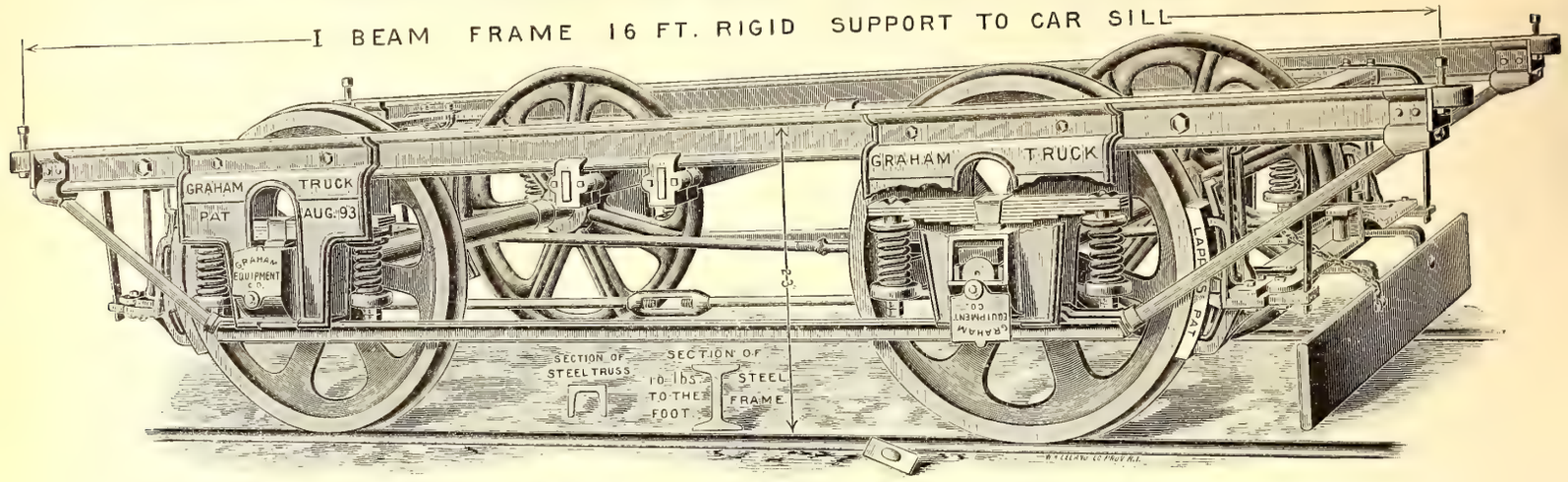
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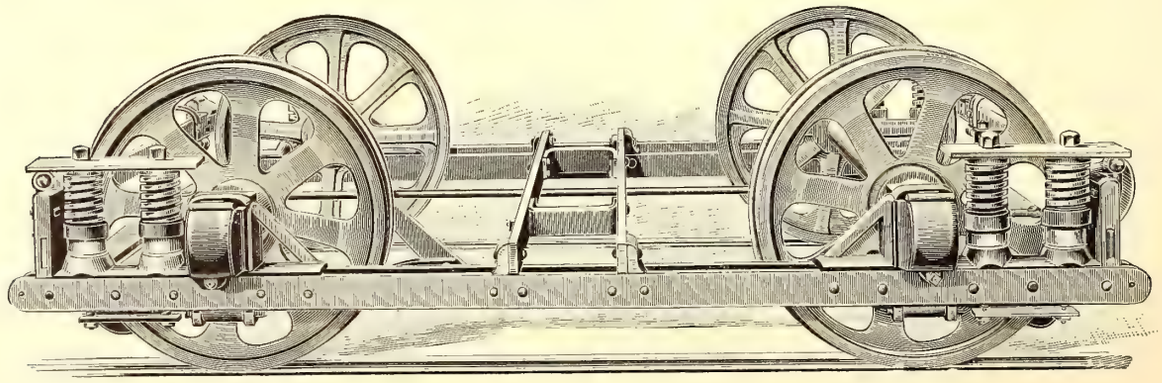
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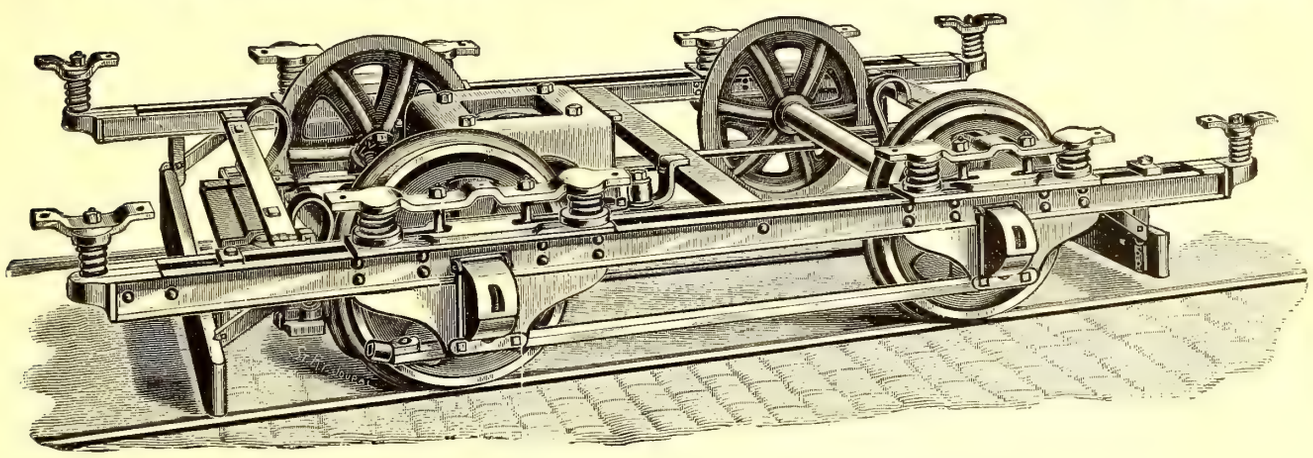
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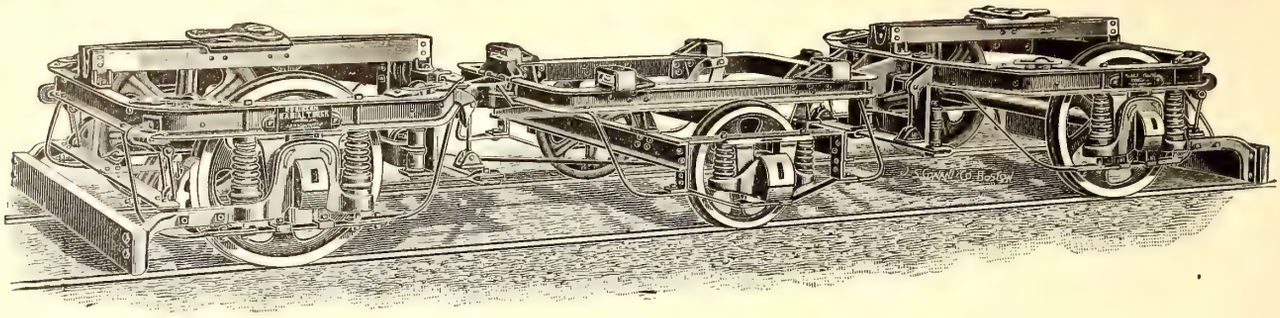
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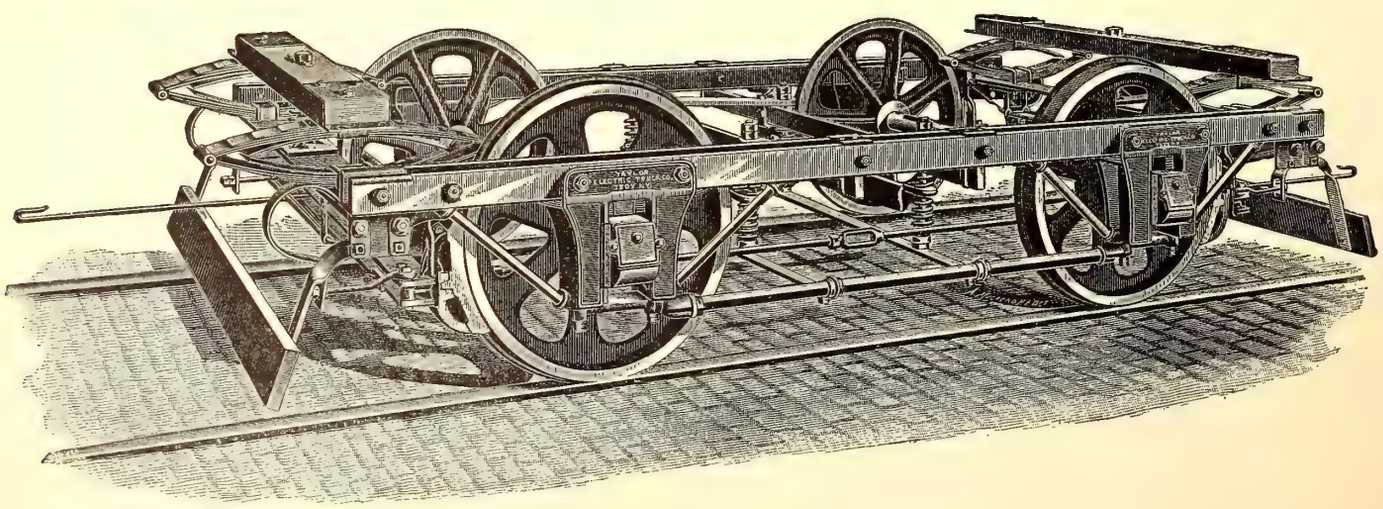
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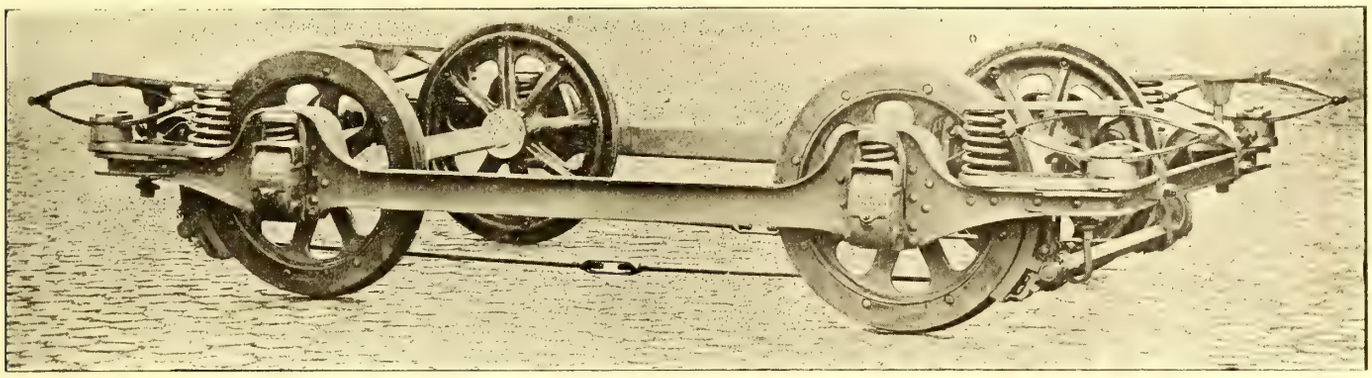
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GENTLEMEN:—In response to your inquiry as to the cost of maintenance, braking and riding qualities of your truck, I take pleasure in stating:

The eighty-five trucks which were purchased from your company, of the type called "Columbia," have been for some time in use under our eighteen foot vestibule bodies, and have given us entire satisfaction, both in regard to riding qualities and cost of repairs. I believe this truck to be the best riding truck in this company's service, and the brake is both efficient and durable. The repairs upon these trucks have been less than the repairs upon any other type of truck which we are using. In brief, they are in all respects satisfactory.

Very truly yours,
J. N. BECKLEY.

NEW ORLEANS & CARROLLTON RAILROAD COMPANY.

NEW ORLEANS, April 1, 1893.

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GENTLEMEN:—We have in use forty of your trucks; we bought them because we believed they were the best trucks made. They are better than we thought they were. The best proof of the entire satisfaction which they have given us, is that we have just ordered twenty more. The "Boss" truck. Yours truly,
CHRIS. V. HAILLE, Superintendent.
W. N. SHEAFF, Superintendent Motive Power.

THE TOLEDO CONSOLIDATED STREET RAILWAY COMPANY.

TOLEDO, O., April 26, 1893.

McGUIRE MANUFACTURING COMPANY, CHICAGO, ILL.

GENTLEMEN:—We are so well pleased with the twenty "Columbian" trucks recently purchased of you, that you may now enter our order for ten additional trucks of the same pattern.

Respectfully yours,
(Signed) ALBION E. LANG, Vice-President and General Manager.

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GLENWOOD STATION, PITTSBURGH, PA., MARCH 10, 1893.

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Your "Columbia" truck gives us perfect satisfaction and solves the problem of an easy riding truck on a rough track; also I think it is the most substantial truck in the market.

JOHN MURPHY, Superintendent.

YOUNGSTOWN STREET RAILWAY COMPANY.

YOUNGSTOWN, O., February, 23, 1893.

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GENTLEMEN:—Your trucks have been in use on our road ever since the change from horse to electric power some two years ago, and we have found them easy riding, simple in construction and exceedingly durable; we are using your trucks with seven foot wheel base, and running them around short curves, one of which has a radius of only thirty-three feet. We consider this as good a test as any truck could be put to. Yours very truly,
F. WAYLAND BROWN, General Manager.

MILWAUKEE, WIS., July, 21, 1893.

McGUIRE MANUFACTURING COMPANY,
122 NORTH SANGAMON STREET, CHICAGO, ILL.

GENTLEMEN:—It gives us pleasure to state that your "Columbian Truck," which we are now using on our system, has given us the best of satisfaction, and we can conscientiously commend it to all street railways purchasing new equipment.

Yours very truly,
H. C. PAYNE, Vice-President.

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WILLIAMSPORT, PA., January 3, 1893.

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GENTLEMEN:—We have been using your make of trucks for the past eighteen months, making from 110 to 130 miles per car, and during that time the cost for repairs has been nominal. They are strong, easy riding, and are about all that could be required, and we have no suggestions to make concerning their improvement.

I enclose photograph of a car equipped with your truck, taken at our car house. Yours very truly,
H. R. RHOADS, President.

CHICAGO CITY RAILWAY COMPANY.

CHICAGO, ILL., December 16, 1893.

McGUIRE MANUFACTURING COMPANY,
122 NORTH SANGAMON STREET, CHICAGO, ILL.

GENTLEMEN:—It gives us pleasure to say, unsolicited, that your "Columbian" trucks have been in use under seventy twenty-one foot motor cars operated on our lines since June 1, and that they have given excellent service and satisfaction. We have had no trouble with them, even during the extremely heavy travel of the World's Fair season. Yours truly,
M. K. BOWEN, Superintendent.

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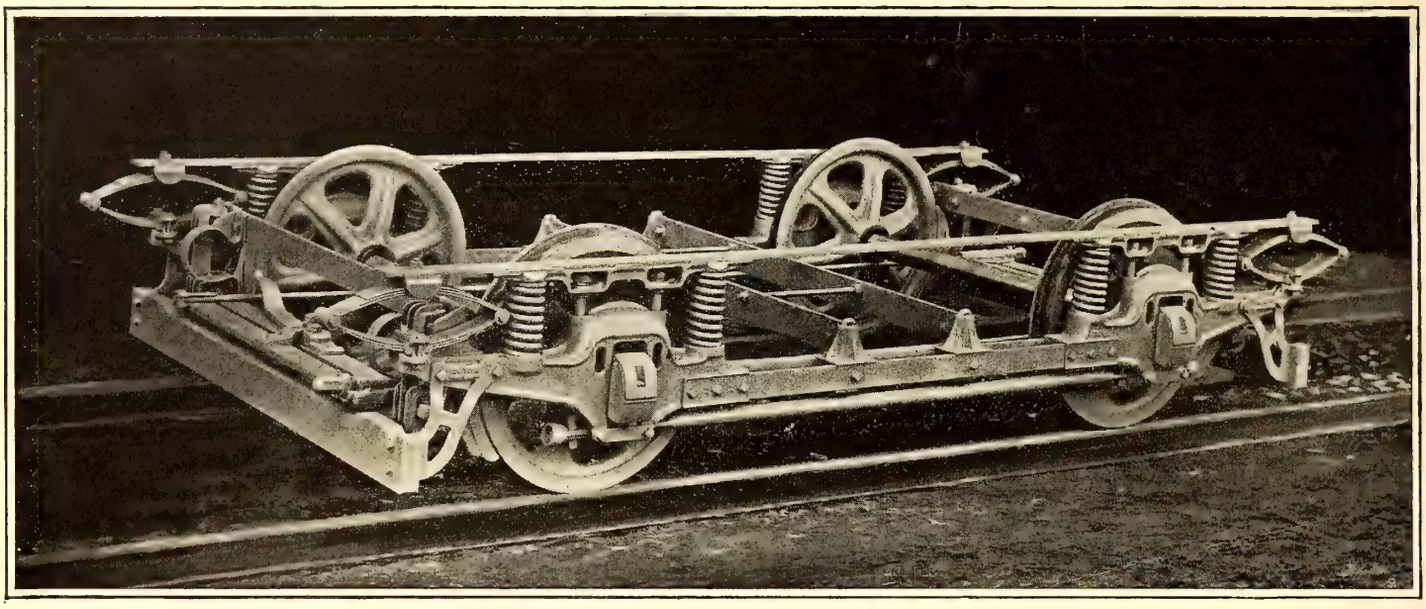
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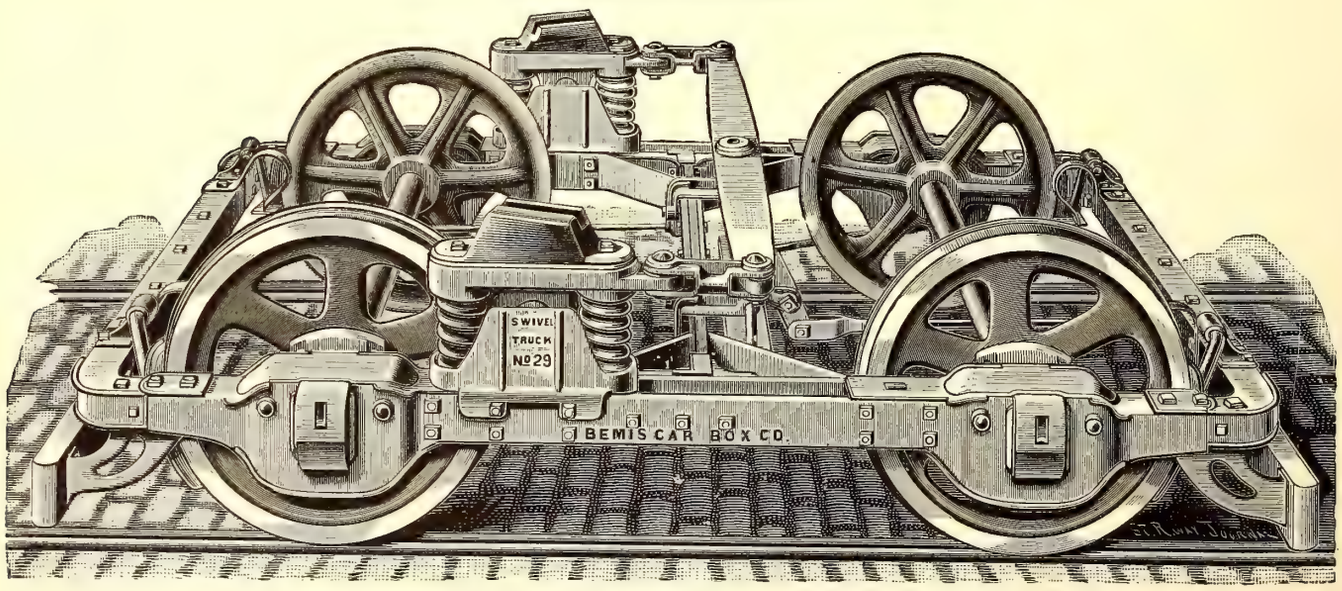
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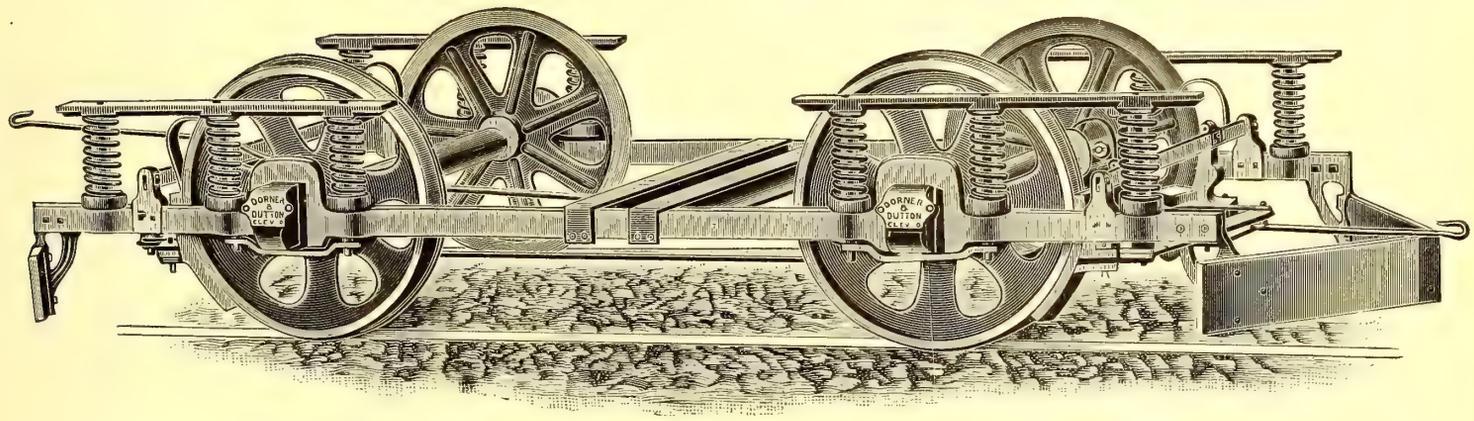


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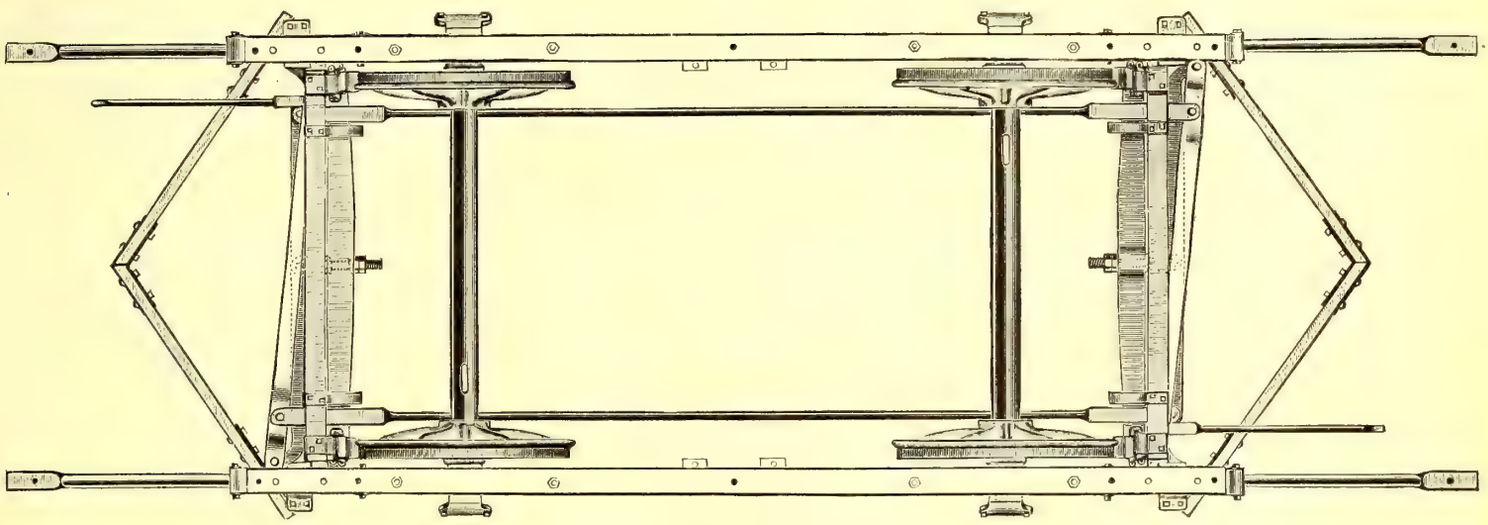
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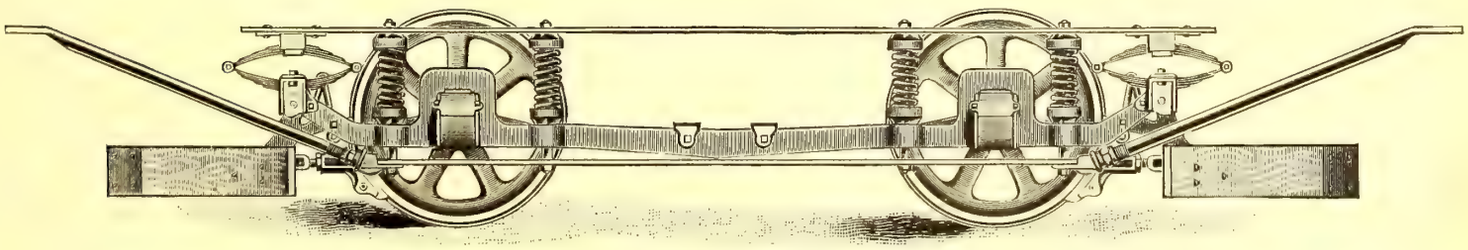


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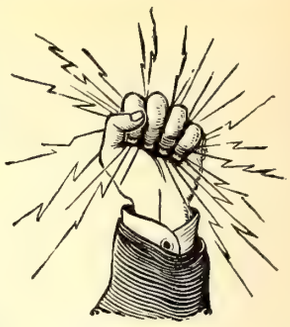
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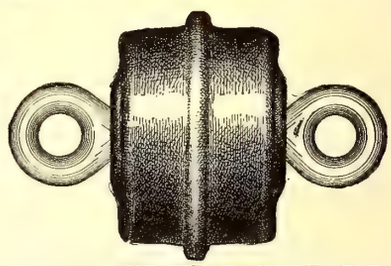
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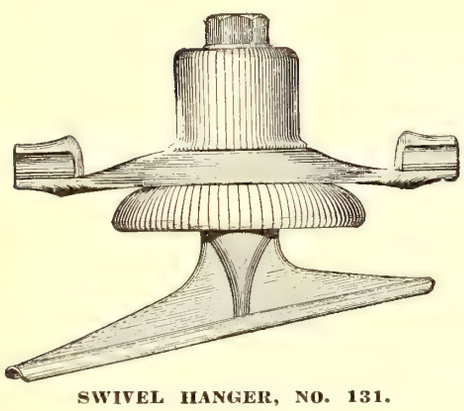
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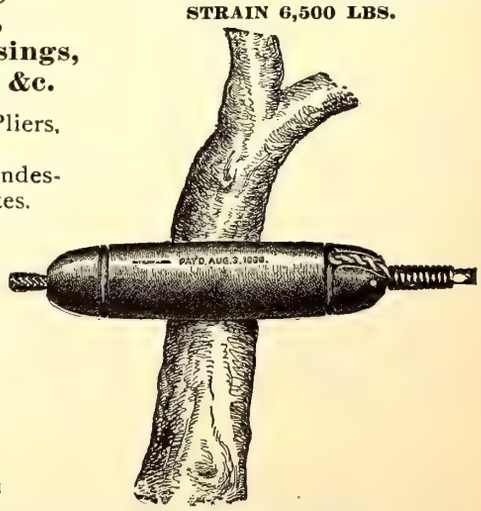
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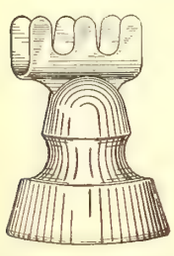
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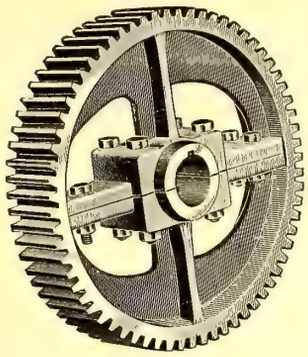
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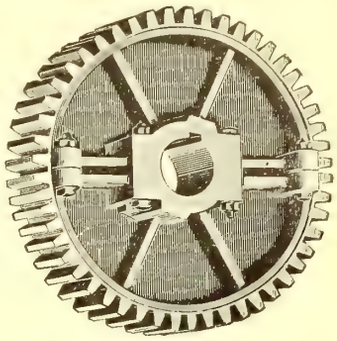
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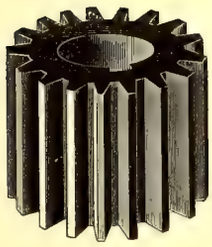
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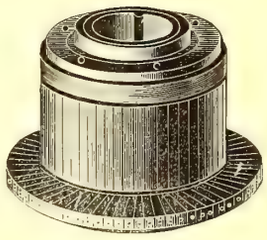
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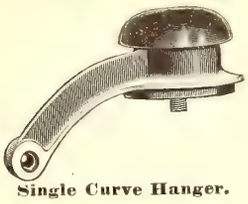
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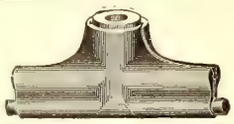
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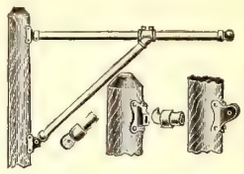
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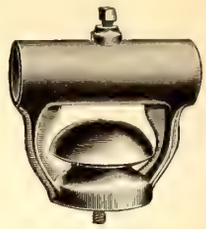

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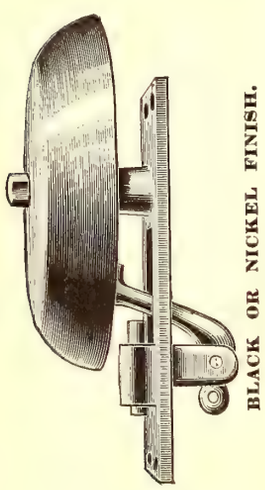
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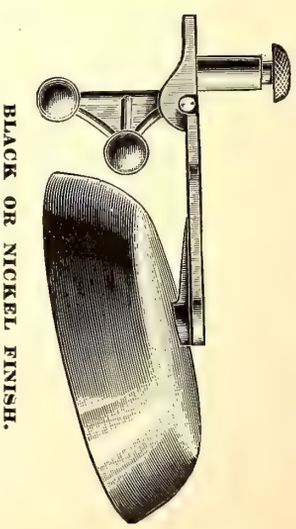
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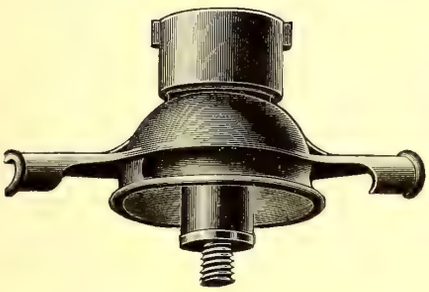
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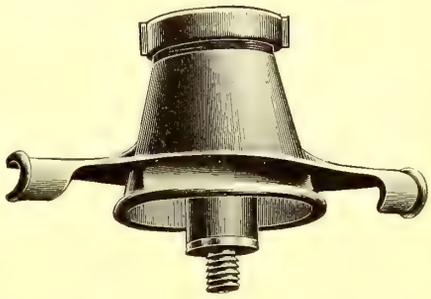


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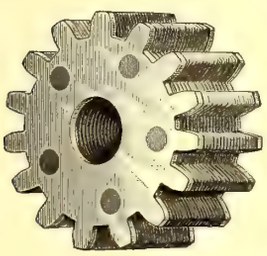
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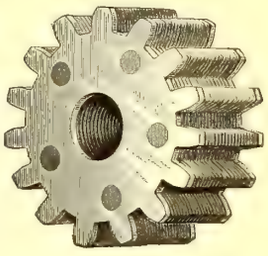
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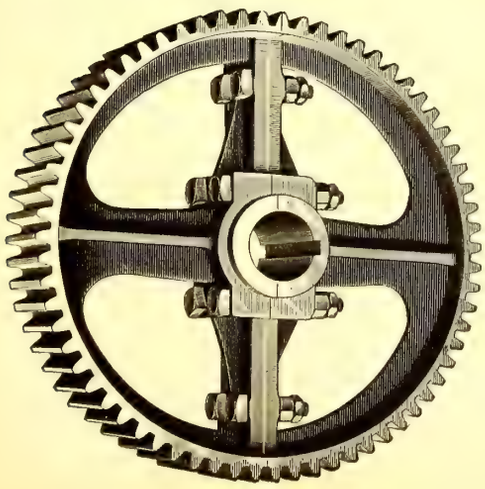
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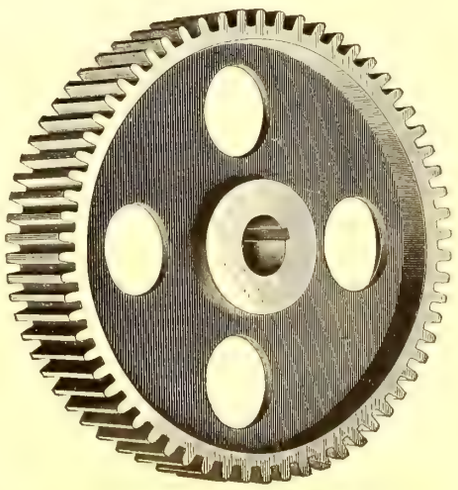
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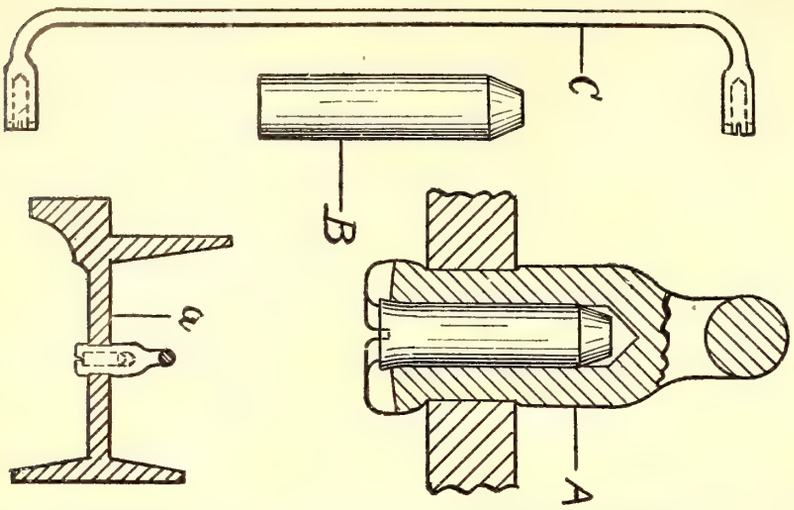
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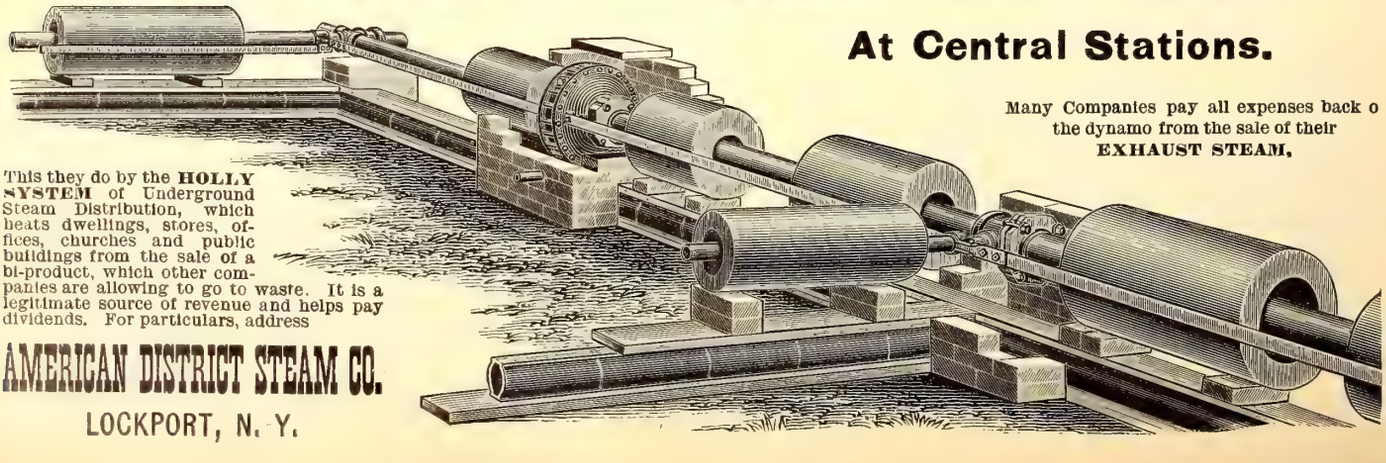
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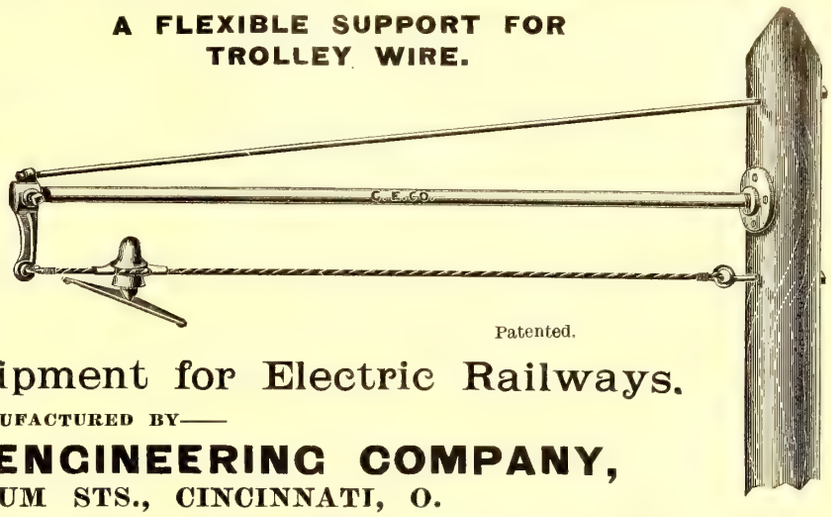
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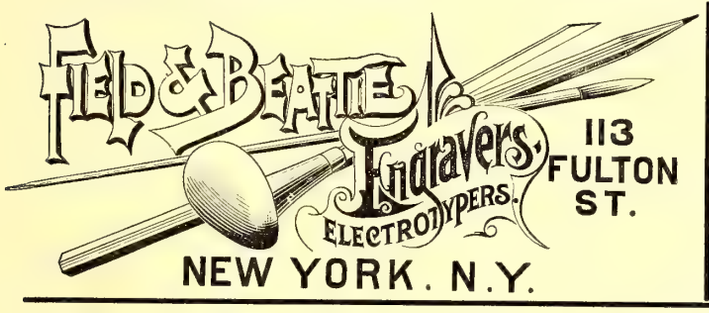
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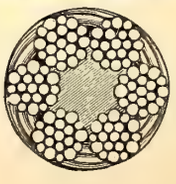
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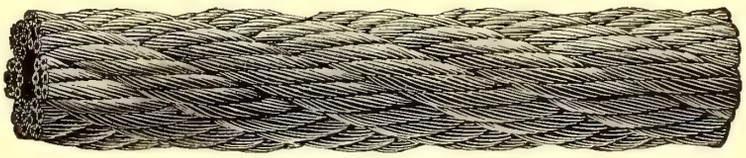
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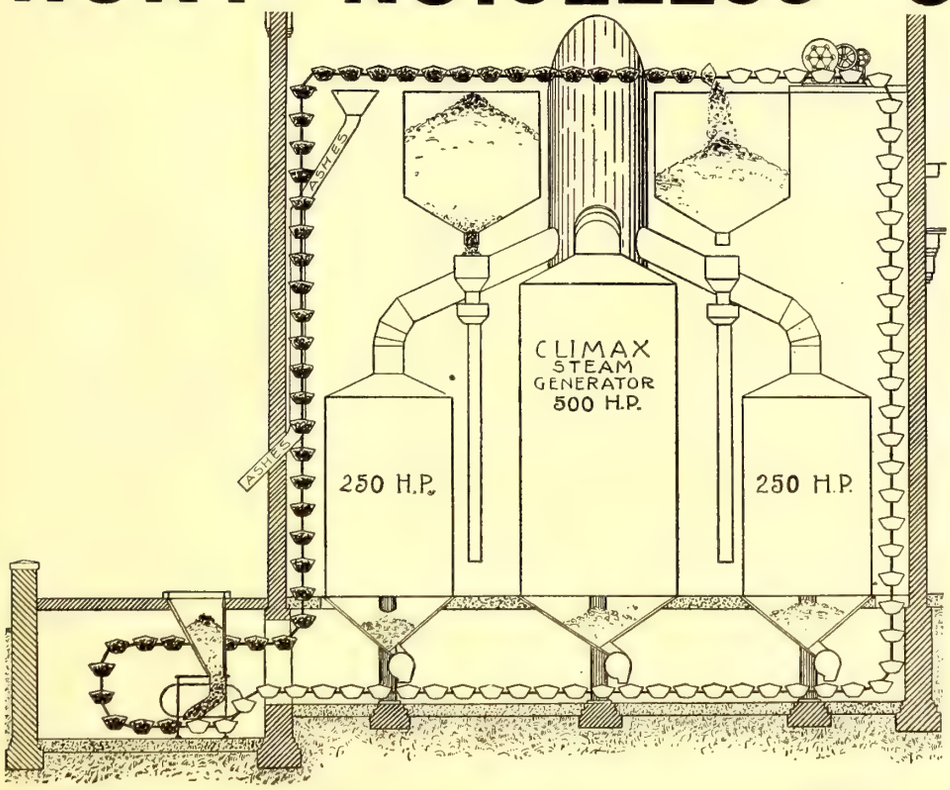
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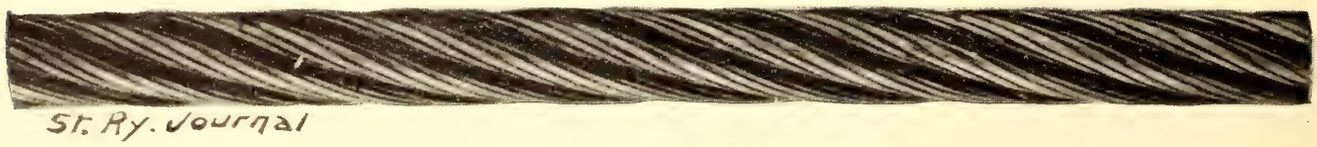
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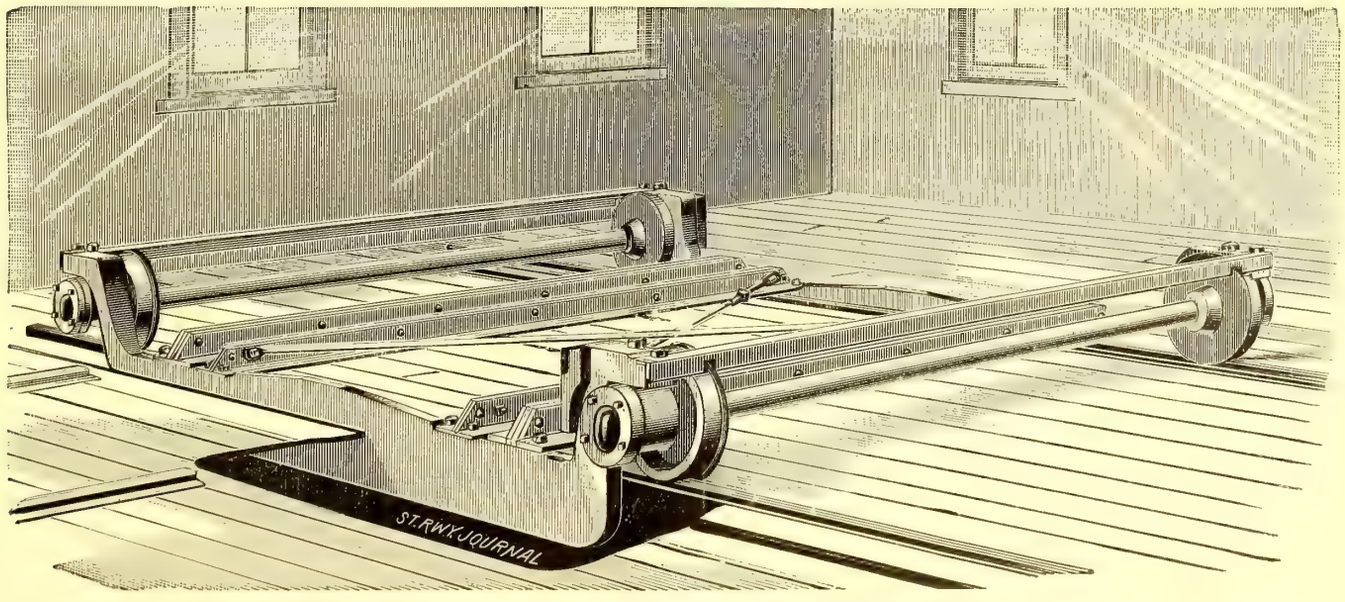
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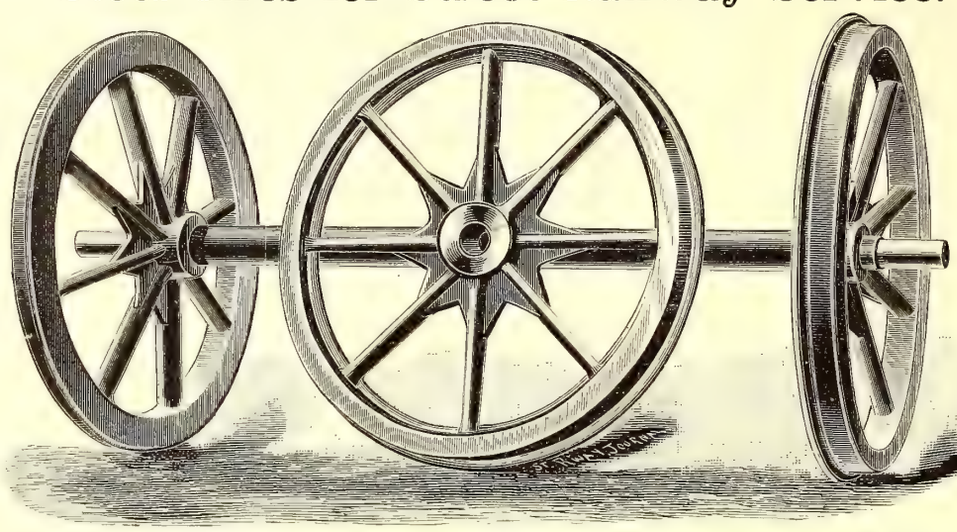
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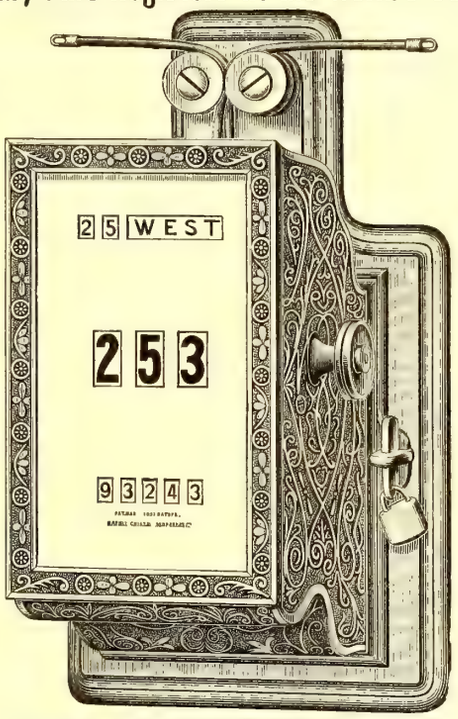
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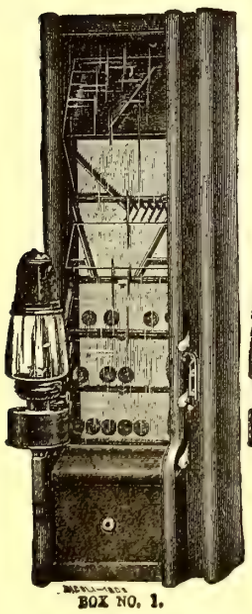
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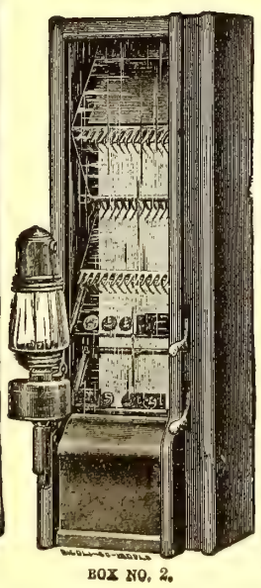
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Patented Oct. 14, 1873.

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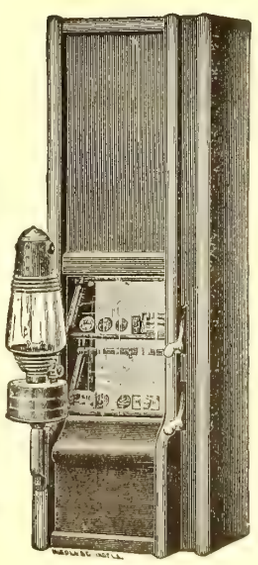
Fares Cannot be Extracted or boxes Robbed without violence.

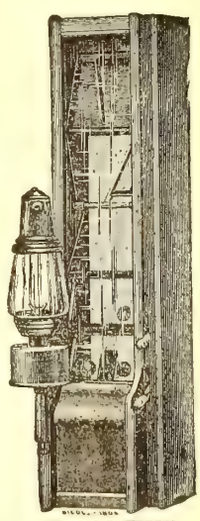
Roads Equipped with Boxes on Trial, and if not satisfactory, returned without any expense to the company trying them.

Ornamental to any Car.

Special Sizes built to order.

NOTICE.—All parties are cautioned against using fare boxes recently placed on the market which are direct infringements on our patents.


BOX NO. 3.


CHARIOT PATTERN.

REDUCED PRICES. **Write for Descriptive Circular and Price List.**

St. Louis Car Company,

MANUFACTURERS OF ALL KINDS OF HORSE, ELECTRIC, CABLE AND ALL OTHER MOTOR CARS.

3023 North Broadway, St. Louis, Mo.

See Pages 114-115.



"PAY HERE."

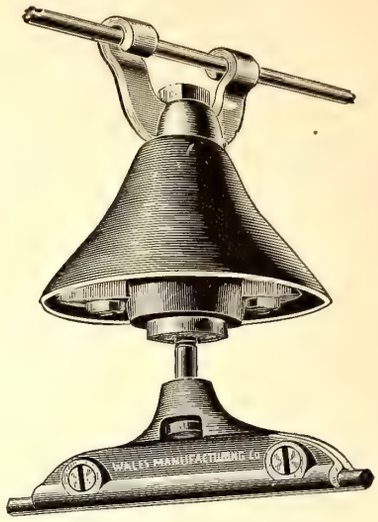
THE WALES FARE BOX

SO WELL KNOWN AND LARGELY USED IN THIS AND FOREIGN COUNTRIES.

SPECIALTIES AND NOVELTIES,
INSULATOR, SELF-OILING TROLLEY WHEEL.
ELECTRIC HEADLIGHTS.

TICKET PUNCHES, UNIFORM BUTTONS, CAPS AND BADGES.
SEND FOR CATALOGUE.

WALES MANUFACTURING CO.,
SYRACUSE, N. Y.



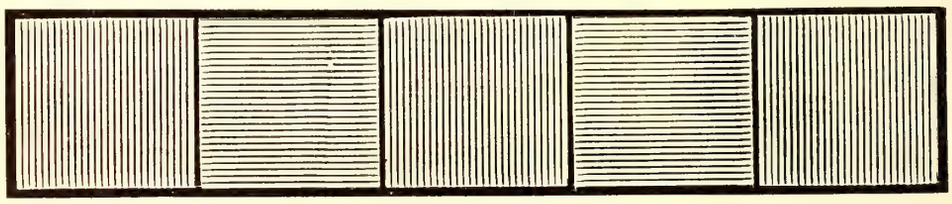
SAMUEL LEWIS,

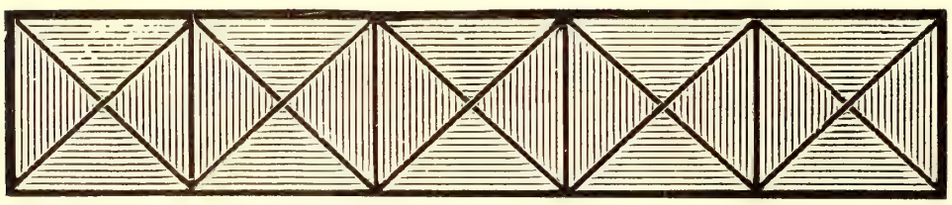
ORIGINATOR AND MANUFACTURER

—OF—

LEWIS' PATENT WOOD MATS.

LIGHTEST,
STRONGEST,
CHEAPEST,
CLEANLIEST,
} MAT EVER DESIGNED FOR STREET CARS.



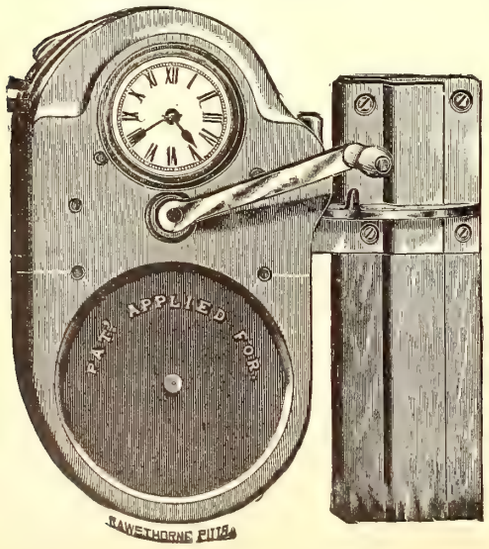


PRICES REDUCED
AND
MANY IMPROVEMENTS ADDED.

Prompt attention will be given to any orders, and information cheerfully furnished on application.

These mats are interchangeable and reversible, made of well-seasoned maple-wood slats, assembled with strong screw-rods which cut their own thread, rendering infiltration of dust or liquids impossible, maintain them smooth and prevent warping, so that the underlying material is not injured ; these screw-rods give great strength and insure durability to the mats, some have been worn by usage until the screw-rods in the middle of the slats were exposed without decreasing their firmness and strength. **They are easily repaired by screwing two half slats in the place of the one broken.**

10 to 18 Lorimer Street, near Broadway, Brooklyn, N. Y., U. S. A.



THE NEW SYSTEM of ISSUING TRANSFERS.

The accompanying cut is one-quarter size of the Time Transfer Printer. By this system only the tickets actually needed are printed. The time is automatically and accurately recorded on each ticket, and mistakes are impossible.

GREAT SAVING OF TIME, LABOR AND MONEY.

FOR FULL PARTICULARS APPLY TO

THE TIME TRANSFER PRINTER MFG. CO.,
Schmidt Bldg., 95 5th Ave., Pittsburgh, Pa.

RAILWAY REGISTER MANUFACTURING COMPANY.

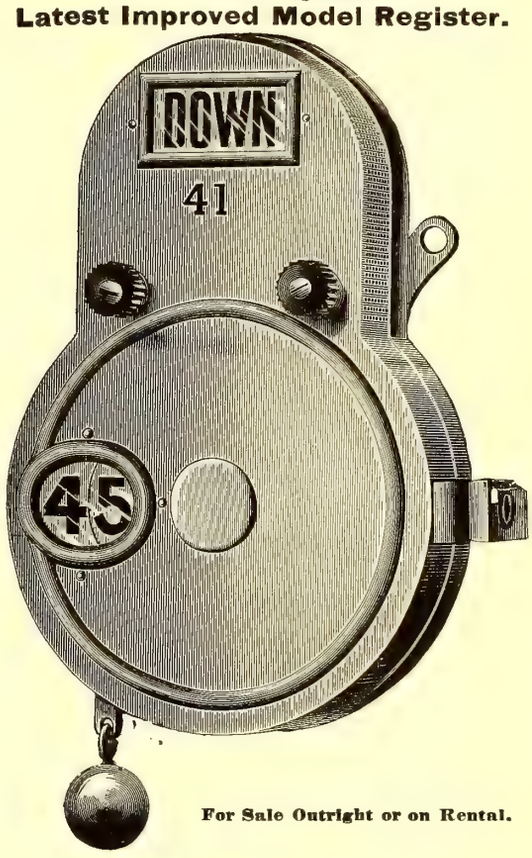


MANUFACTURERS AND OWNERS OF THE

Latest Designs, Improvements and Inventions in Registers, Indicators, Classifiers and Punches, for the Recording of Fares Collected on Street and Steam Railroads.

This company owns over 100 Patents embracing all the Valuable Features of Fare Registers, Indicators, etc., and was awarded three Medals at the Chicago Exposition of Railway Appliances.

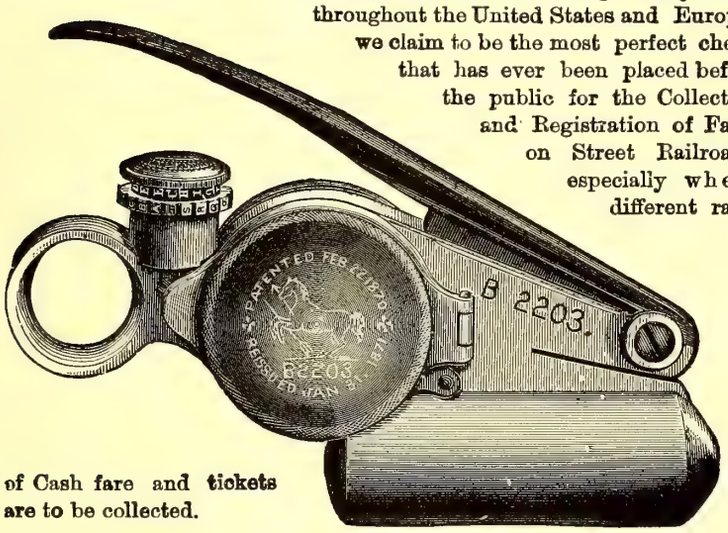
Latest Improved Model Register.



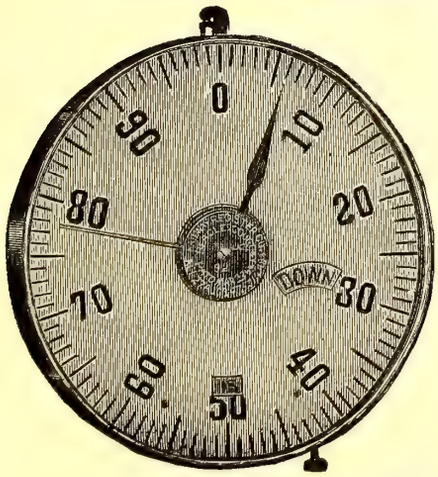
For Sale Outright or on Rental.

The Alarm Registering Punch.

This Register, which is so generally used throughout the United States and Europe, we claim to be the most perfect check that has ever been placed before the public for the Collection and Registration of Fares on Street Railroads, especially where different rates of Cash fare and tickets are to be collected.



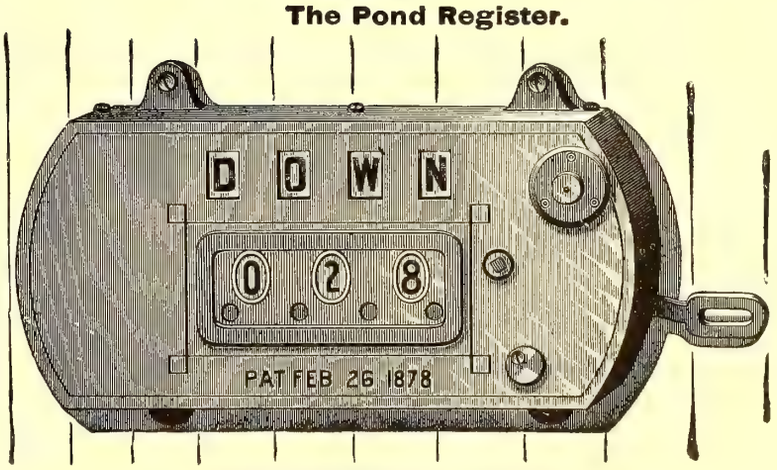
The Monitor Register.



For Sale Outright or on Rental.

Railway companies desiring to use a Stationary Register will consult their own interest by examining this Register before adopting any of the cheap devices now offered as it is the most Reliable Register of its kind. For further particulars address

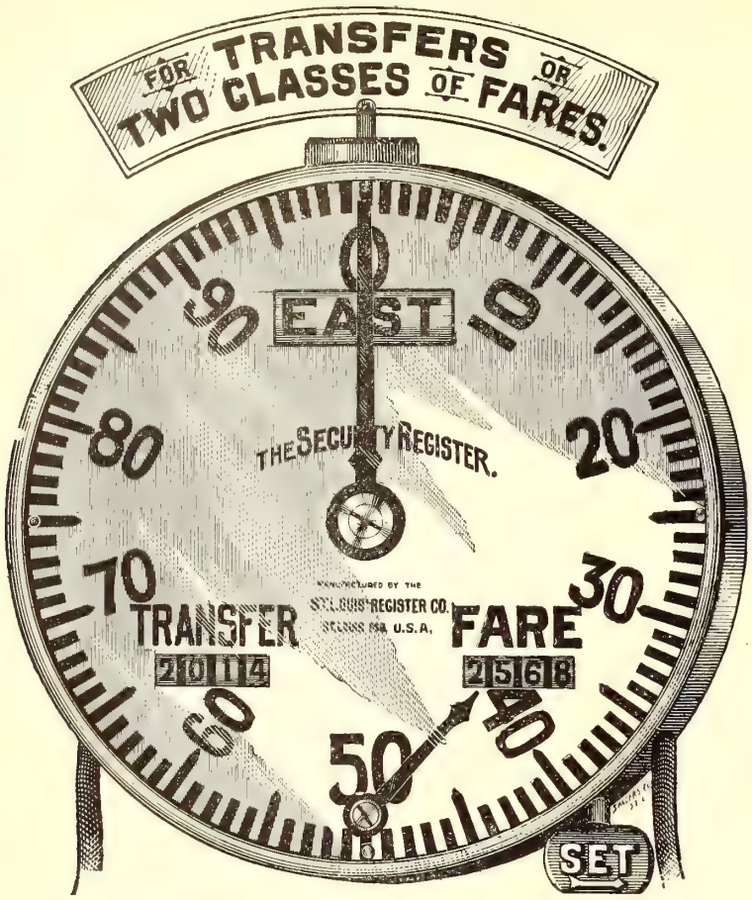
The Pond Register.



For Sale Outright or on Rental.

SPECIAL ATTENTION PAID TO EXPORT ORDERS.

EDWARD BEADLE, Manager, 1193 Broadway, New York City, N. Y.



This is the only device on the market that shows on one dial Full Fares and Transfers, or two classes of fares. The red hand always points to last fare rung up. The register has two bells of different tones, and two totalizers, keeping the records separate and distinct. It is as simple in its construction as our Security Register, and absolutely accurate and durable.

We refer to a few of the principal roads who are using our Security Registers.

The West End Road, of Boston, Mass.
The Philadelphia Traction Co., of Philadelphia, Pa.
The Scranton Traction Co., of Scranton, Pa.
New Orleans & Carrollton Ry., of New Orleans, La.
Denver Tramway Co., of Denver, Colo.
Lindell Railway, of St. Louis, Mo.
St. Louis & Suburban Railway, of St. Louis, Mo.
South St. Louis Electric Road, of St. Louis, Mo.
Missouri Railway, of St. Louis, Mo.
Benton-Bellefontaine Railway, of St. Louis, Mo.

We claim Superiority for the Security Register on the following points.

Simplicity of Mechanism.

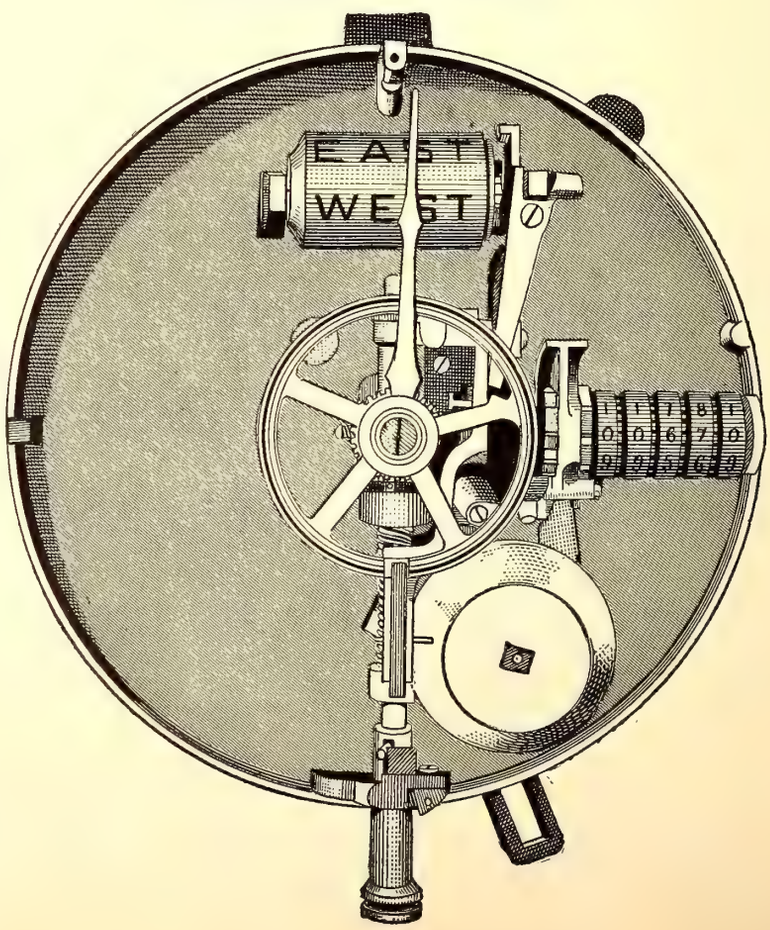
Absolute Accuracy of Registration.

The only Register Locked at all Times During its Action.

The Only Register that can be placed in the hands of Conductors without case or dial, and defy Manipulation.

A liberal basis of exchange will be made with railway companies dissatisfied with the device they are now using.

SECURITY REGISTER.



ST. LOUIS REGISTER CO.,

703 Houser Bldg., St. Louis.

Certificate of Merit.

The story of the **FARE REGISTER** is a very interesting one. Much has been said regarding it that might be styled "cheap talk," but we believe all street railway men are interested in knowing the

EXACT FACTS.

The **Lewis & Fowler Register** is in use to-day on nearly **600** street railways in the United States and Canada. That means **19,000 Registers** of our make in **daily** use. Every Register is thoroughly tested by being rung up 100,000 times before leaving our works.

SIMPLICITY of construction is not desirable in a Fare Register where absolute security is demanded.

AS TO DURABILITY

We can furnish the names of Street Railway companies who are to-day operating our registers that were put in use more than SIXTEEN YEARS ago, and every attempt to tamper with them or beat them, has proved an entire failure.

THE LEWIS & FOWLER MANUFACTURING CO.,

Office, 28 Sanford Street, Brooklyn, N. Y.

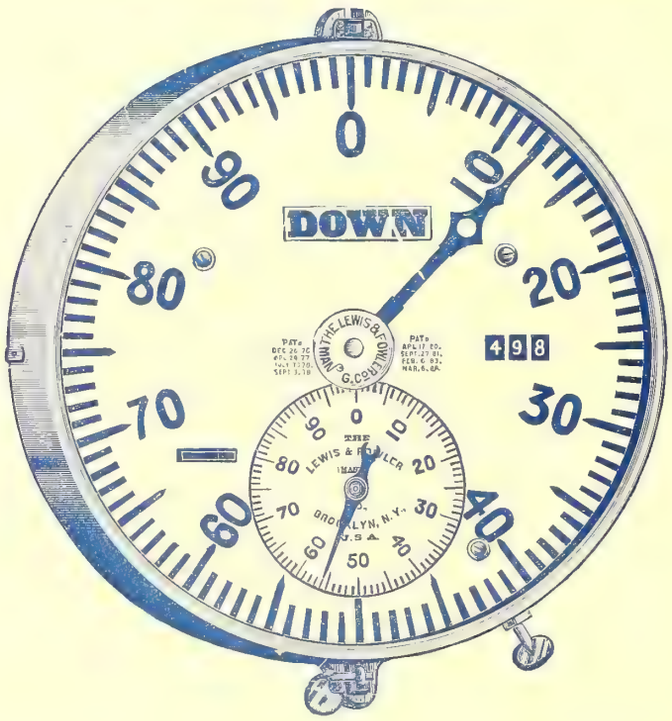
THE

LEWIS & FOWLER MFG. CO.

28 Sanford St., Brooklyn, N. Y.

Patentees and Sole Manufacturers of the

Improved "Alarm" Passenger Register



ACKNOWLEDGED TO BE THE SAFEST AND MOST COMPLETE REGISTER IN THE WORLD.

Over Eighteen Thousand (18,000) in Daily Use

—BY OVER—

500 RAILROAD COMPANIES.

SEND FOR PRICES.

Our Registers Will Totalize Up to 100,000 if Required.



THE

MEAKER

PORTABLE and STATIONARY REGISTERS

SIMPLE! DURABLE! RELIABLE!

THIS is a Double Register, being so constructed that the statement (settlement numbers) may be visible or not, at will, by the simple use of a key. It is impossible to change the direction signal without cancelling the fares recorded at the trip window, and said cancellers can only be removed by a return to zero. It is also impossible to ring the bell without registering, or register without ringing the bell. The pull cords will be placed on both sides of the car, without extra charge, if desired. The machine is made strong in all its parts, and being constructed without wheels, is not subject to the same wear as cogged devices.



THE IMPROVED STATIONARY.

Our Registers have been adopted by over Sixty Street Railway Companies. For Reference, Terms, Etc., address

THIS Register can be read correctly from any part of the car.

Fac-simile of Figures Used.



MEAKER MANUFACTURING CO.,

134 WEST WASHINGTON STREET,

CHICAGO.

Successors to Railway Register Company.

THE AMES REGISTER COMPANY'S

COMBINED PORTABLE and STATIONARY REGISTER

The attention of street railway officials is called to this new departure in car registers. It is the only one in the market combining the portable and stationary register.

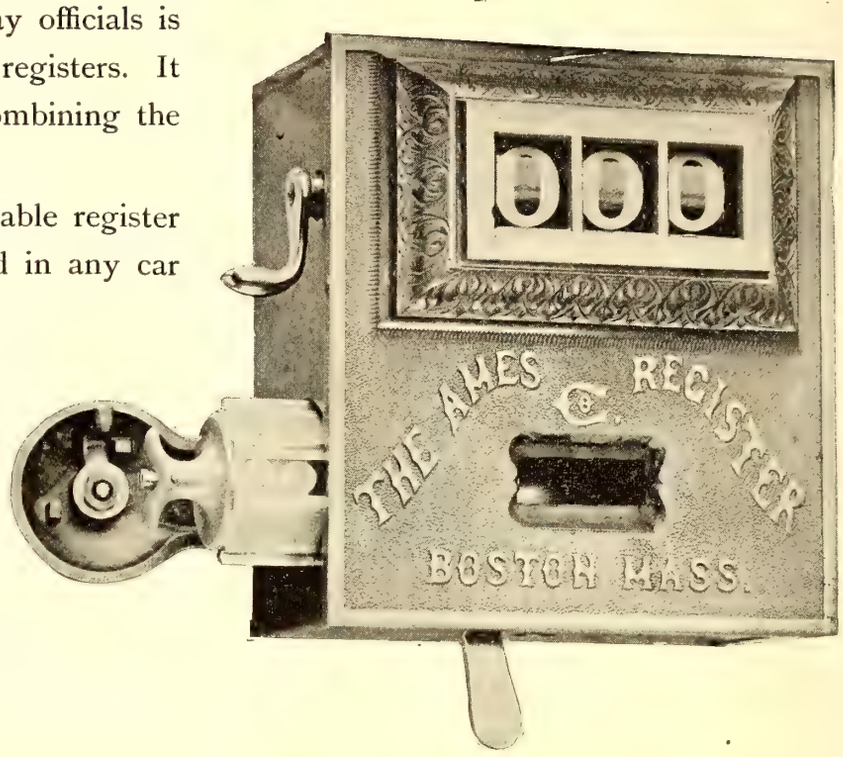
A small interchangeable portable register is furnished the conductor and used in any car having the stationary register.

It is inserted in the stationary register by the conductor, the fares registered, and returned by him whenever required.

It shows the fares registered each trip, day or other desired length of time. It is accurate and cannot be altered, changed or tampered with. No inspectors are required in the car stations or elsewhere where the register is used.

It is well and substantially made, and will sustain severe usage without liability of getting out of order.

It is protected by broad patents and is fully guaranteed.



THE PORTABLE REGISTER PARTIALLY IN PLACE.



THE PORTABLE REGISTER.



THE REGISTER READY FOR USE.

For further information, address the Company or General Manager.

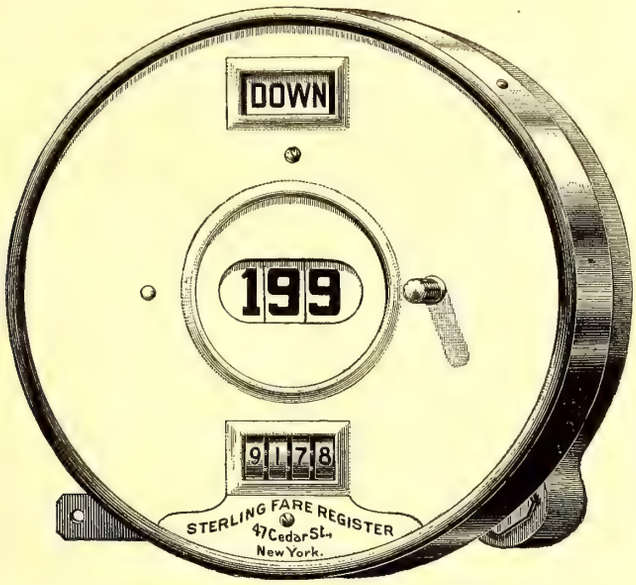
OAKES. A. AMES, President. ——MANUFACTURED BY—— A. C. TITCOMB, Treasurer.

THE AMES REGISTER COMPANY,

LOUIS PFINGST, General Manager,
53 State St., Boston, Mass.

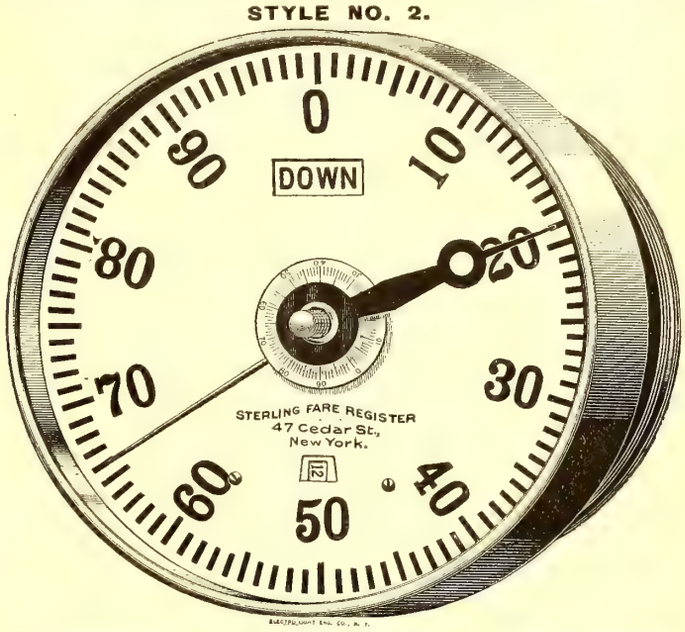
89 State Street, Boston, Mass.

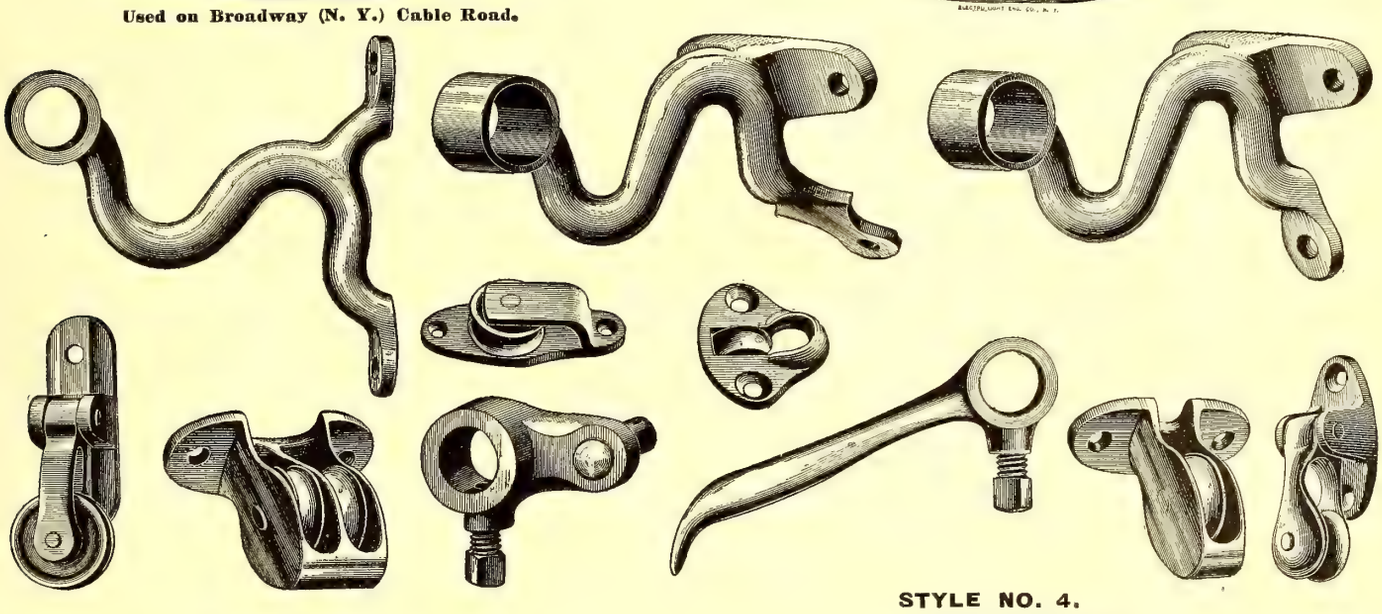
STYLE NO. 1.



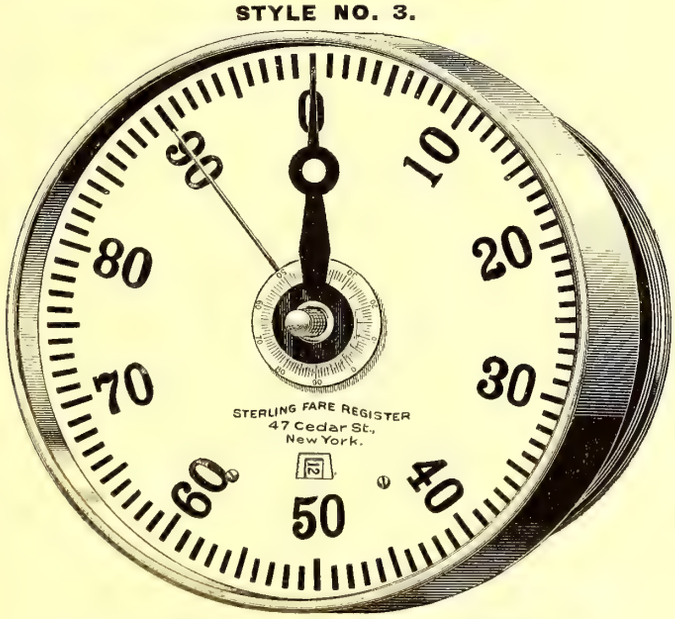
Used on Broadway (N. Y.) Cable Road.

STYLE NO. 2.



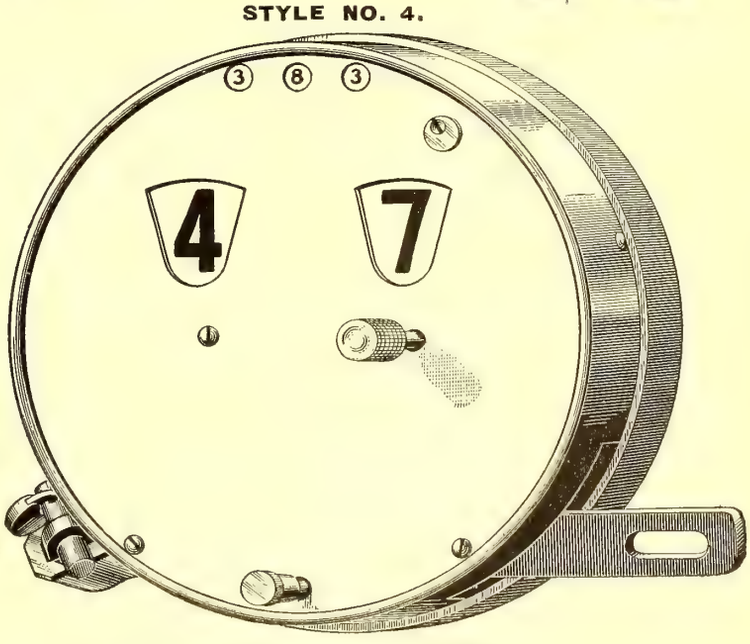


STYLE NO. 3.



Used on Third Ave. (N. Y.) Railway 18 Years.

STYLE NO. 4.



Used on 23d St. Railway (N. Y.) 10 Years.

Sterling Supply and Manufacturing Co.,

MANUFACTURERS OF STREET RAILWAY SUPPLIES, STERLING FARE REGISTERS.

97 BANK STREET, (Ross Building.) **NEW YORK.**

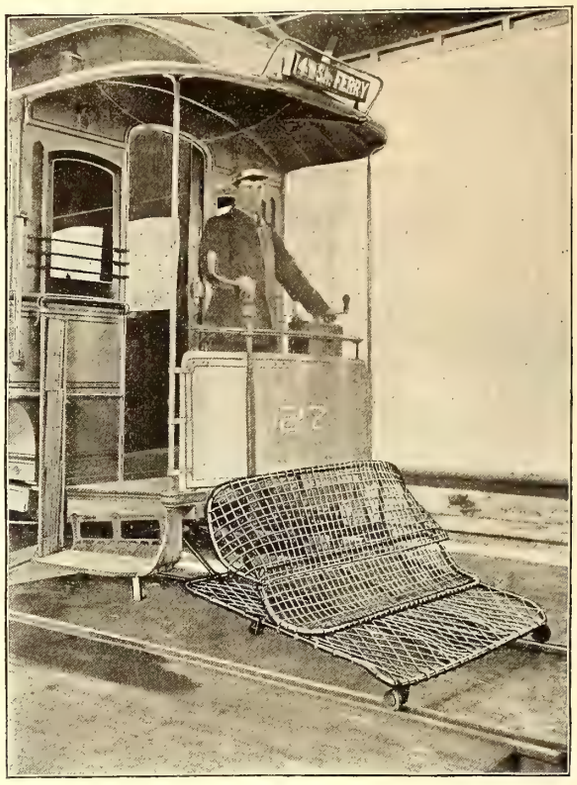
TELEPHONE 233 SPRING.

THE FOSTER AUTOMATIC SAFETY GUARD CO.



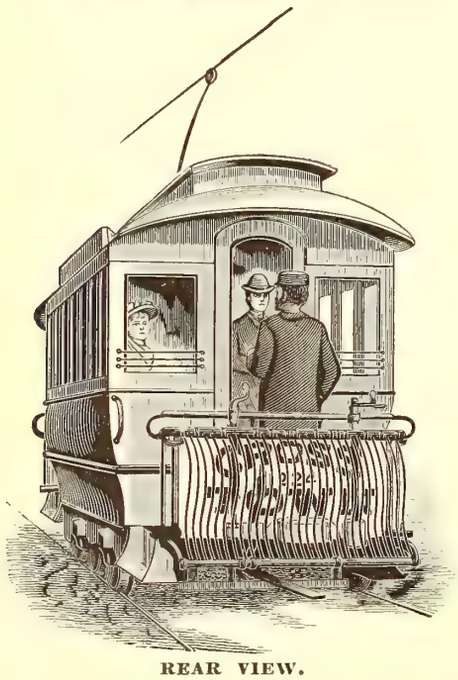
150
Broadway,
New York.

Our Fender has been adopted by the North Hudson County Street Railway Co., of Hoboken, N. J., and all the Street Railway Companies in Paterson, N. J., after a long series of competitive trials with other fenders.



Can be Made to Run Flush with the Dashboard.
Runs Only Three Inches or Less Above the Track.
Cars Can be Trailed Without Removing Fender.
All Tests Have Been Made With Human Beings.

The Car Fender Which is a Life Saver



REAR VIEW.

Perfectly Satisfactory
Results from the
Most Severe
Tests.



FRONT VIEW.

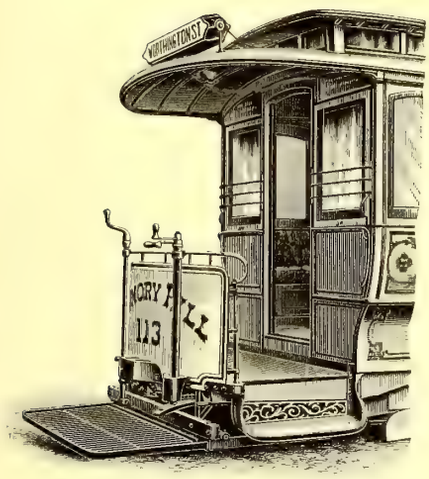
Impossible for a person or object to get under the wheels of cars equipped with our fenders. Practical Tests Given. Address

FIELD LIFE GUARD COMPANY,

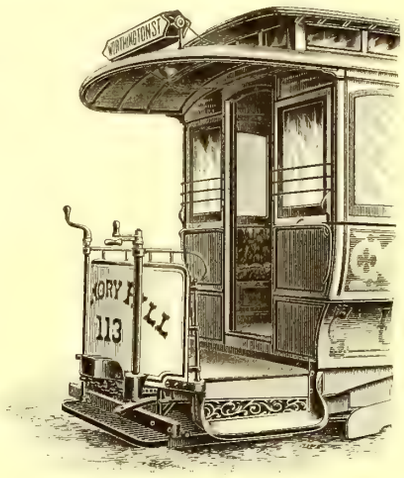
430 Butler Exchange, PROVIDENCE, R. I.

THE PFINGST FENDER.

ADOPTED BY THE BROOKLYN CITY RAILROAD,
WHICH HAS ORDERED 1,000 CARS
EQUIPPED WITH THIS FENDER.



Also in use in
BOSTON, MASS.
SPRINGFIELD, MASS.
HOLYOKE, MASS.
PATERSON, N. J.



—MANUFACTURED BY—

LOUIS PFINGST, 53 State St., Boston, Mass.

THE ONLY PNEUMATIC CAR FENDER.

STRONG AND SIMPLE IN CONSTRUCTION.

AUTOMATIC IN ACTION.



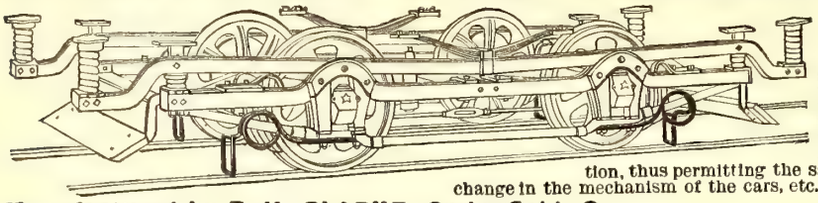
ALL PARTS INTERCHANGEABLE.

A POSITIVE SAVER OF LIFE AND LIMB.

Quickly Transferred from One End of Car to the Other.

CORRESPONDENCE SOLICITED.

CLARKE'S CAR WHEEL FENDERS



To Prevent Accidents by the Wheels of ELECTRIC, CABLE and HORSE CARS, Switch and Locomotive Engines, Suburban, Passenger and Freight Cars.

SIMPLE, CHEAP and EFFECTIVE,

Our devices are constructed of one piece of spring steel, so designed as to be placed close above the rail and directly in front of the wheel. The bottom is formed into a loop placed oblique to the rail, thus effectually preventing any body or limb passing under the wheel, and with a tendency to remove them to the outside of the track. The coil is designed to provide, with certainty, for an ample lateral yield in case of the fender striking a fixed obstruction, thus permitting the safe running of the car. These devices can be applied without any change in the mechanism of the cars, etc., being attached by bolts now in use.

Manufactured by F. H. CLARKE, Springfield, O.

New York Office, 1267 Broadway, Room 7.

When Ordering

From firms whose names appear in the **Street Railway Journal,** our friends will confer a favor on our advertisers and ourselves by mentioning this paper. Very respectfully,

STREET RAILWAY PUBLISHING CO.

JAMES A. TRIMBLE,

MANUFACTURER OF

Rail Road Car Wood Work,

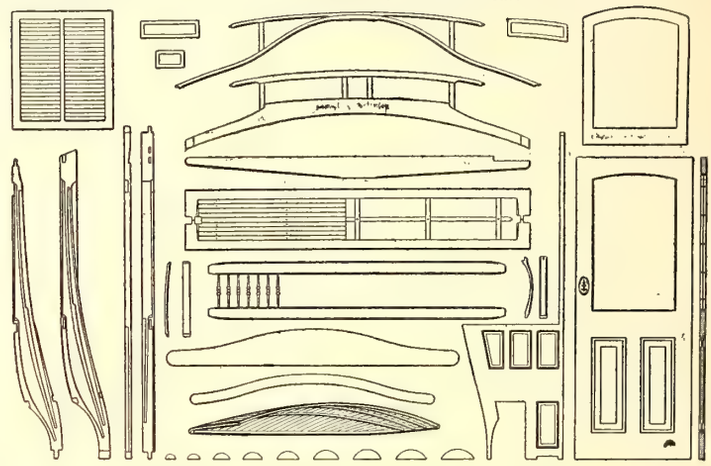
PLAIN AND CARVED MOULDINGS,

Doors, Sashes, Blinds, Pillars and Sills,

ALL PATTERNS.

Nos. 220 & 222 East 28th St., bet. 2d & 3d Aves.

NEW YORK.



J. P. SJOBERG & CO.,

MANUFACTURERS OF STREET CAR WOOD WORK.

155 and 157 Eleventh Ave., New York.

THE LEADING STREET RAILWAY SAFETY APPLIANCES.

CRAWFORD'S Wheel Guard Fender Board.



PICK-UP FENDER—POSITION IN USE.

OUR LIST OF ORDERS FOR ALL CARS.

WHEEL GUARDS.

Philadelphia (Pa.) Traction Co.
Terre Haute (Ind.) Street Ry. Co.
Williamsport (Pa.) Passenger Ry. Co.

IN PITTSBURGH, PA.

Pittsburgh Traction Co.
Duquesne Traction Co.
Central Traction Co.
Citizens' Electric Traction Co.

PICK-UP FENDERS.

Pittsburgh & Birmingham Traction Co.
Pittsburgh & West End Pass. Ry. Co.
Second Ave. Passenger Ry. Co.
Rochester (N. Y.) Ry. Co.
Citizens' Street Ry. Co., Indianapolis.
New Orleans (La.) Traction Co.
Turentum (Pa.) Traction Pass. Ry. Co.

OUR LIST OF REFERENCES:

Geo. D. Widener, Vice-President Philadelphia Traction Co.
J. T. Gorman, General Superintendent Philadelphia Traction Co.
H. A. Newell, Superintendent Broadway Line, New York.
A. N. Connett, Chief Engineer Baltimore City Passenger Railway Co.
Geo. W. Elkins, President Pittsburgh & Duquesne Traction Co.
E. McDowell, Superintendent Pittsburgh & Duquesne Traction Co.
Miller Elliott, Superintendent Pittsburgh & Birmingham Traction Co.
W. C. Smith, Superintendent Central Traction Co., Pittsburgh, Pa.
J. E. Rugg, General Manager Citizens' Traction Co , Pittsburgh, Pa.
Many Others.

LIVES SAVED SINCE FEB. 1st.
PICK-UP FENDER 6,
WHEEL GUARD 8.

CRAWFORD'S PICK-UP FENDER.



PICK-UP FENDER—FOLDED POSITION.

WRITE FOR ANY INFORMATION, PRICES, ETC.

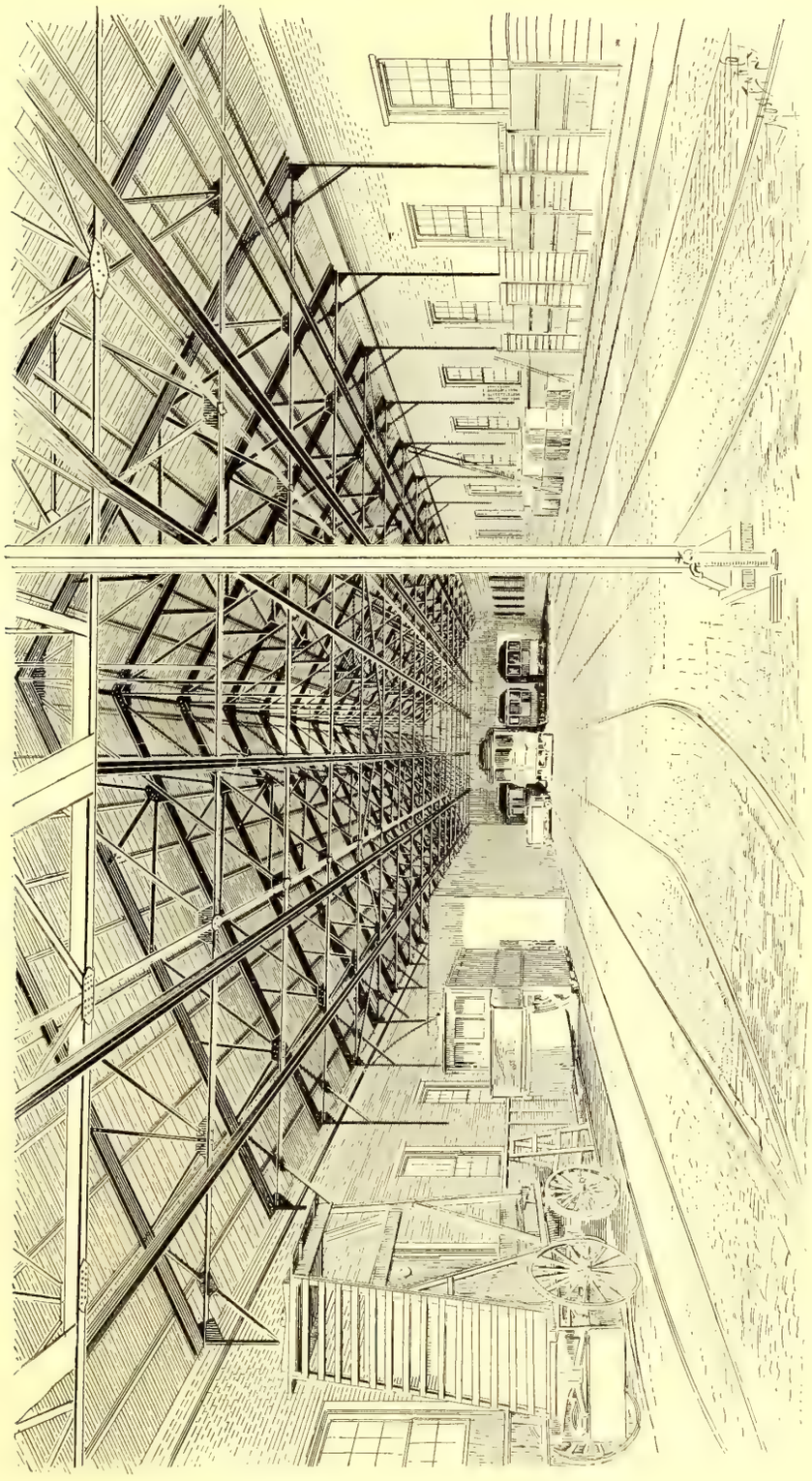
R. A. CRAWFORD MFG. CO., 35 Water St., Pittsburgh, Pa.

F. A. LAWSON & CO., Coast Agents, San Francisco, Cal.

THE BERLIN IRON BRIDGE CO.

CHAS. M. JARVIS, President and Chief Engineer.
FRANK L. WILCOX, Treasurer.

BURR K. FIELD, Vice-President.
GEO. H. SAGE, Secretary.



The above illustration is taken direct from a photograph and shows the interior of a Car Shed designed and built by us for the Wilmington City Railway Co., at Wilmington, Del.

Send for Illustrated Catalogue of Over 300 Pages, Describing Iron and Steel Buildings, Car Sheds, Power Houses, etc.

Office and Works: - - East Berlin, Conn.

L. BACHENHEIMER, President,
C. E. BAIRD, Vice-President and Manager.

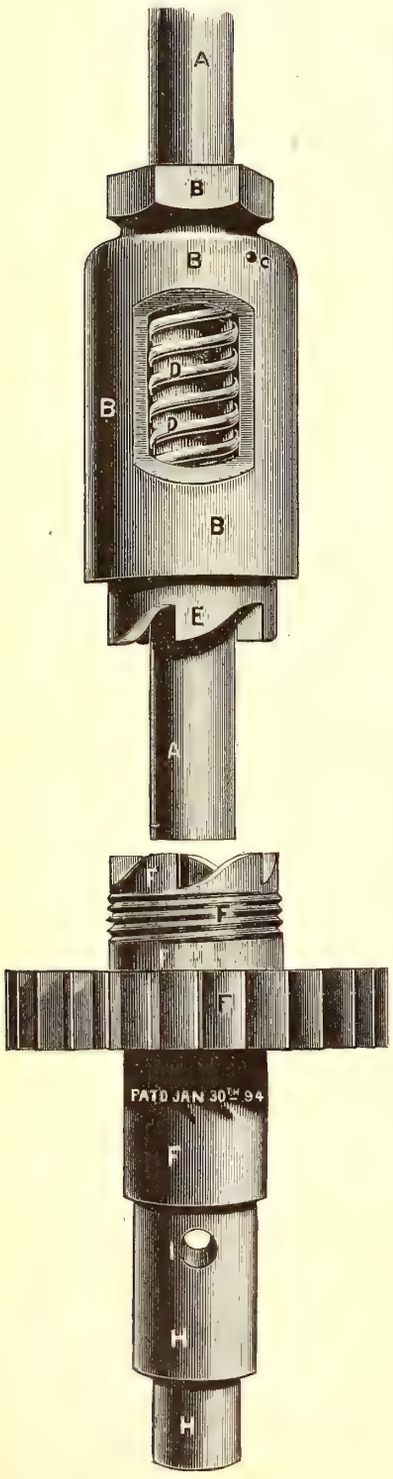
E. M. FIELDS, Secretary and Treasurer.
C. W. ARMSTRONG, Superintendent.

THE SAFETY CLUTCH BRAKE CO.

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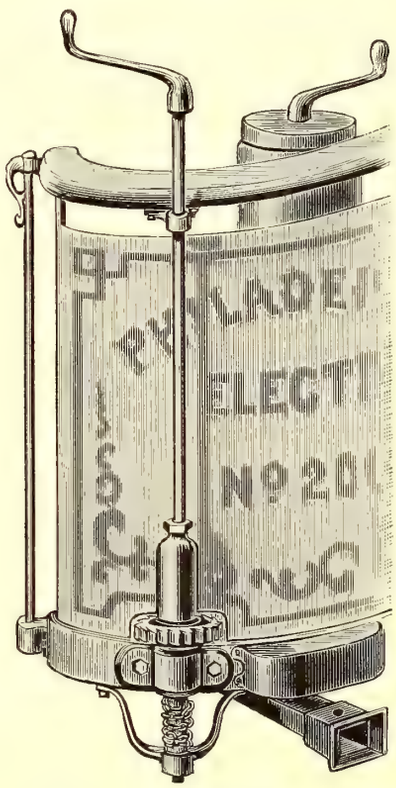
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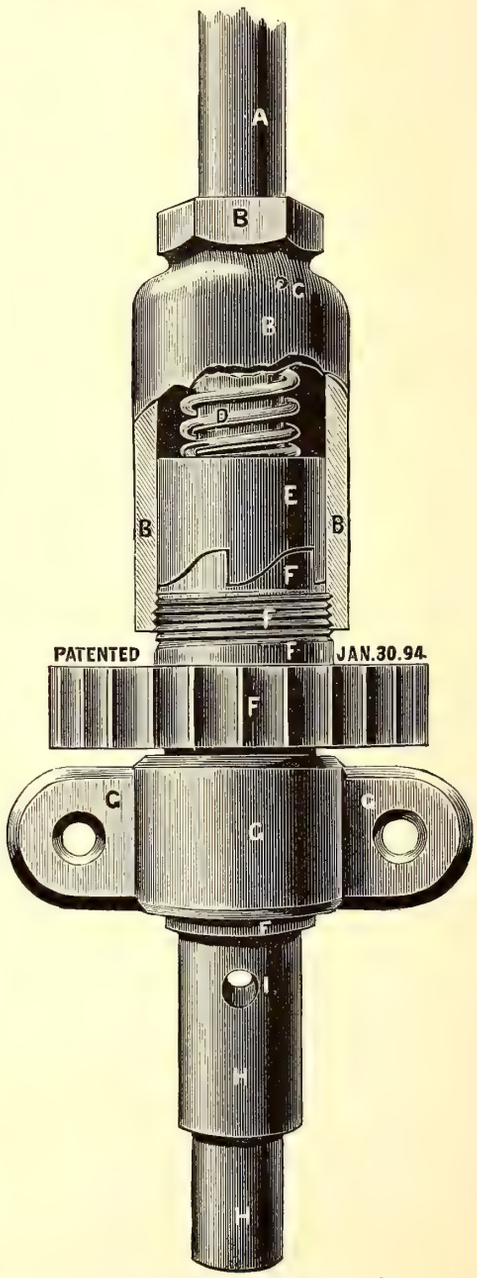
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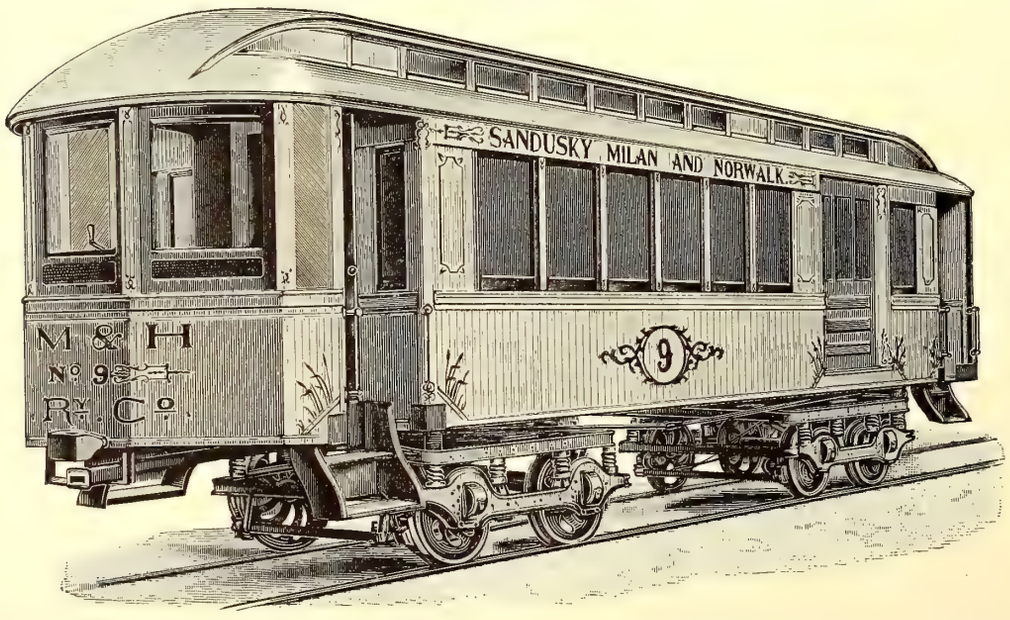
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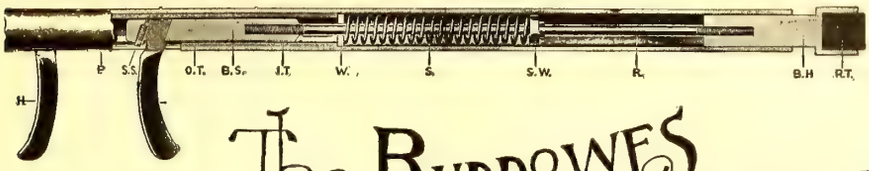
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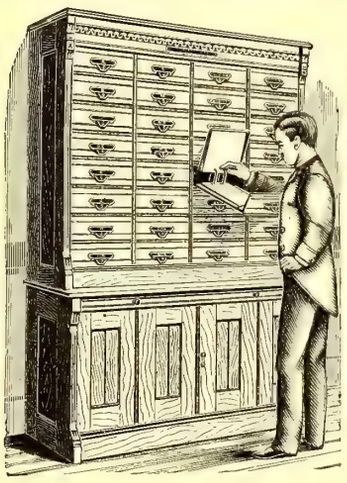


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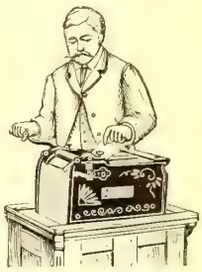
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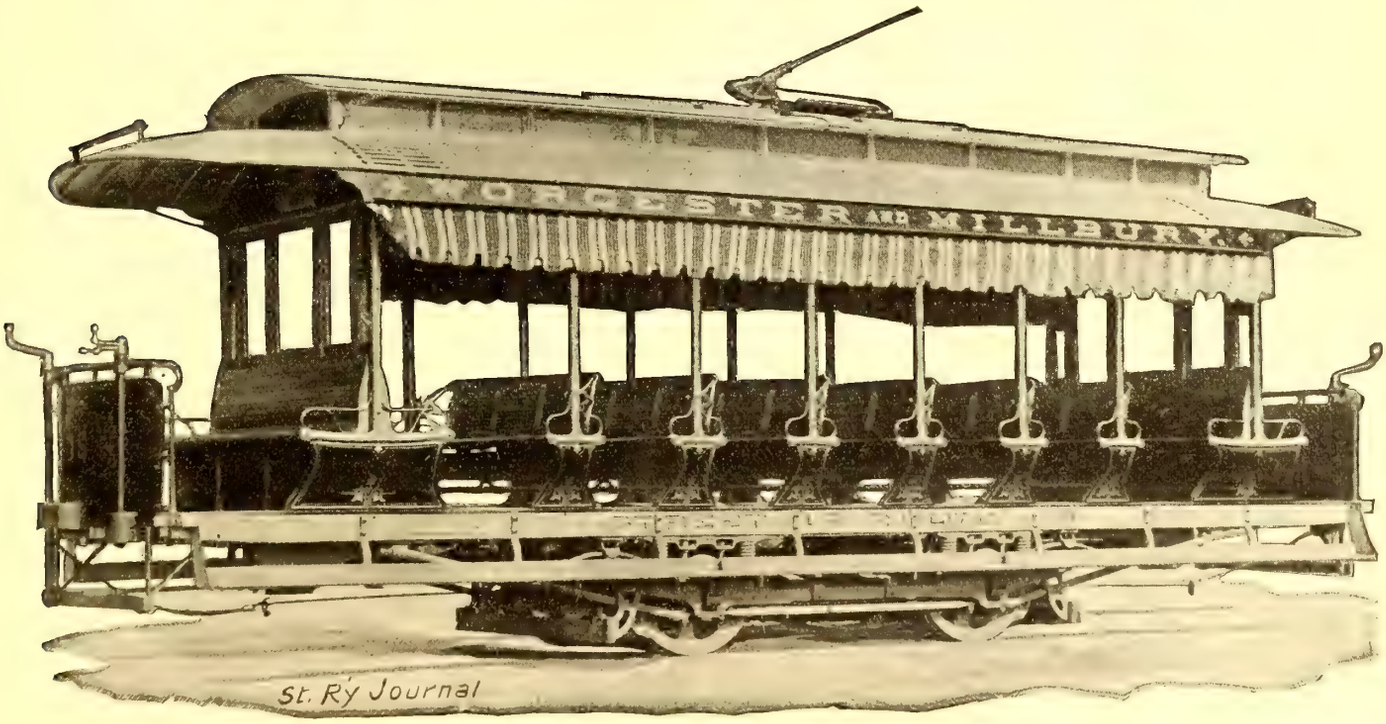
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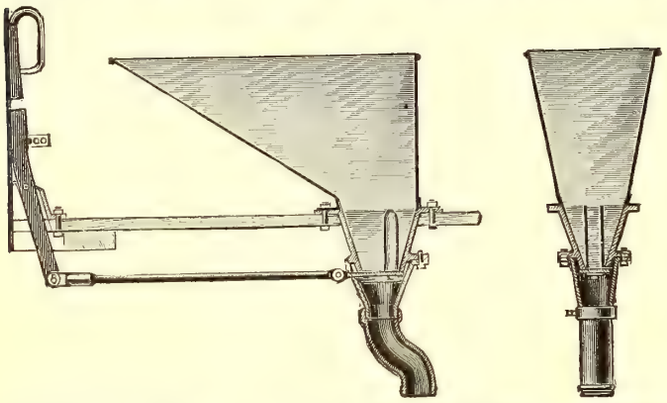
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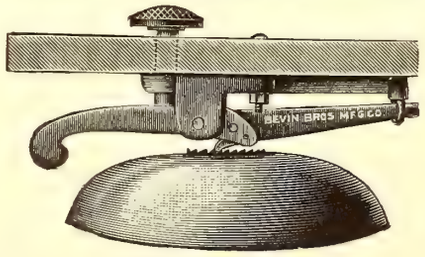
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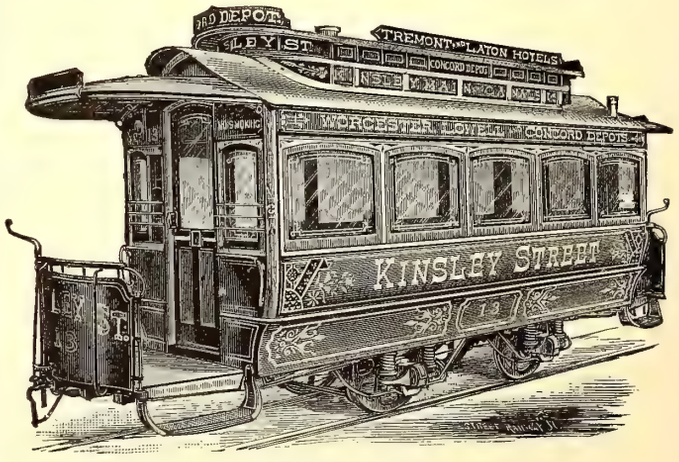
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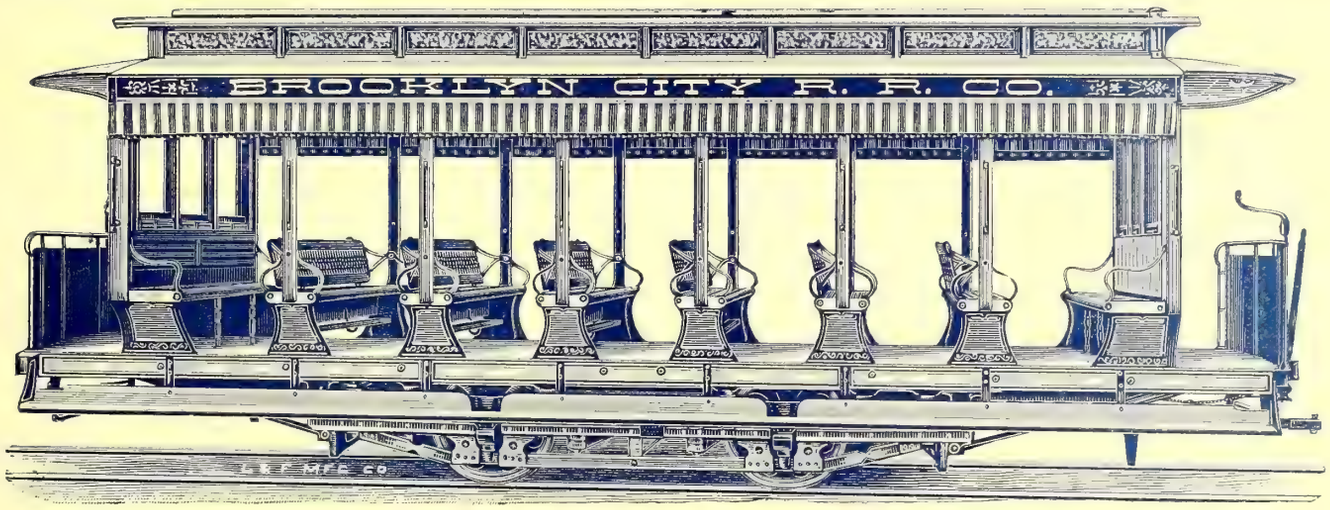
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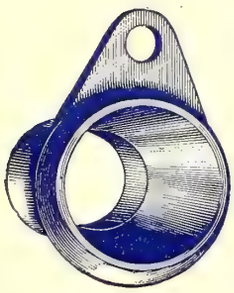
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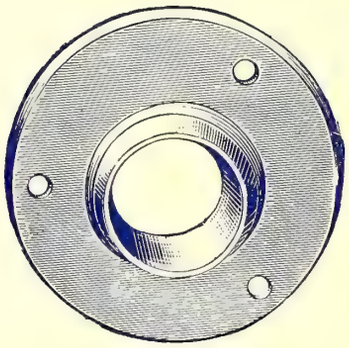
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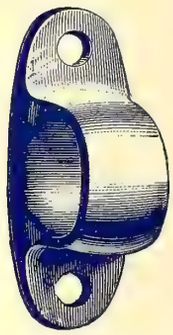
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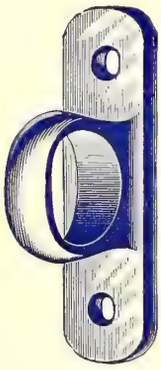
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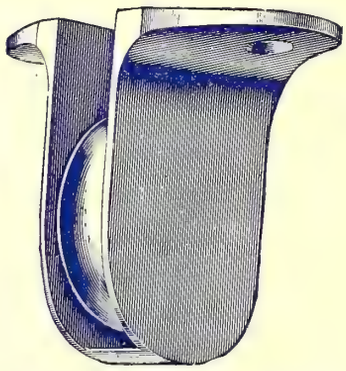
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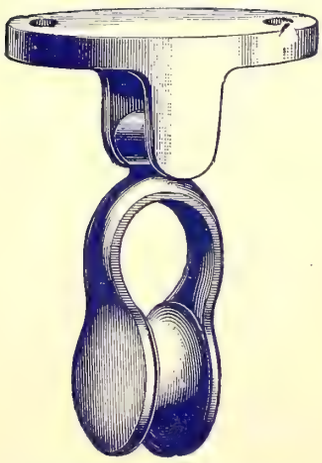
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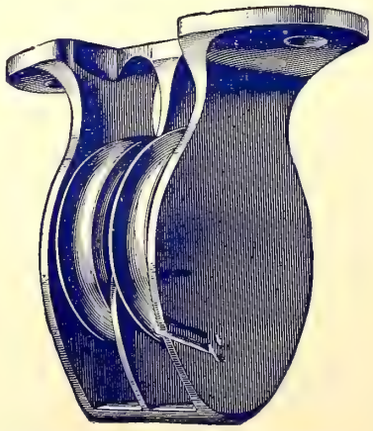
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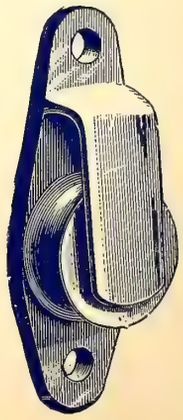
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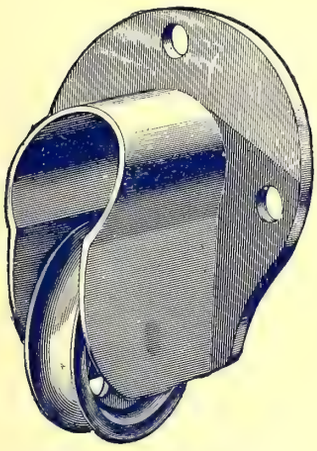


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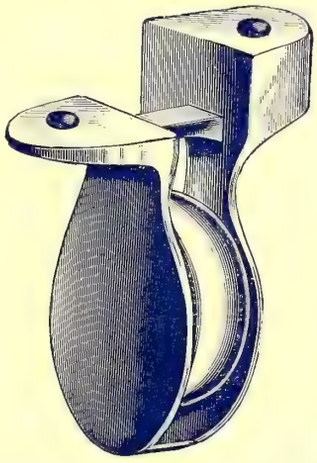
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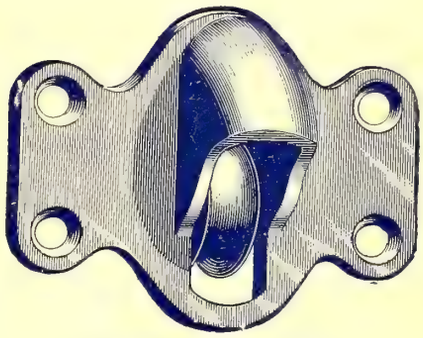
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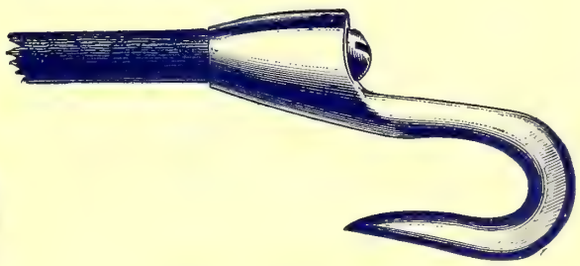
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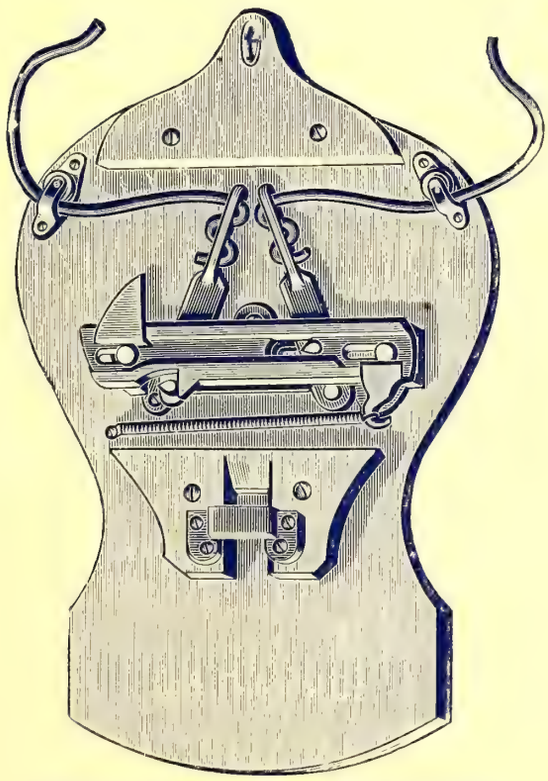
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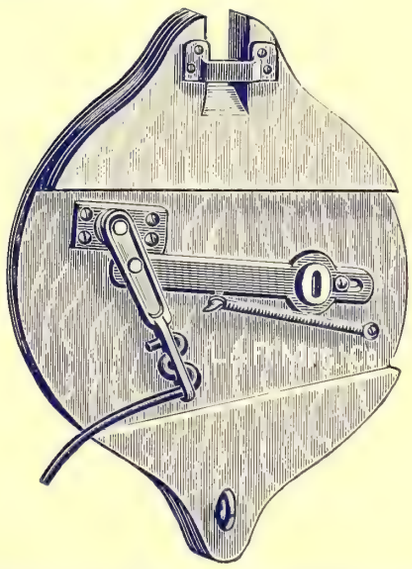
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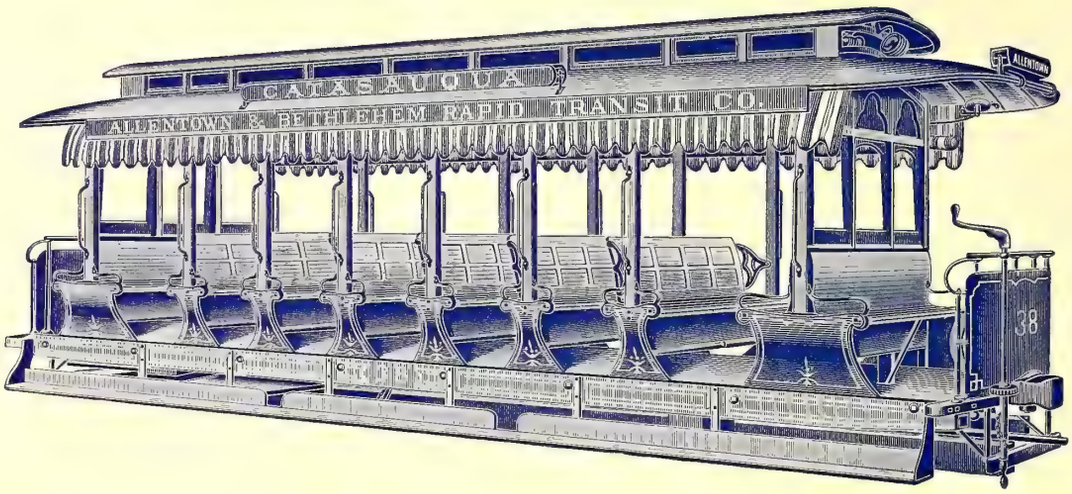
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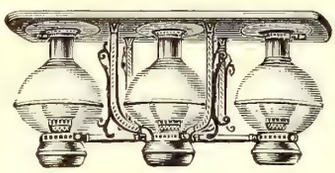
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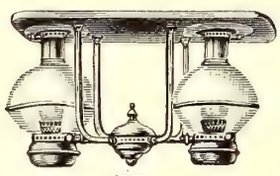
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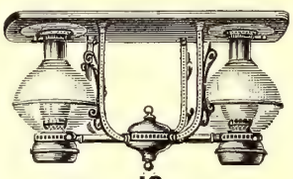
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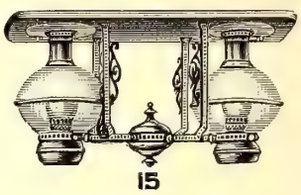
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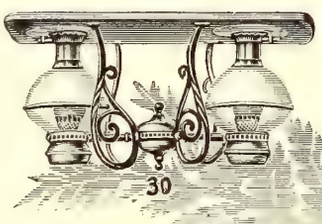
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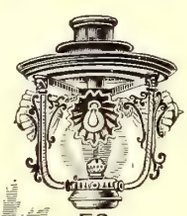

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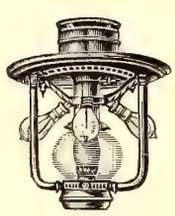

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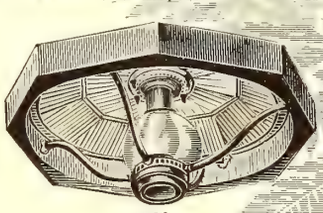

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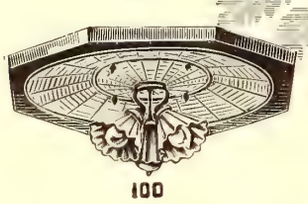

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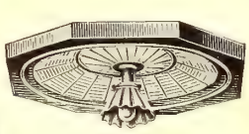

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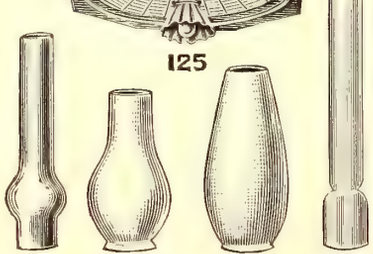

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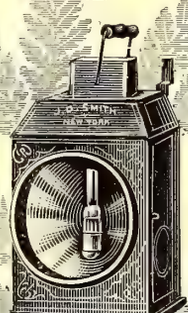

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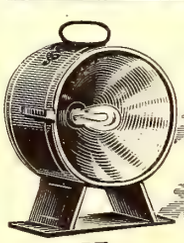


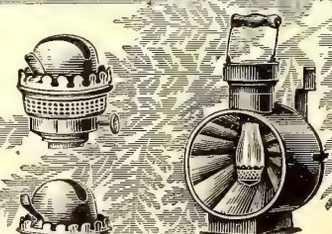

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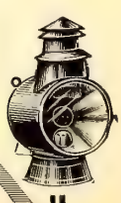

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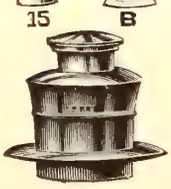

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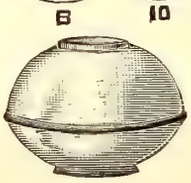

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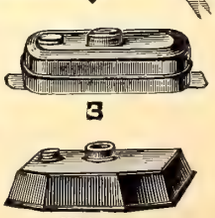









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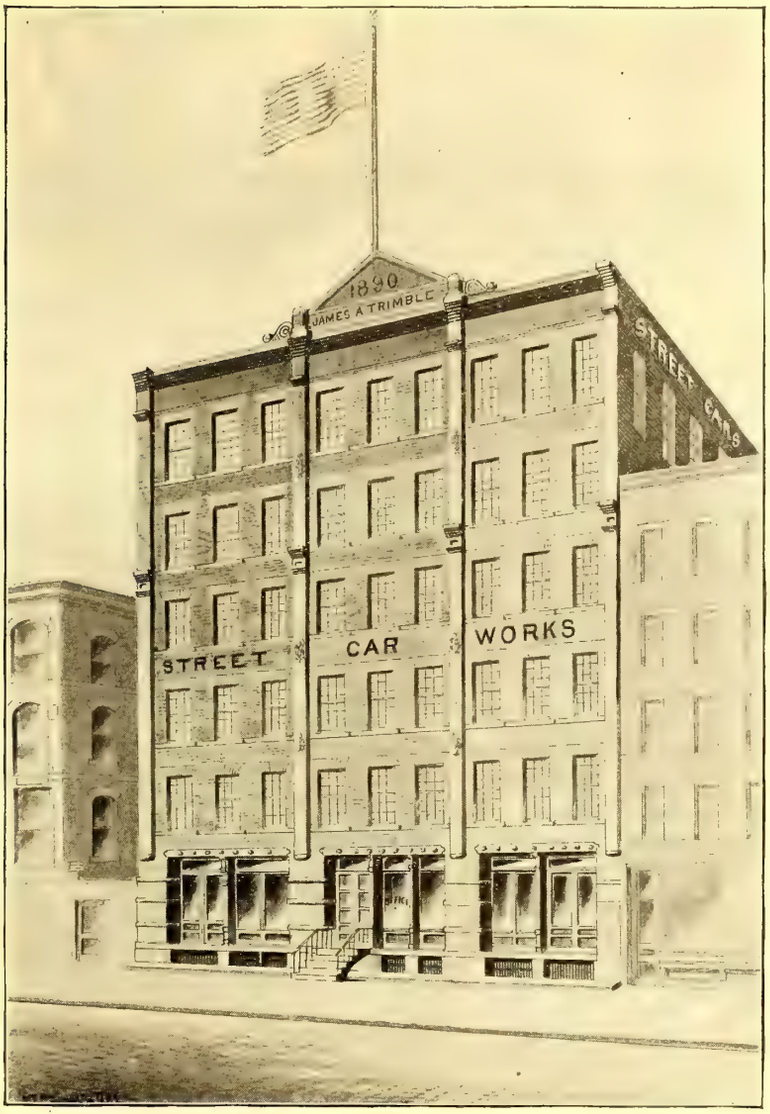

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27

JAMES A. TRIMBLE,

CARS



Horse,

Cable,

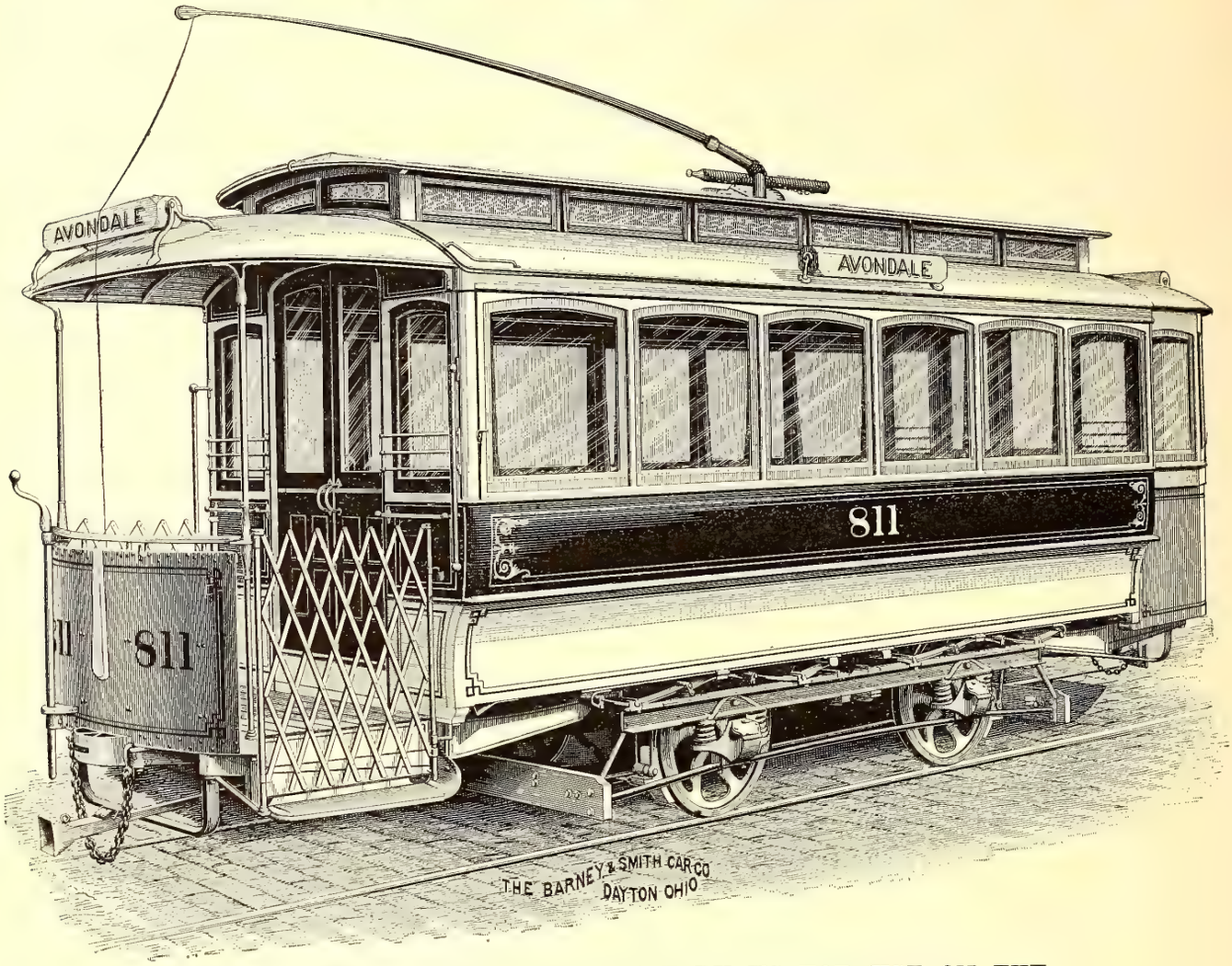
Electric



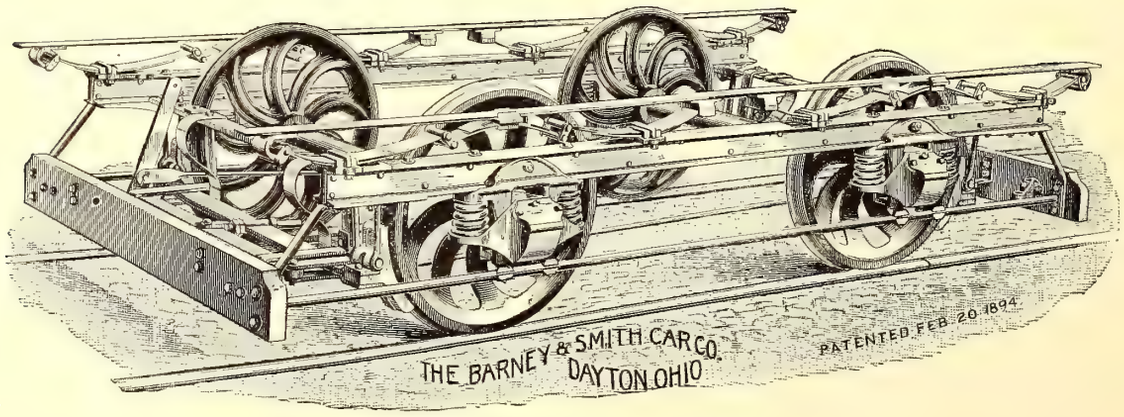
218 East 28th St., New York.

THE BARNEY & SMITH CAR CO.

DAYTON, OHIO.



THIS IS ONE OF THE CARS BUILT BY US FOR USE ON THE CONSOLIDATED LINES IN CINCINNATI, O.



PATENTED FEBRUARY 20, 1894.

OUR STANDARD TRUCK FOR CLOSED CARS.

BUILDERS OF HIGH CLASS

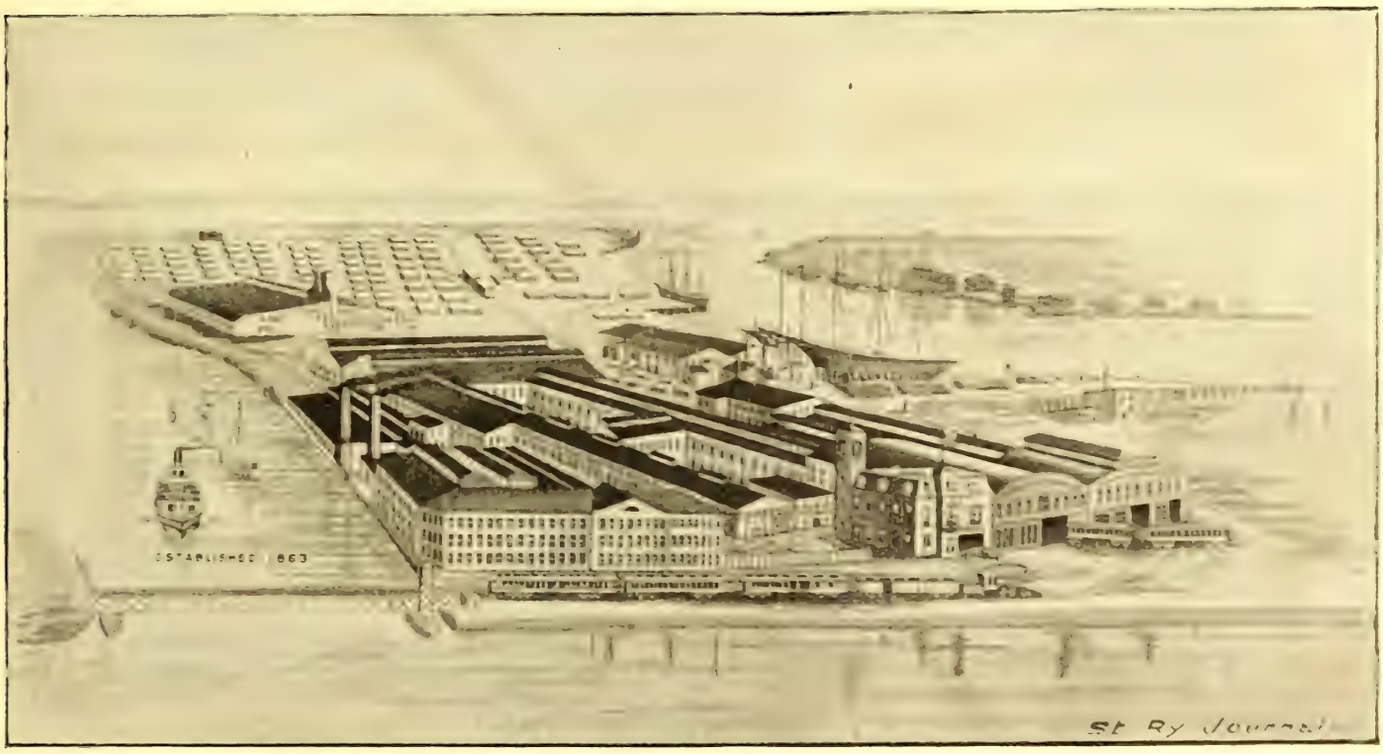
ELECTRIC, CABLE AND HORSE CARS.

SEND FOR CATALOGUE.

Jackson & Sharp Co.

DELAWARE CAR WORKS,

WILMINGTON, - DELAWARE,



BUILDERS OF

STREET RAILWAY CARS

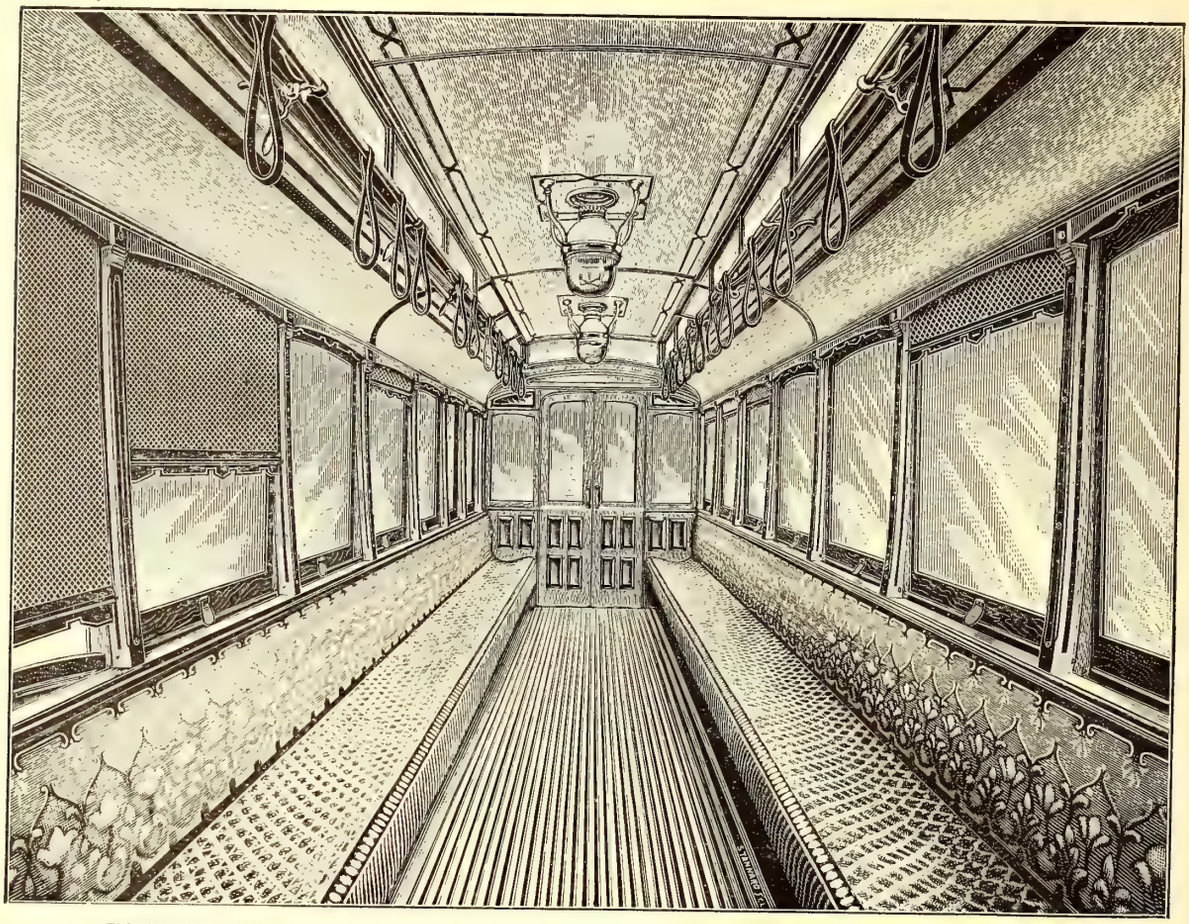
OF ALL KINDS.

Between 6,000,000 and 7,000,000 feet of thoroughly dry and seasoned lumber of all kinds constantly on hand, and 2,000,000 feet under cover.
Extraordinary facilities and large experience give us many advantages.

WRITE FOR DRAWINGS AND PRICES.

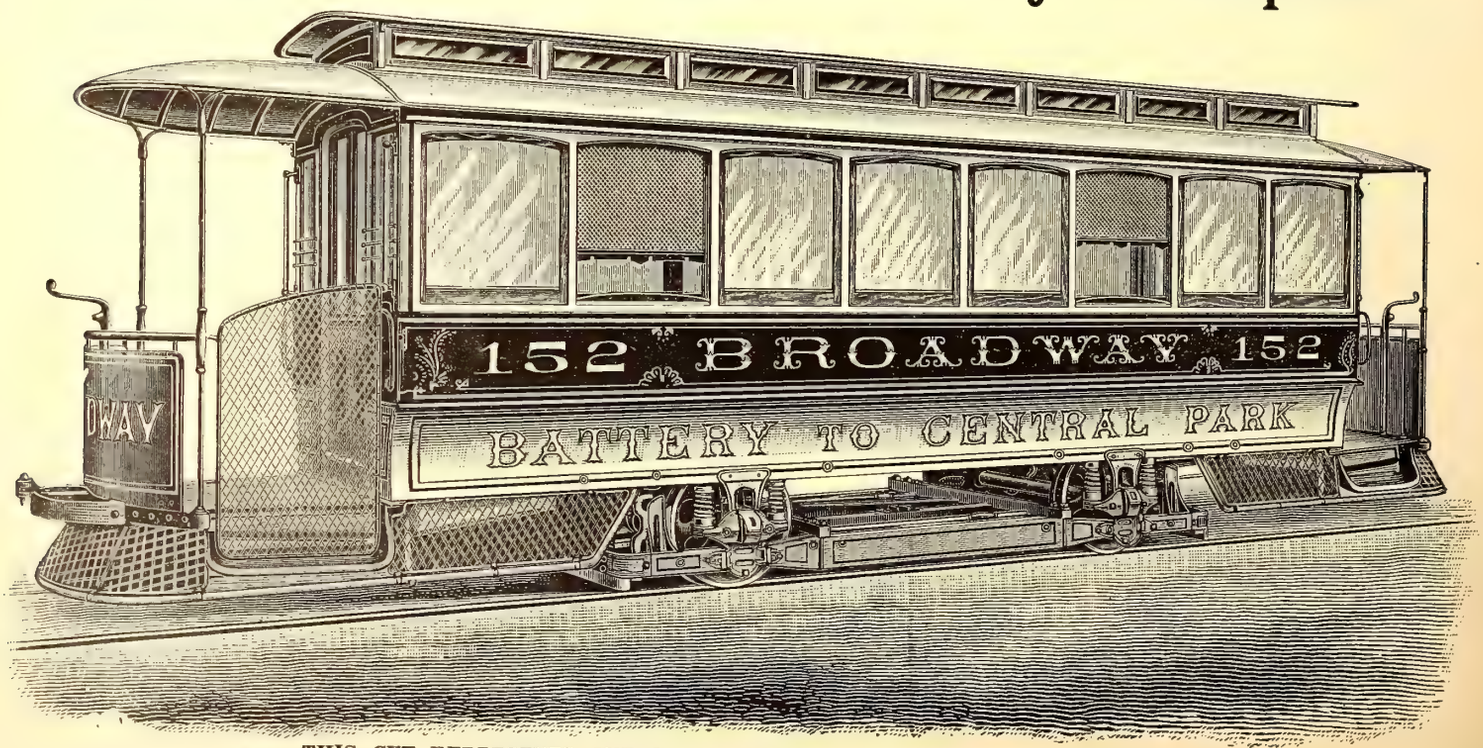
THE LACLEDE CAR CO.,

ST. LOUIS, MO.



INTERIOR OF CAR BUILT FOR THE BROADWAY CABLE LINE, NEW YORK CITY.

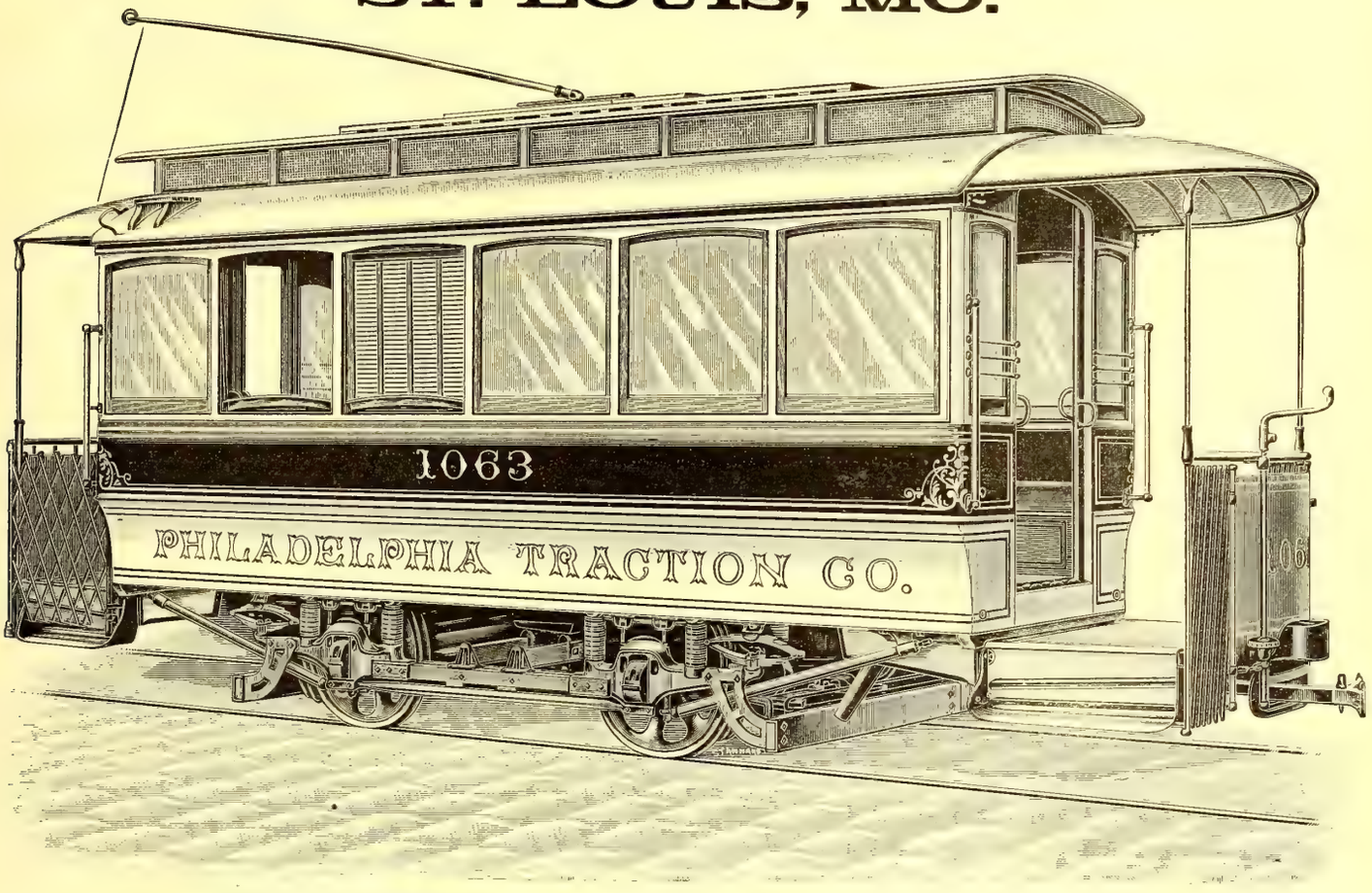
Builders of Street Cars of Every Description.



THIS CUT REPRESENTS ONE OF THE CARS BUILT FOR THE BROADWAY CABLE LINE OF NEW YORK CITY.

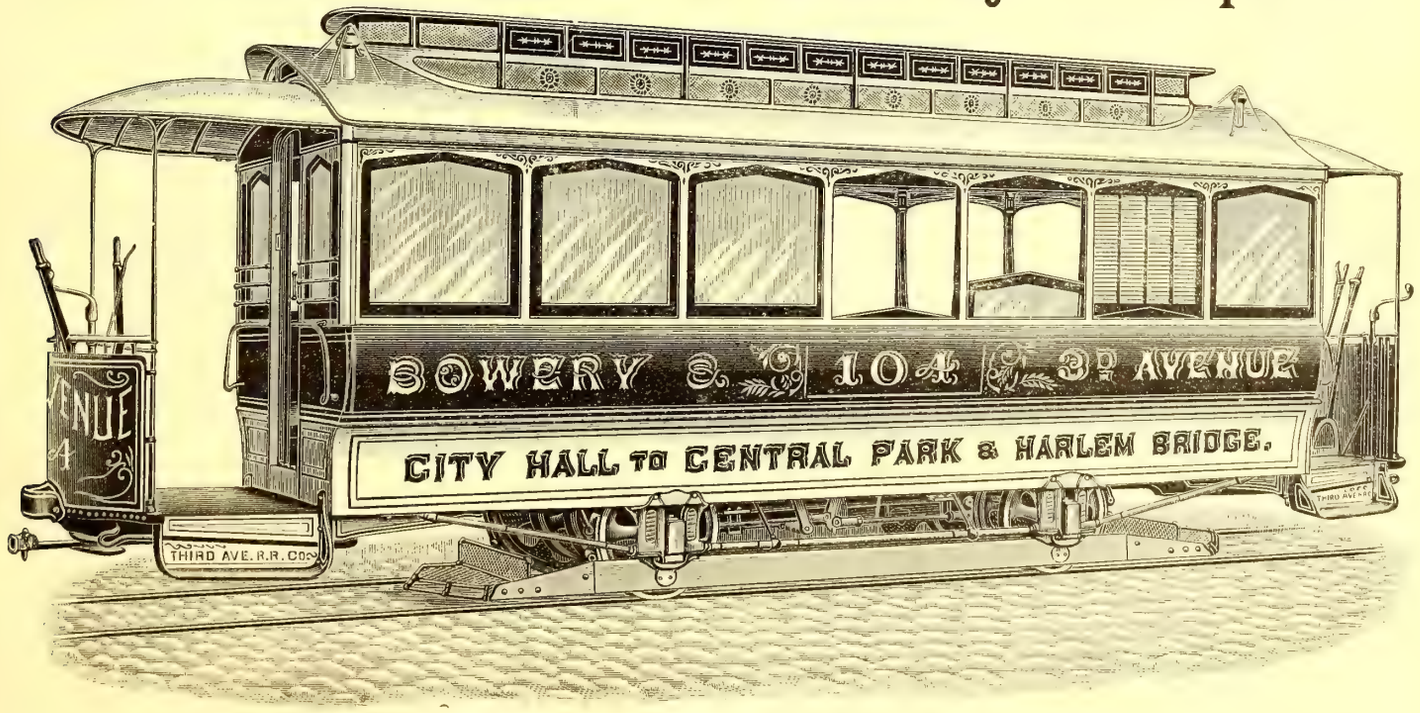
The Laclede Car Co.,

ST. LOUIS, MO.



THIS CUT REPRESENTS ONE OF THE 200 CLOSED CARS WE ARE FURNISHING THE PHILADELPHIA TRACTION CO.

Builders of Street Cars of Every Description.



THIS CUT REPRESENTS ONE OF THE 200 CARS BUILT FOR THE THIRD AVENUE R. R. CO., OF NEW YORK CITY.

BIG JOKE ON RAILROAD MEN!

Three years ago this month, May, '91, a Railroad President—peace to his ashes—asked us for some device to carry more passengers and let 'em on and off in less time.

We ought to have thought of it first ourselves—it's our business to do such things, and we do 'em generally—we made the first reversible seat with no arms, and now we've got a reversible folding seat, like a theater chair; we'll tell of it shortly if it turns out to be good-for-anything—sorry we didn't think of it. No matter—he did; and we got the thing up and patented it.

The man who does the inventing gets the patent, not the man that wants the inventing done.

We were fool enough to show him how we did it, the road we took. We widened the doorway; put in two doors—a really pretty arrangement—all the Conductor had to do was to touch one door, and both flew open or shut. We tried to think we had done it. No; it was something else. It worked like a jack-in-the-box; but it wouldn't carry more people or let 'em on and off faster.

We put the door at the step, and it carried 20 per cent. more people and let 'em on and off so fast that we got about 10 per cent. more speed in the safest and most agreeable way, by shortening stops.

We got our patent but lost our customer—we can afford to laugh at the joke, for we've got the world by the tail in spite of him.

He took up with our jack-in-the-box twin-door arrangement, and went to somebody else for his cars; and, being a great big man—at least in a great big place—four-fifths of the railroad men have gone after him! There's actually a run on twin doors! The car builders who have no patents, yell "steboy!" And the railroad men do the running.

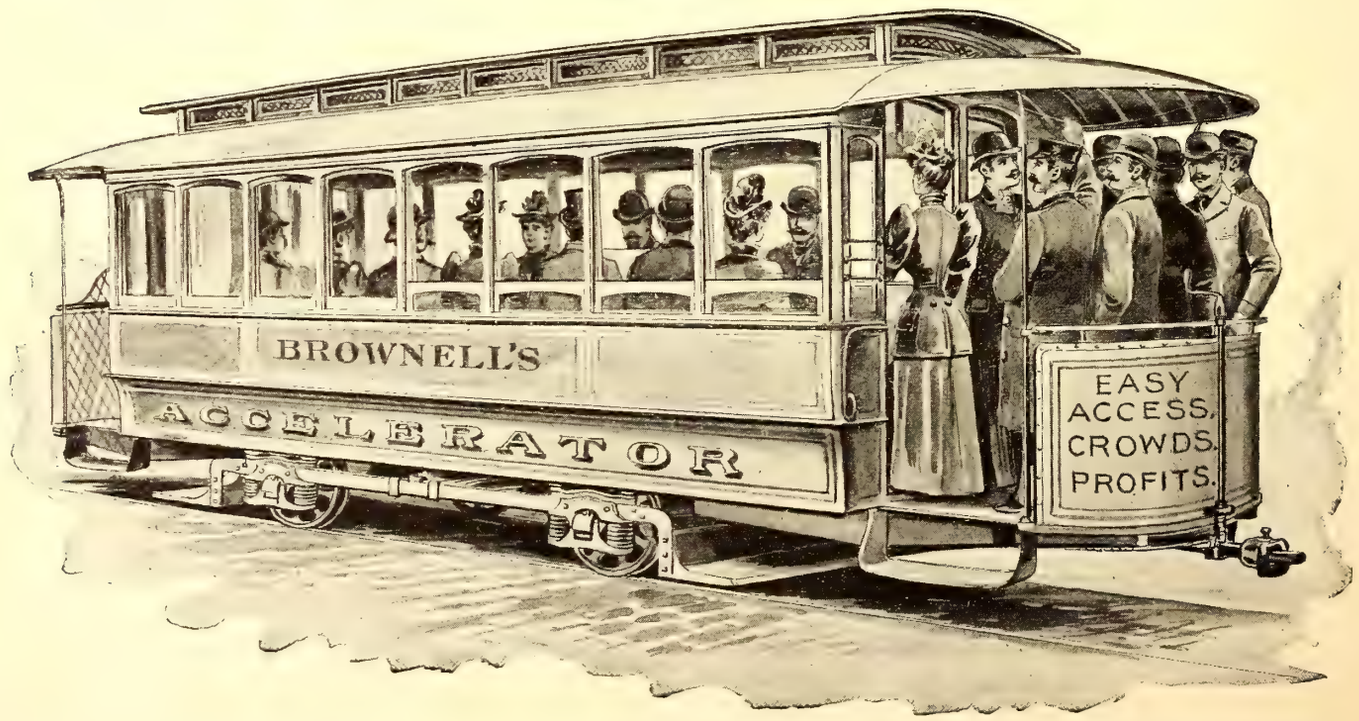
Meanwhile we are building Accelerators, and railroad men who kept their wits are buying 'em. 20 per cent. more passengers on at a time and 10 per cent. more speed and trips are too much for a jack-in-the-box twin-door I-move-without-touching car.

We build good cars at fair prices—all we want is all we can do at fair prices—we build all through as we build outside; and we make the prettiest cars this side of Jerusalem.

Gentlemen, you have lost your way, don't all come at once.

BROWNELL CAR COMPANY.

Saint Louis, Missouri.



If we should fill that car as full of passengers as you will when you have it, and the passengers want to ride, you couldn't see it half so clearly. There's room for twenty or thirty men on the platform, without obstructing the path between door and sidewalk. A woman with a baby in her arms can get on, without touching a man on the platform; and the Conductor is right at the step to help her.

May 7th last we received this telegram :

> " First open car in service to-day. It is a bird. I congratulate you on your exquisite taste, and myself on my nerve to give you *carte blanche* order. We are the people. The best, East, West, North, South, can't catch us." JOHN J. SHIPHERD.

And three days later, this letter :

> " Our $250 to $300 a day increase in Newport and Covington this year over last, while Cleveland is not keeping up in receipts, shows that the bright attractive equipment should have credit. I believe it is the true way to do the street railroad business."
>
> JOHN J. SHIPHERD.

They were the spontaneous expressions of gratification over the last lot of cars we had made for him.

We quote from his first order from memory—it was spoken, not written :

> " We want to show the people that we are going to give them the best service they ever had. We want the best and finest cars you can build. If it is necessary to spend $200 more on a car, I want to do it. I understand from our General Manager that you are a man we can deal with in this way."

He had just bought a road in Toledo with which we had made a contract for cars a few days before ; and that is how he treated our contract. It was in 1884.

It is not necessary to deal in this extremely generous way to get good cars ; but we print (without permission) the telegram, letter and speech, to show that a buyer is safe in dealing with us, no matter how he deals—and he may as well deal agreeably.

He was a total stranger to us ; there was nothing personal in the case. We had been making cars for the road since 1873, and had the good-will of the officers of it. That's all the foundation he had.

One road wants one sort of equipment, another another. One wants fine cars ; another durable ones—we never heard of a road that wanted mean ones or weak ones.

We have no difficulty in making exactly such cars as the buyer wants ; and this is how we go about it :

We reckon the costs of the stuff and the work—of the grade that is wanted—put on the profit we want—and put 'em together. That is our price for the cars. The buyer pays it ; and we are good friends forever after.

On the next large order we have, we are going to make an extra car to be *inspected.* There's only one way to inspect a car ; that is to knock it to pieces and see what it was made of and how it was made.

The car to inspect will be drawn by lot ; and you shall be there to see the show, if you like. We'll give due notice of time and place.

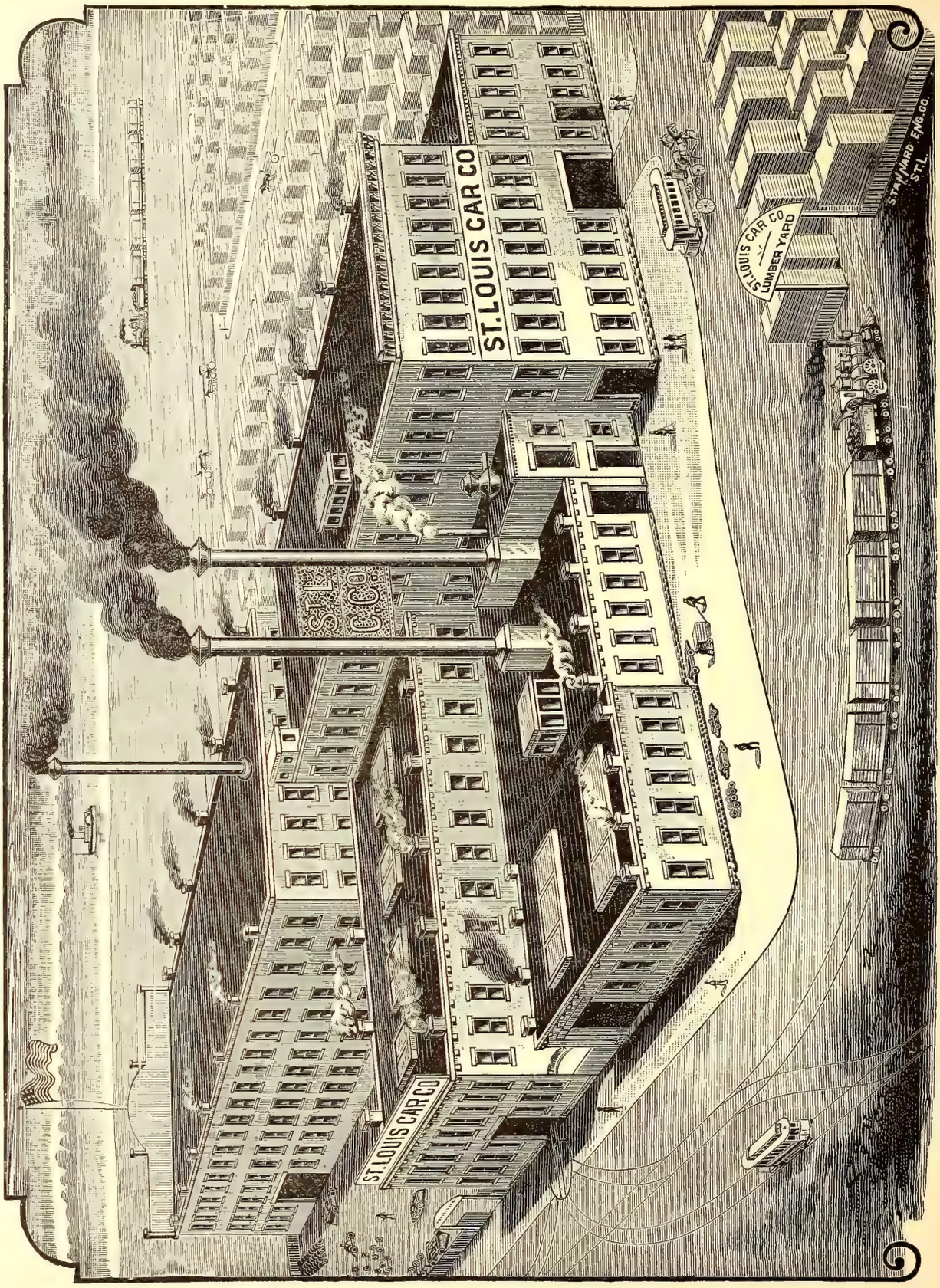
We have never been suspected, so far as we know, of making poor cars, or of cheating inside, or of anything else that might be supposed to call for ocular proof of how we make all cars ; but we have a substantial reason for giving an extra car to be inspected now and then—for we mean to do it occasionally—and the reason is ; we want a larger and readier market ; we want more money. Our cars are worth it ; we want it.

We have a good deal more to say ; but this will do for once.

BROWNELL CAR COMPANY.

SAINT LOUIS, MISSOURI.

The Largest and Most Complete Street Car Factory in the World.

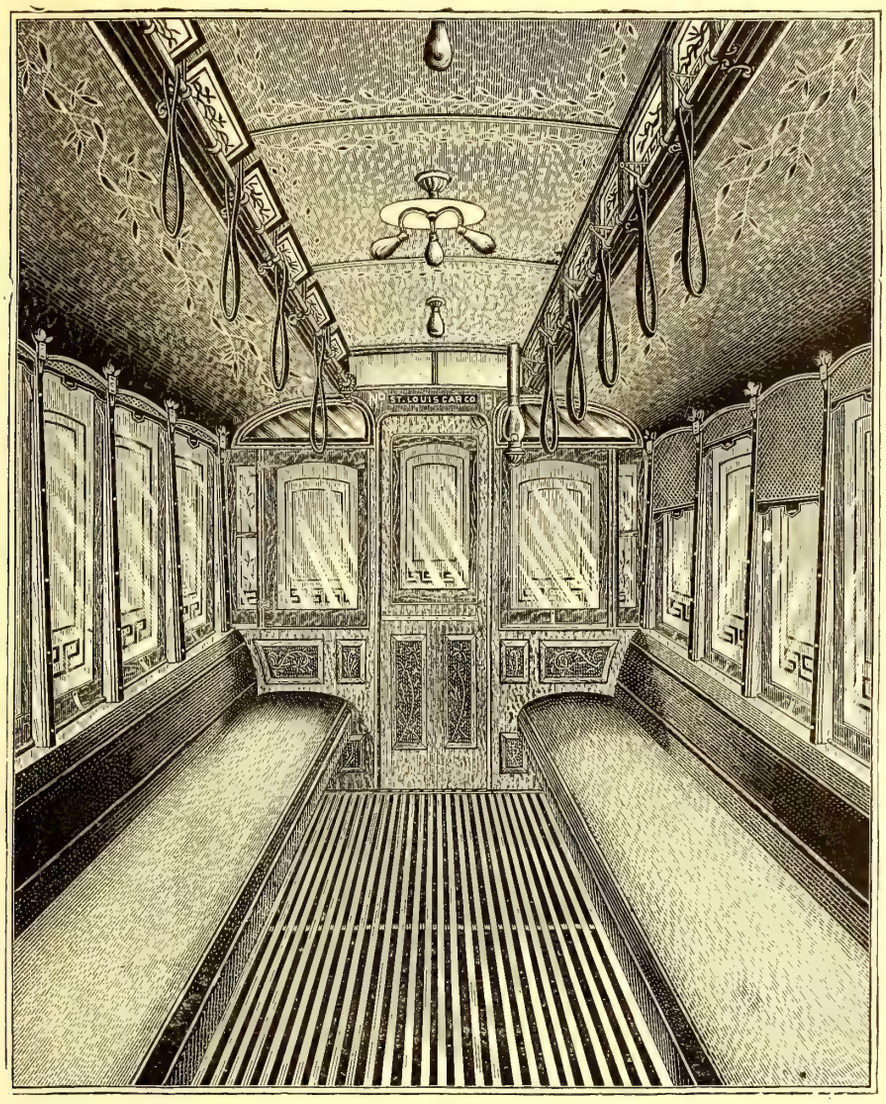


PERSPECTIVE VIEW OF THE NEW WORKS OF THE ST. LOUIS CAR CO.

EASTERN AGENTS:

EDMUND D. SMITH & CO.,

208 S. 4th St., Philadelphia. Pa.



INTERIOR FINISH OF FANCY ELECTRIC CAR

ST. LOUIS CAR CO.,

Manufacturers of all kinds of

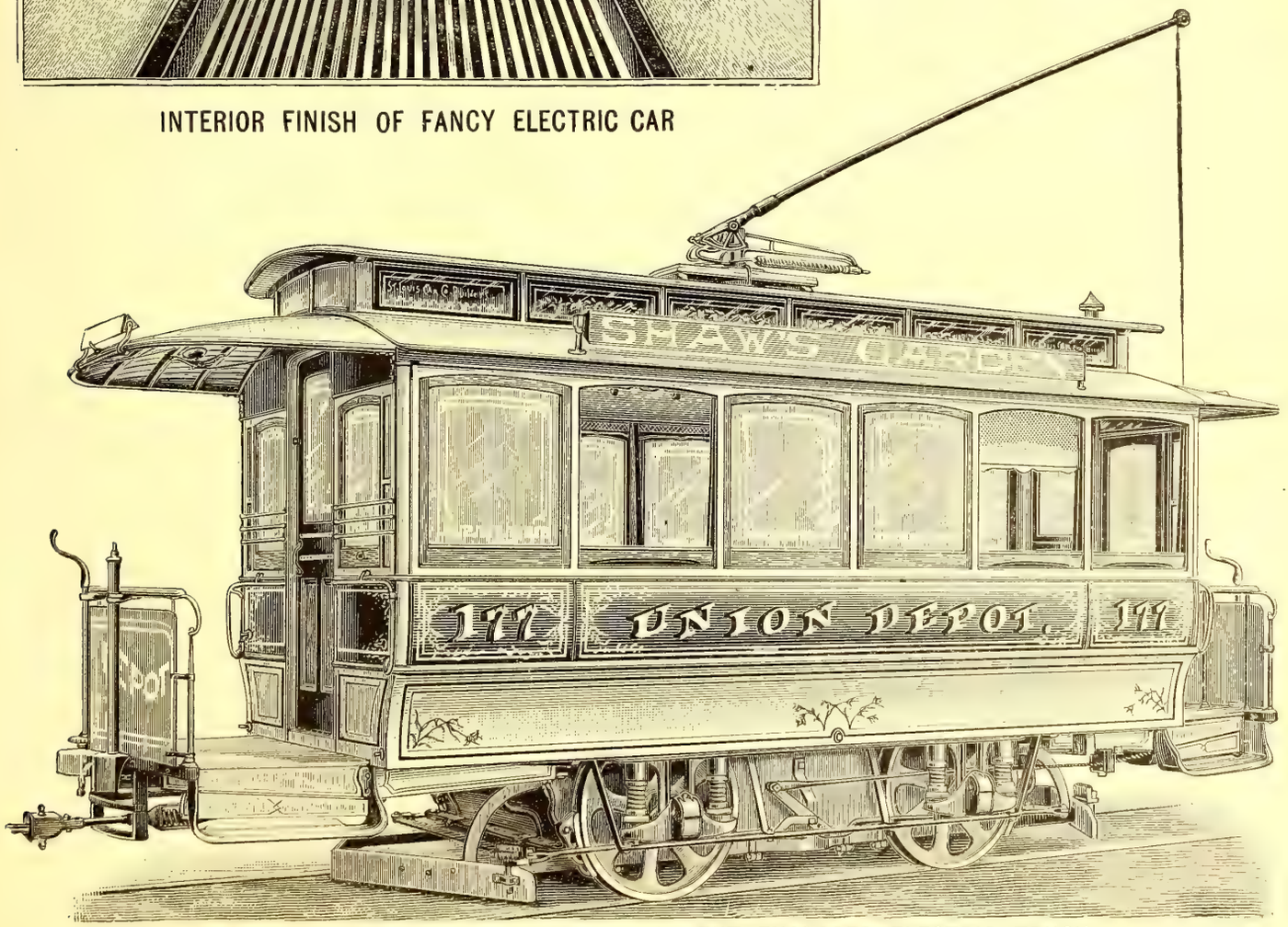
MOTOR CARS, ELECTRIC CARS AND TRUCKS

A SPECIALTY.

OFFICE:

3,023 N. Broadway,

ST. LOUIS.



16 FOOT CLOSED CAR MOUNTED ON PATENT ENCLOSED ELECTRIC TRUCK.

AMERICAN CAR CO.

WM. SUTTON, President.
EMIL ALEXANDER, Secretary.

STRICTLY

HIGH CLASS

ELECTRIC,
CABLE AND
HORSE

CARS

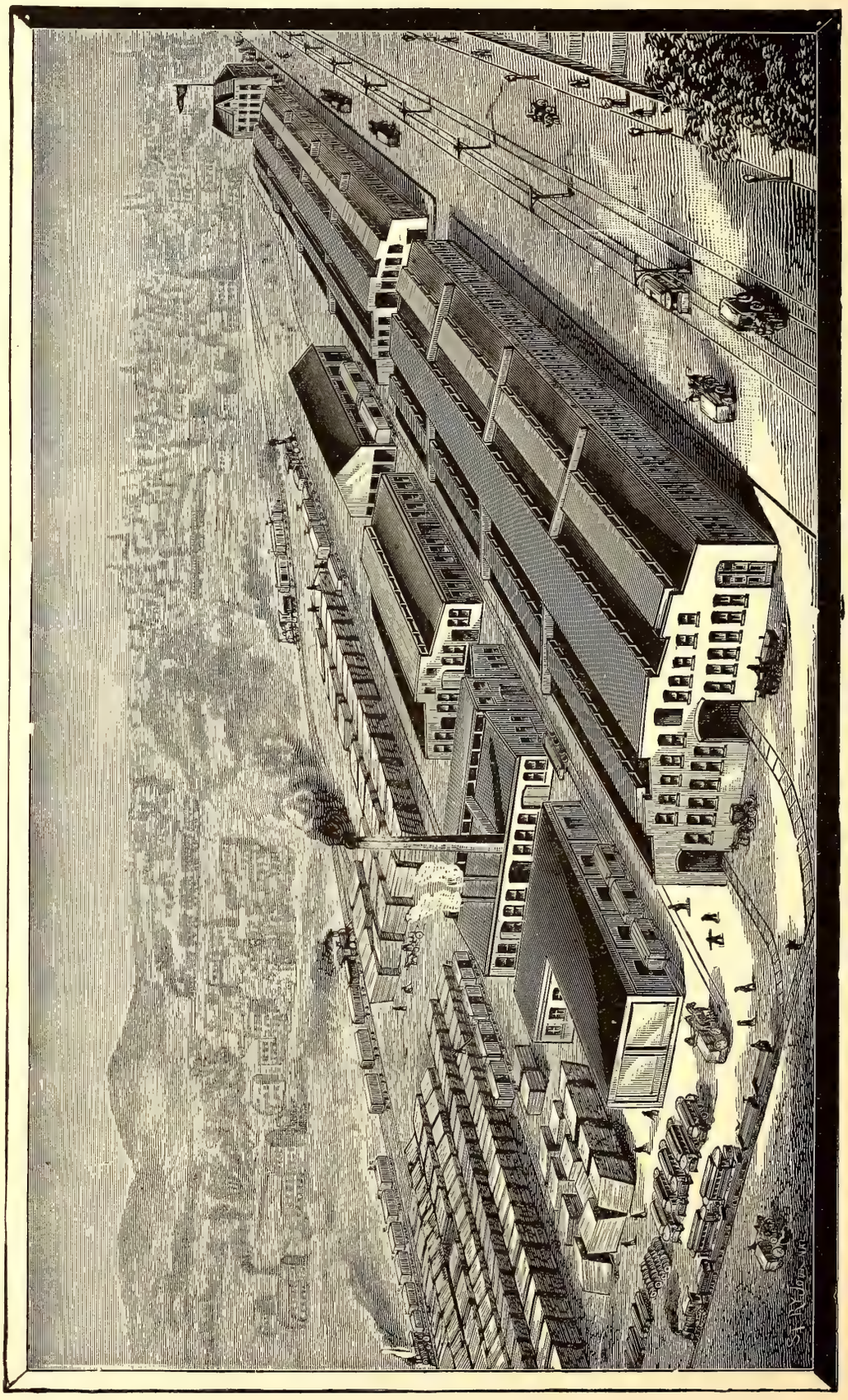
FOR

Early Delivery

Extensive Shops.

New Machinery.

Correspondence Invited.

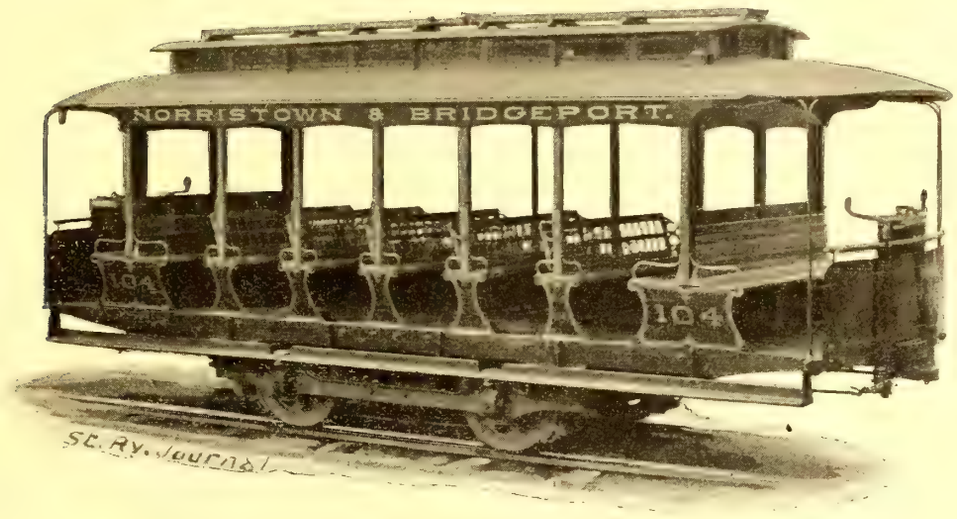


Works, Old Manchester Road, near Tower Grove Ave. 626 CHESTNUT ST., ST. LOUIS, MO.

THE

NEW CASTLE CAR MFG. CO.

NEW CASTLE, PA.



BUILDERS OF ALL KINDS OF

STREET RAILWAY CARS

Orders Filled Promptly and with Care.



Material and Workmanship Guaranteed.

SEND FOR CATALOGUE.

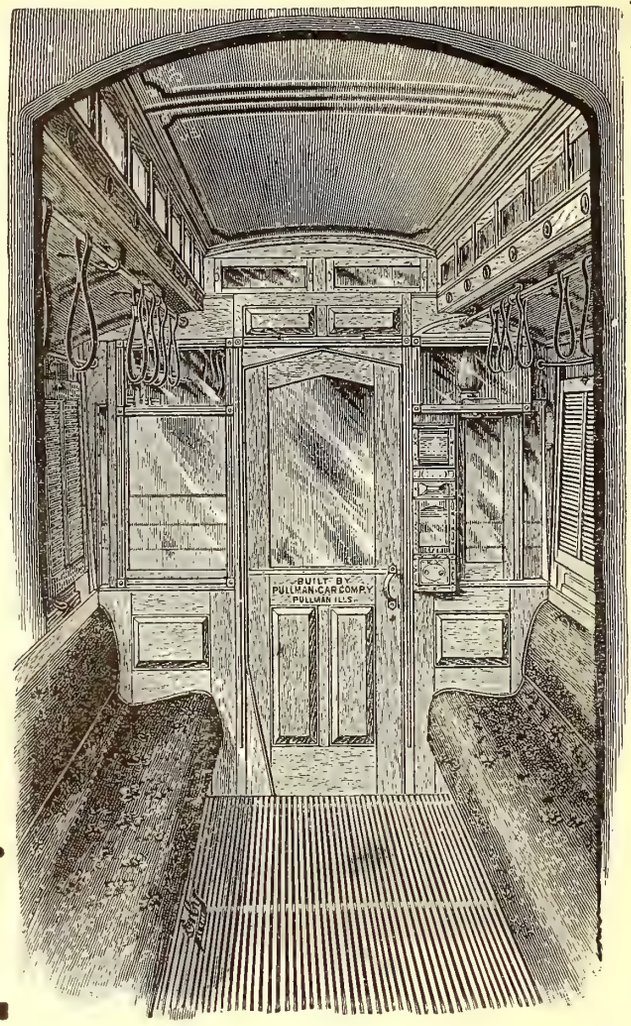
Pullman's Palace Car Co.,

Manufacturers of

RAIL-ROAD

CARS.

Pullman, Illinois.

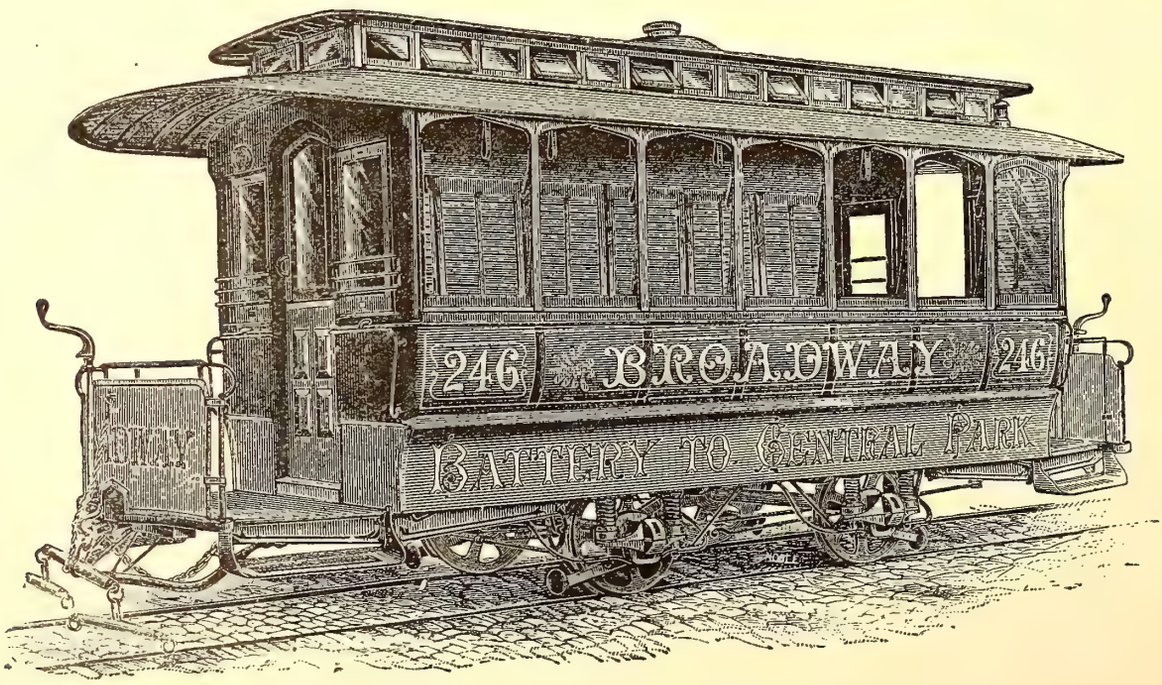


Make a Specialty of

Street, Cable Grip & Electric Motor

CARS.

Detroit, Michigan.

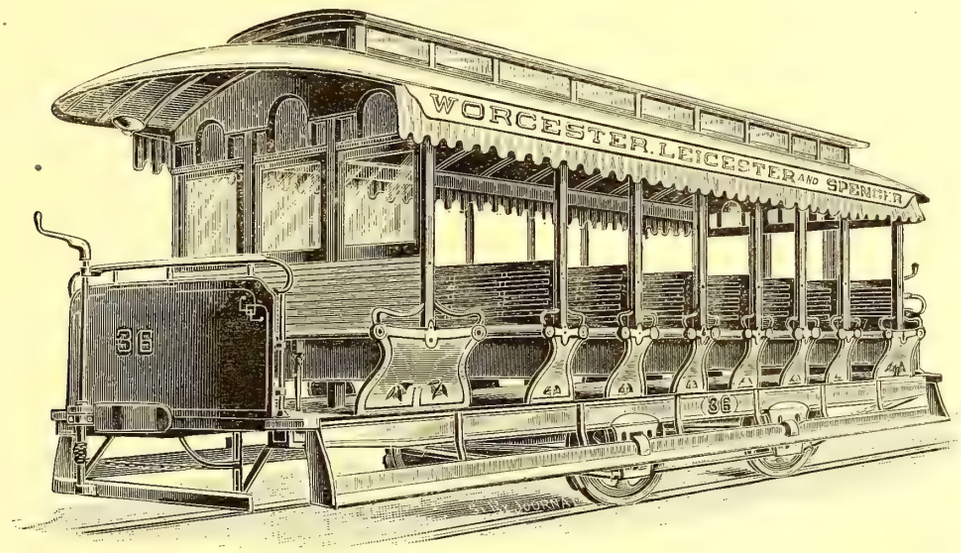


Address all Correspondence

Contracting Agent, Chicago, Ill.

THERE ARE MANY

CAR BUILDERS



BUT IF YOU THINK OF BUYING CARS YOU OUGHT TO BE SURE TO GET PRICES AND ESTIMATES OF

THE ELLIS CAR CO.

AMESBURY, MASS.

N. B.—We have in stock that we can ship on short notice, the following car bodies: Five 9 bench open car bodies with closed ends, ten 10 bench open car bodies with closed ends, five 16 foot box car bodies, five 19 foot box car bodies and one 25 foot box car body.

CARLETON & KISSAM

LARGEST STREET CAR ADVERTISING CONCERN IN THE WORLD!

WILLIAM F. CARLETON.
BOSTON, MASS.

GEORGE KISSAM.
NEW YORK, N. Y.

MAIN OFFICE:
50 Bromfield St., Boston.

NEW YORK OFFICE:
Postal Telegraph Building.

BRANCH OFFICES:

Chicago, Cincinnati, Minneapolis, St. Paul, Pittsburgh, Buffalo, Rochester, Columbus, Duluth, Denver, Milwaukee, Newark, Providence, Albany, Hamilton, Canada.



CONTROLS THE ADVERTISING PRIVILEGE IN

1000	Cars	of the	West End Co., Boston, Mass.
50	"	"	Boston, Revere Beach & Lynn R. R., Boston, Mass.
50	"	"	Lynn & Boston Railway, Boston, Mass.
75	"	"	Lynn & Boston Railway, Lynn, Mass.
50	"	"	Naumkeag Street Railway, Salem, Mass.
50	"	"	Globe Street Railway, Fall River, Mass.
50	"	"	Brockton Street Railway, Brockton, Mass.
40	"	"	Merrimac Valley Railroad Co., Lawrence, Mass.
40	"	"	Lowell Railroad Co., Lowell, Mass.
40	"	"	Haverhill & Groveland St. R.R. Co., Haverhill, Mass.
169	"	"	Union Railroad, Providence, R. I.
500	"	"	Consolidated Cincinnati Railways, Cincinnati, O.
250	"	"	New Jersey Traction Co., Newark, N. J.
70	"	"	Citizens' Traction Co., Pittsburgh, Pa.
60	"	"	Pittsburgh Traction Co., Pittsburgh, Pa.
200	"	"	St. Paul City Railway Co., St. Paul, Minn.
100	"	"	Consolidated Street Railroad Co., Columbus, O.
13	"	"	Elizabeth Street Railway Co., Elizabeth, N. J.
50	"	"	Duluth Street Railway Co., Duluth, Minn.
25	"	"	Superior Rapid Transit Ry. Co., West Superior, Wis.
20	"	"	Citizens' Street Railway Co., Kalamazoo, Mich.
25	"	"	N. F. & Susp. Bridge Ry. Co., Niagara Falls, N.Y.
200	"	"	Milwaukee Street Railway Co., Milwaukee, Wis.
10	"	"	Buffalo & Tonawanda Ry. Co., Tonawanda, N. Y.
17	"	"	West End Street Railway Co., Denver, Colo.
170	"	"	Denver City Cable Ry. Co., Denver, Colo.
40	"	"	Cicero & Proviso Railway Co., Chicago, Ill.
60	"	"	Hamilton Street Railway Co., Hamilton, Canada.
13	"	"	North & East River Railway Co., New York.
44	Cars	of the	Pittsburgh & West End Pass, Ry. Co., Pittsburgh, Pa.
850	"	"	West Chicago Street Railway, Chicago, Ill.
75	"	"	Chicago Passenger Railway Co.
400	"	"	North Chicago Street Railway, Chicago, Ill.
225	"	"	Third Avenue Railway, New York.
65	"	"	125th St. & 10th Ave. Cable Railway, New York.
47	"	"	Central Crosstown Railway, New York.
41	"	"	Chistopher & 10th St. Railway Co., New York.
200	"	"	Brooklyn City & Newtown Ry., Brooklyn, N. Y.
50	"	"	South Covington & Cincinnati Railway Co.
50	"	"	Newark & South Orange Ry. Co., Newark, N. J.
175	"	"	Rochester Railway Co., Rochester, N. Y.
250	"	"	Buffalo Street and Crosstown St. Ry. Cos., Buffalo, N.Y.
200	"	"	Minneapolis St. Railway Co., Minneapolis, Minn.
20	"	"	New Jersey Traction Co., Elizabeth, N. J.
50	"	"	Patterson Railway Co., Paterson, N. J.
18	"	"	Hamilton & Lindenwald Elec. Transit Co., Hamilton, O.
13	"	"	New Brunswick City Ry. Co., New Brunswick, N. J.
27	"	"	Springfield Railway Co., Springfield, O.
25	"	"	Second Avenue Pass. Railway Co. Pittsburgh, Pa.
107	"	"	Albany Railway, Albany, N. Y.
5	"	"	Plainfield St. Ry. Co., Plainfield, N. J.
6	"	"	Buffalo, Bellevue & Lancaster Ry., Buffalo, N. Y.
6	"	"	Stillwater & Mechanicville St. Ry. Co., Mec'ville, N. Y.
14	"	"	Madison City Ry. Co., Madison, Wis.
42	"	"	Mt. Auburn Cable Ry. Co., Cincinnati, O.
52	"	"	Steinway Railway Co., Long Island City, N. Y.
15	"	"	Newport Street Railway Co., Newport, R. I.
47	"	"	Pittsburgh & Birmingham Traction Co., Pittsburgh, Pa.

290 CARS OF THE BROOKLYN UNION ELEVATED R. R. CO., Brooklyn, N. Y., After May 1, 1895.

And has Special Contracts with many other Companies.

References: Presidents of all the above Roads.

This Company is prepared to negotiate for long time leases with first-class roads in any part of the United States.

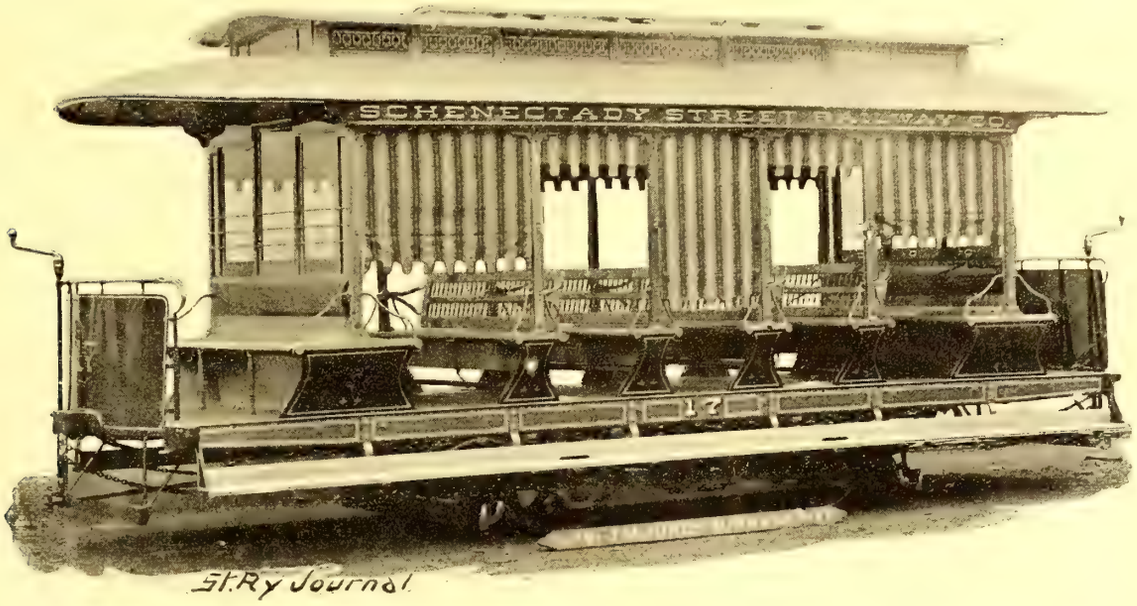
—ESTABLISHED 1839.—

J. M. JONES' SONS,

STREET RAILWAY

CAR BUILDERS,

West Troy, N. Y.



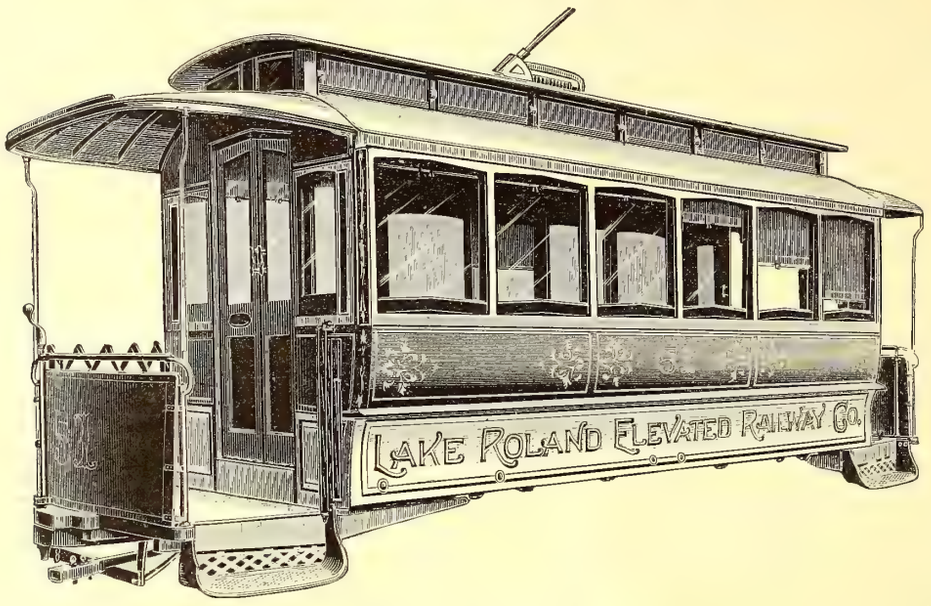
ORDERS FILLED PROMPTLY.



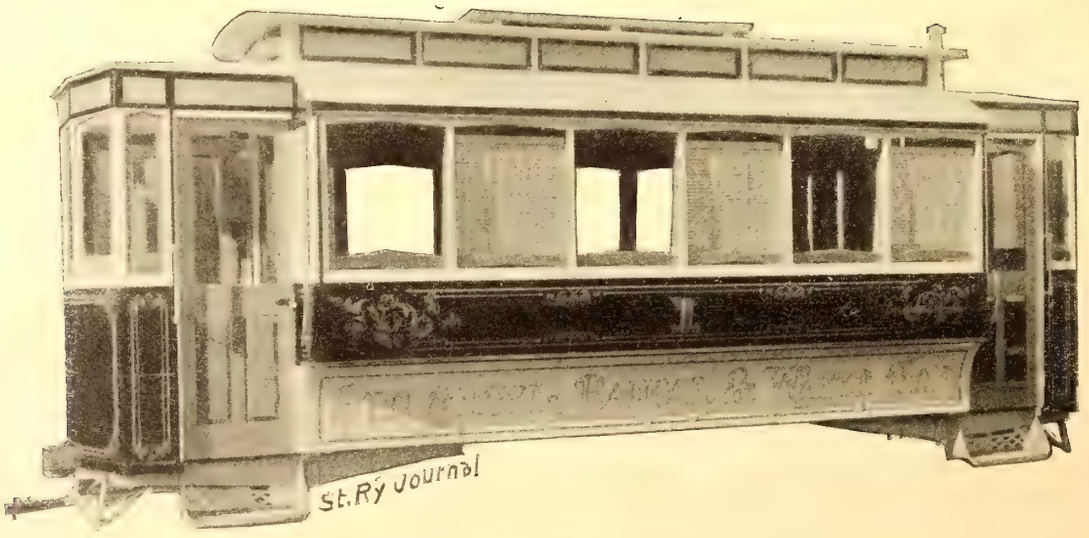
SPECIAL ATTENTION GIVEN TO

CARS FOR ELECTRIC AND CABLE SERVICE.

CARS



J.W. FOWLER CAR CO



GENERAL OFFICE AND WORKS:

ELIZABETHPORT, N. J.

GENETT AIR BRAKE.

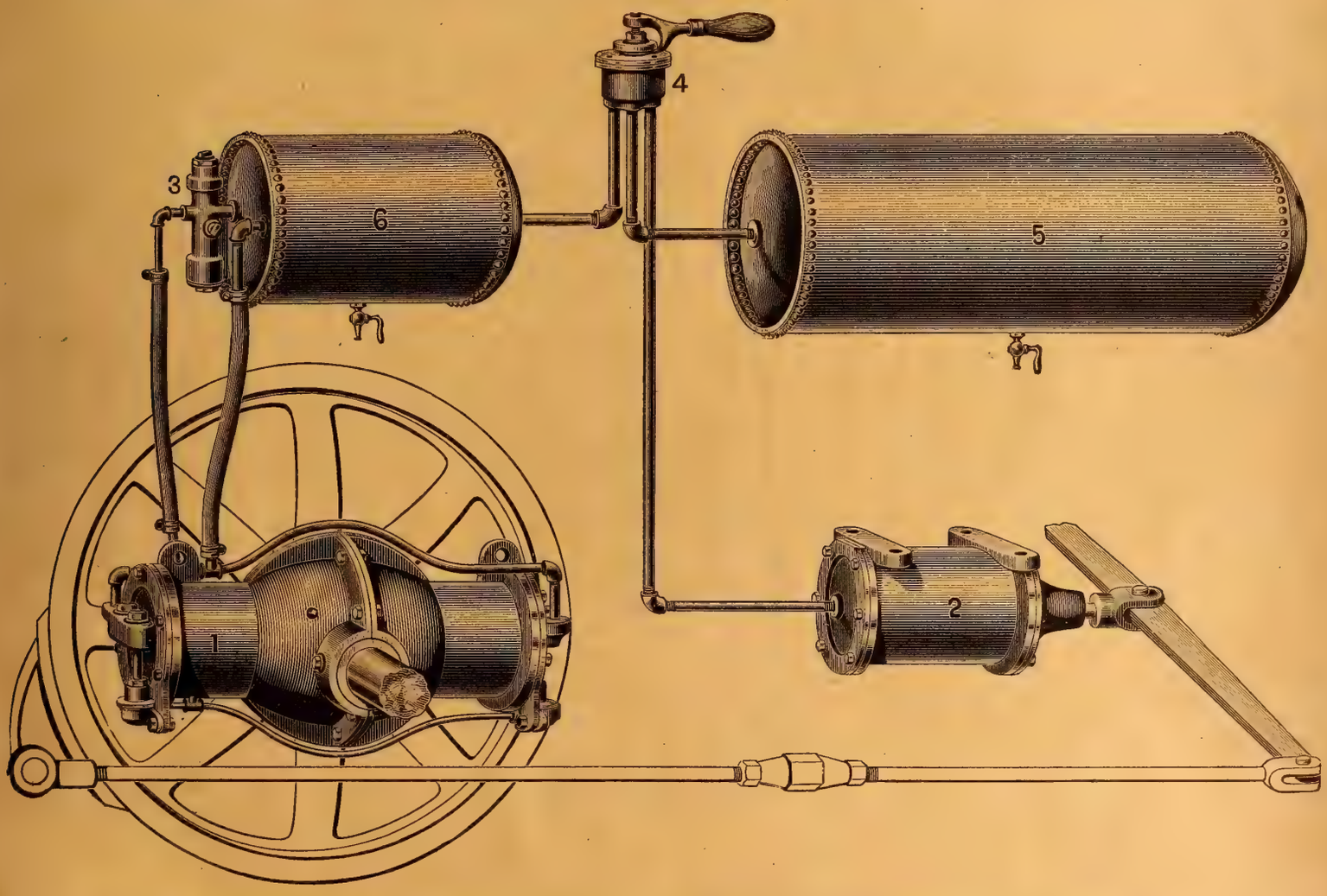
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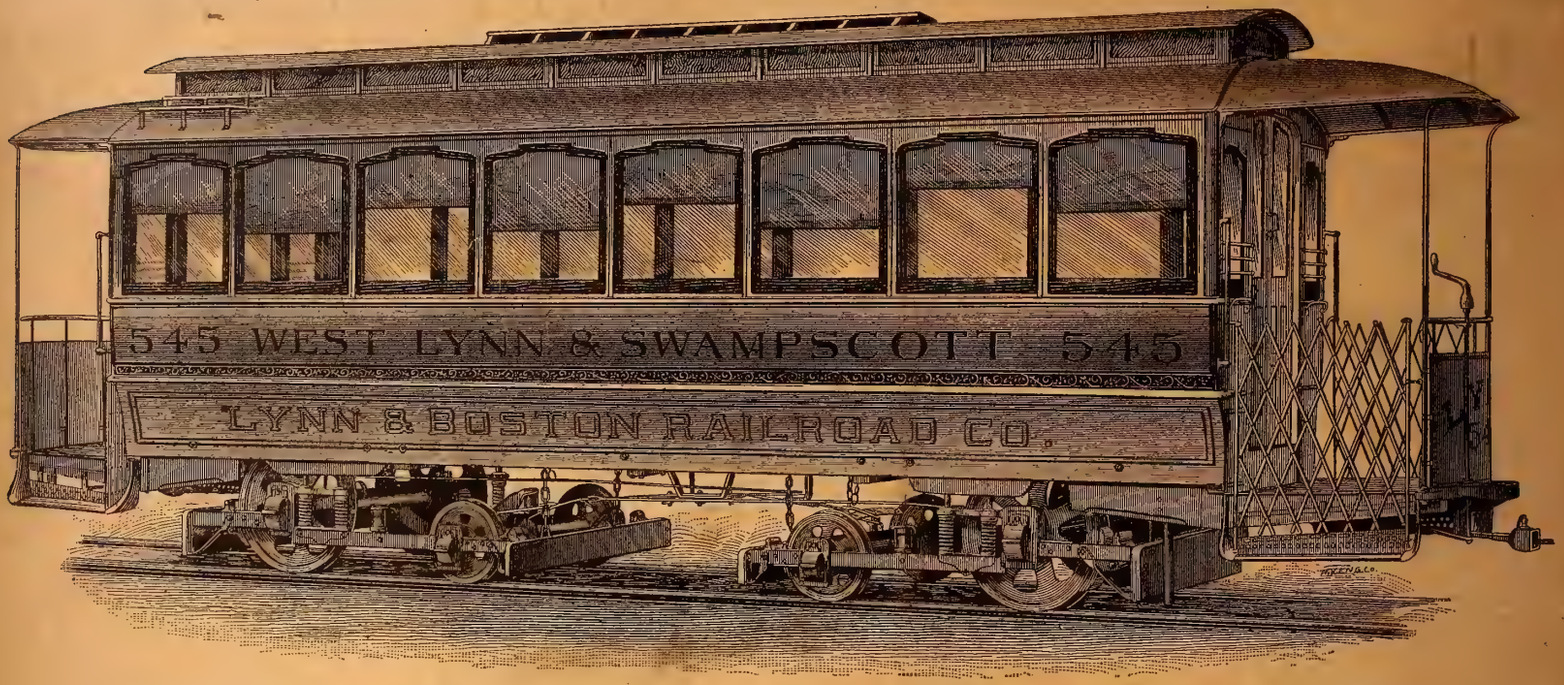
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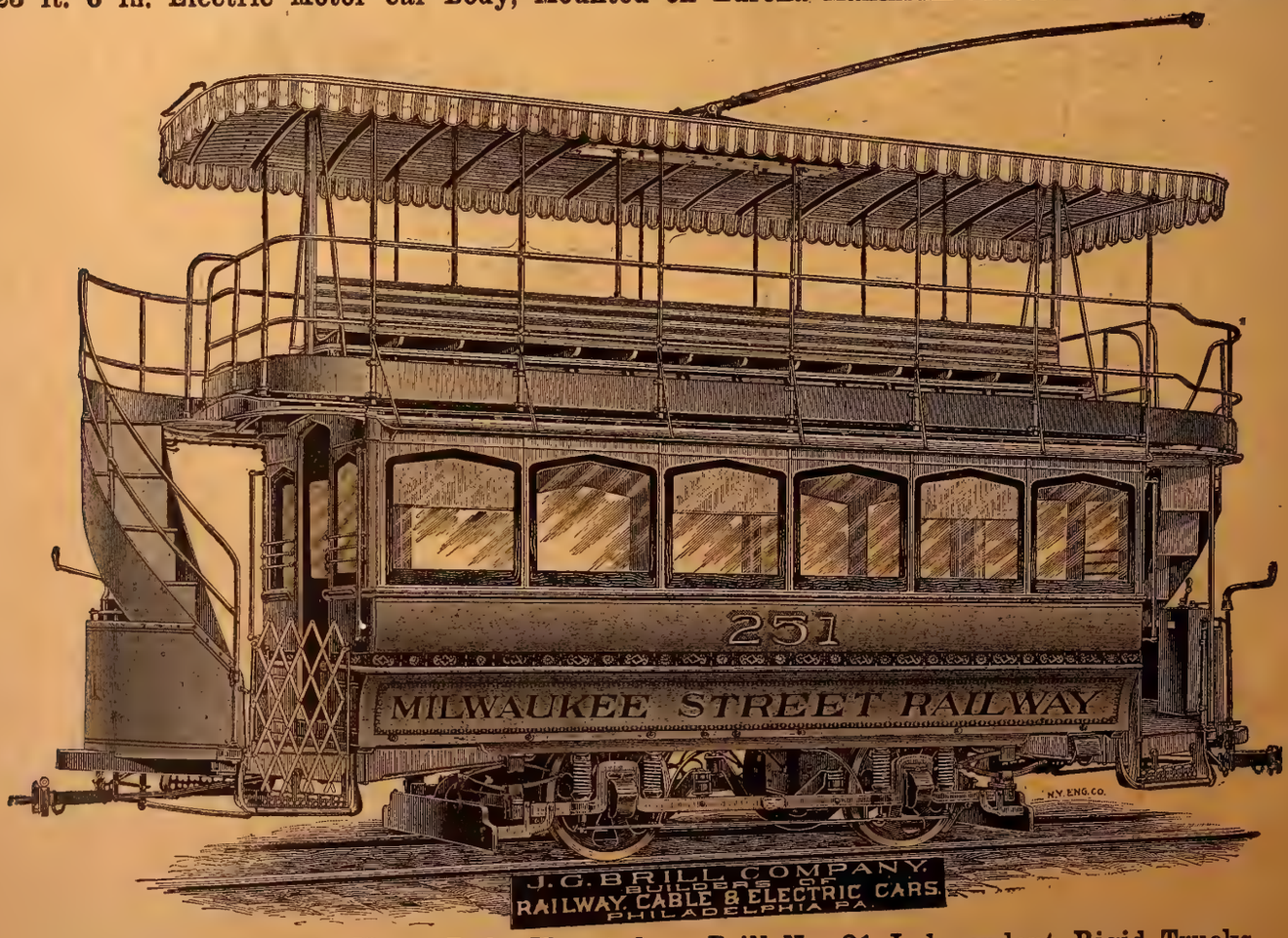
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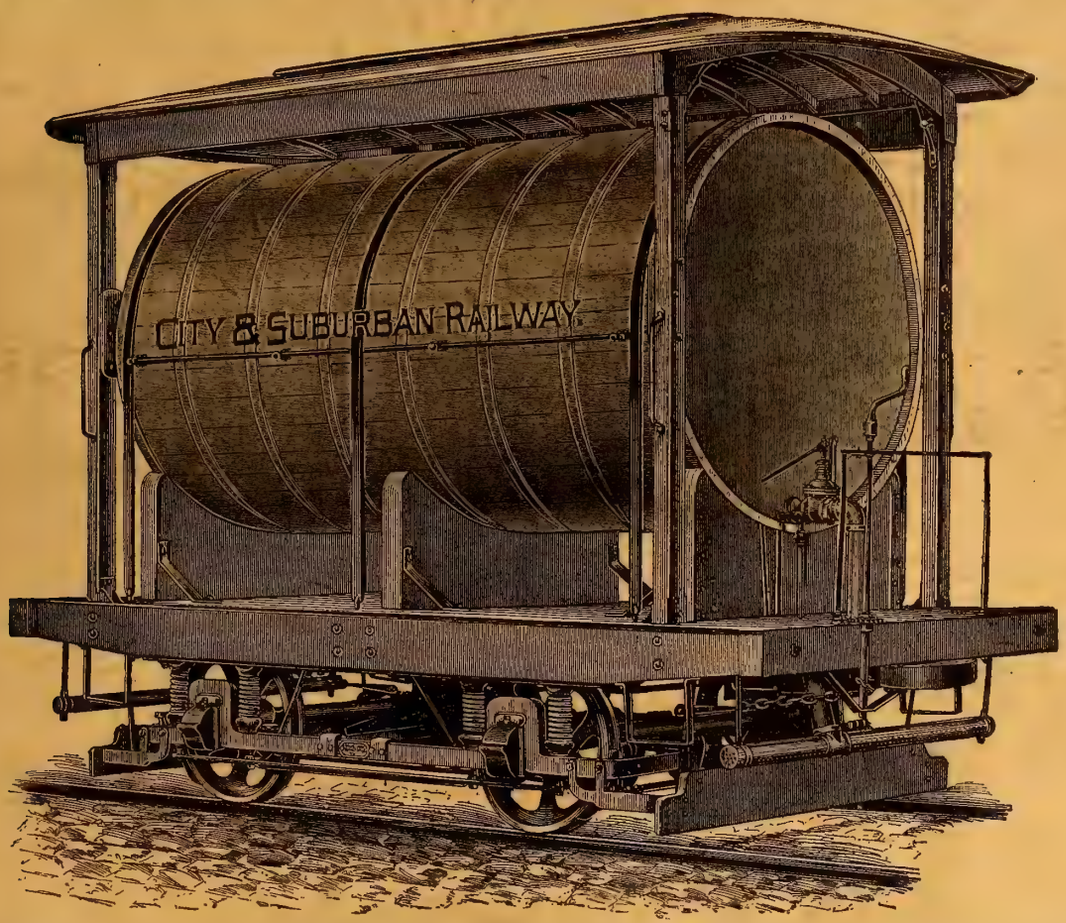
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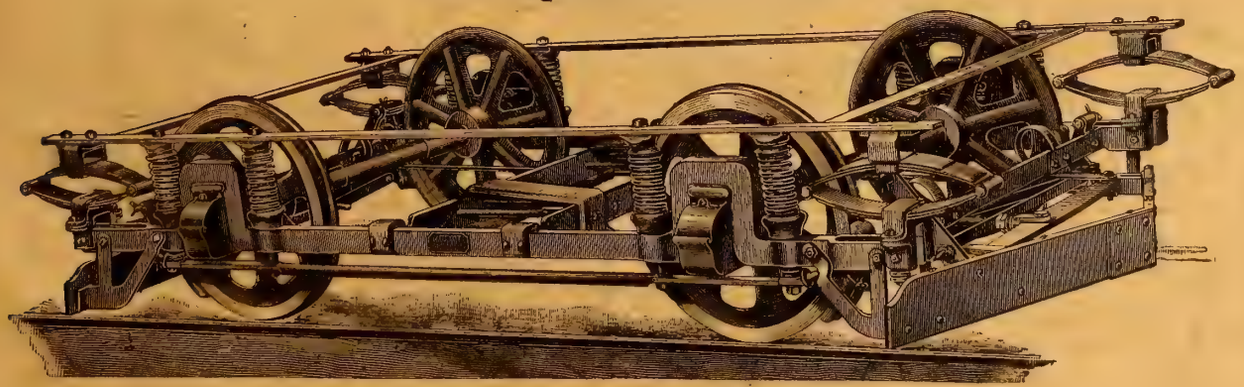
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